Under Graduate Syllabus

2017-2018

Subject: Biotechnology

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Date of submission in Autonomous Examination cell:

Signature
H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomes) College
Shivaji Nagar, Bhopal - 462016

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Scheme of examination

Course: Biotechnology

B.Sc. (3 Years Degree Course)

Theory Papers/practical	Title of paper	Compulsory/ Optional	Marks
B.Sc. Ist year Annual system			
Paper I	Cell Structure & Biology	Compulsory	42.5+7.5CCE=50
Paper II	Microbiology	Compulsory	42.5+7.5CCE=50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**150**
SEMESTER III			
Paper	Biostatistics and Instrumentation	Compulsory	70+30CCE=100
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**150**
SEMESTER IV			
Paper	Genetics and Genetic Engineering	Compulsory	70+30CCE=100
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**150**
SEMESTER V			
Paper	Immunology & Molecular Biology	Compulsory	70+30CCE=100
Practical	Biotechnology Practical	Compulsory	50
Internship	**Training**	**Compulsory**	**100**
Total Marks			**250**
SEMESTER VI			
Paper	Applied Biotechnology	Compulsory	70+30CCE=100
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**150**

Signature with date

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Under Graduate Annual Pattern of Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		2017-18
Class		**B.Sc.. Ist Year**
Subject	(English)	**Biotechnology**
	(हिन्दी)	
Paper		**I**
Paper code		BT-101
Title of the Paper	(English)	**Cell Structure & Biology**
	(हिन्दी)	**कोशिका संरचना एवं विज्ञान**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+30 C.C.E.

Unit		Syllabus	Periods
Unit-I	(English)	Cell structure and Theory, Structure of Prokaryotic cell, Eubacteria and Archaebacteria. Size, shape and arrangement of bacterial cell. Gram's positive and Gram's negative cells. Structure of Eukaryotic cell, plant cells, animal cells, Difference between Prokaryotic and Eukaryotic cells .	09
	(हिन्दी)	कोशिका की संरचना एवं सिद्धान्त, प्रोकेरियाटिक कोशिका की संरचना, युबैक्टीरिया एवं आर्कीबेक्टिरिया जीवाणु कोशिका की माप, अकारिकी एवं विन्यास। ग्राम .अम एवं ग्राम .अम कोशिकाओं युकेरियॉटिक कोशिका पादंप कोशिकाओं जन्तु कोशिकाओं की संरचना, प्रोकोरियॉटिक एवं युकेरियॉटिक कोशिकाओं में अंतर।	
Unit-II	(English)	Structure and function of bacterial cell- flagella, pili, cell wall, cytoplasmic membrane, nuclear region, mesosomes, ribosomes, vacuoles, metachromatic	09

		granule, spores and cysts. Structure and function of eukaryotic cell- cell wall, cell membrane, mitochondria, chloroplast, endoplasmic reticulum, Golgi bodies, nucleus, cytoskeleton, microbodies, centriole, Lysosomes.	
	(हिन्दी)	जीवाणु को शिका की संरचाना एवं कार्य कशाम (फ्लैजेला) पिलि, कोशिकामित्ति जीवद्रव झिल्ली, केन्द्रकीय भाग, मीजोसोम्स रिबोसोम्स, रिक्तिका, मेटाक्रोमेटिक ग्रेन्यूल बीजाणु एवं सिस्ट। युकेरियॉटिक कोशिका की संरचना एवं कार्य–कोशिकामिति कोशिका की संरचना एवं कार्य–कोशिकामित्ति कोशिका झिल्ली, माइटोकॉन्ड्रिया हरित लवक इन्डोप्लाज्मिक रेटीकु	
Unit-III	(English)	Cell cycle and cell division- mitosis, meiosis. Anomalies in cell division and associated diseases. Cell synchrony, cell-cell interactions, cell locomotion, cell differentiation.	09
	(हिन्दी)	कोशिका चक्र एवं कोशिका विभाजन समसूत्रीय एवं अर्द्धसूत्रीय कोशिका विभाजन में असंगतता एवं संबंधित रोग/कोशिकीय ससंजन कोशिका से कोशिका से कोशिका अन्तःक्रिया, कोशिकीय गति, कोशिकीय विभिन्नन	
Unit-IV	(English)	Transport Process: Cell membrane: Models of membrane structure. Membrane proteins and their properties, membrane carbohydrates and their roles. Transport across membranes active and passive diffusion mechanisms.	09
	(हिन्दी)	पार अभिगमन प्रक्रिया– कोशिका झिल्ली कोशिका झिल्ली के विभिन्न मॉडल मेम्ब्रेन प्रोटीन एवं उनके गुण मेन्ब्रेन कार्बोहाइड्रेटस एवं उनकी भूमिका झिल्ली के पार परिवहन सक्रिय एवं निष्क्रिय परिवहन, विसरण क्रियाविधि	
Unit-V	(English)	Introduction to Necrosis , Senescence, Apoptosis-Programmed cell death , Mechanism of Apoptosis, Intrinsic and Extrinsic pathways of cell death, Apoptosis in relation to Cancer, Oncogenes-Typesof cancer.	09
	(हिन्दी)	नेक्रोसिस का परिचय, जीर्णता, एपॉप्टॉसिस प्रोग्राम्ड सेल डेथ, एपॉप्टॉसिस की क्रियाविधि, कोशिका मृत्यु के इनट्रिनसेक एवं एक्सट्रिन्सिक मार्ग, कैंसर के संबंध में एपॉप्टॉसिस, ऑफ्रेजीन्स कैंसर के प्रकार	

Suggested BOOKS

1. Cell and molecular. Biology: P.K.Gupta
2. Modern concept of Microbiology: H.D. Kumar & Swati Kumar
3. A text book of Microbiology: Dubey & Maheshwari
4. Microbial ecology fundamentals and application: Atlas Bartha
5. Biophysics : Mohan P. Arora
6. Biology: Raven, Johnsen, Lasos Singer
7. Cell & Molecular biology: S.C.Rastogy
8. Fundamentals of Microbiology & Immun
   ology: A.K.Banerjee,Nirmalya Banerjee
9. Biochemistry:A.C. Deb
10. Biomolecule:Mohan P.Arora
11. Enviornmental Microbiology & Biotech: D.P.Singh,S.K. Dwivedi
12. Biophysics : Pattabh & Gautham
13. Experiment in microbiology, plant pathology & Biotech : K.R. Aneja
14. General Microbiology Vol. I & II-Power & Dangiwala
15. Molecular Biology of Cells, (2002), Albets's et. al.
16. Lehinger principles of Biochemistry (2005), Nelson & Cox.
17. Microbiology, Prescott, Harley & Klein.

Under Graduate Annual Pattern of Syllabus of Biotechnology
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2017-18
Theory / Practical

Session		2017-18
Class		**B.Sc.. Ist Year**
Subject	(English)	**Biotechnology**
	(हिन्दी)	
Paper		II
Paper code		BT-102
Title of the Paper	(English)	**Microbiology**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+30 C.C.E.

Unit		Syllabus	Periods
Unit-I	(English)	Introduction of Microbiology - History, Application & Status of Microbiology in India. Classification of Microorganisms - General Features, systems of Classification. Microbial Taxonomy, Classification and identification of Bacteria Bergey's manual.	09
	(हिन्दी)	सूक्ष्मजैविकी का परिचय– इतिहास अनुप्रयोग एवं भारत में सूक्ष्मजीवविज्ञान का स्थान (स्टेटस) सूक्ष्मजीवियों का वर्गीकरण– सामान्य लक्षण, वर्गीकरण, सूक्ष्मजैवकीय वर्गीकृत विज्ञान, बर्गीज मैनुअल के अनुसार जीवाणुओं का वर्गीकरण एवं पहचान के लक्षण	
Unit-II	(English)	Structure and Diversity of Bacteria & Virus, Microbes in extreme environment. Nutritional requirement of microbes. Bacteriology : Morphology and ultra structure of bacteriomorphological types. Archaebacteria structure and function of cell organelles.	09
	(हिन्दी)	विषाणु एवं जीवाणु की संरचना एवं विविधता, extreme पर्यावरण में सूक्ष्मजीव, सूक्ष्मजीवियों की पोषकीय आवश्यकतायें। जीवाणु विज्ञानः– बाह्य जीवाणु आकारिकीय प्रकारों की बाह्य आकारिकी एवं सूक्ष्म संरचना। कोशिकीय अंगको	

		की Archaebacteria संरचना एवं कार्य	
Unit-III	(English)	Structure and Diversity of Algae, Fungi, Protozoans, Mycoplasmas and Extremophiles. General characteristics, Various methods of staining-simple. Gram. Endospore, capsule, flagella and differential staining, Fungal stains, Algal stians.	09
	(हिन्दी)	शैवाल, कवक, प्रोटोजोअन्स, Mycoplasmas एवं Extremophiles की संरचना एवं विविधता। अभिरंजक– साधारण ग्रामः– सामान्य लक्षण एवं विभिन्न विधियां। Endospore, capsule, flagella एवं विभेदक अभिरंजक, कवक रंजक, शैवाल रंजक	
Unit-IV	(English)	Microbial growth - mathematical expression of growth, methods of growth curve, factors affecting growth. Cultivar Technique, Types of cultivar Batch, continuous, synchronous and diauxic growth. Quantification of microbial growth. Control of micro organism - physical & chemical, Evaluation of chemical disinfectants - tube dilution test, agar diffusion test and phenol - coefficient.	09
	(हिन्दी)	सूक्ष्मजीव वृद्धि– वृद्धि की गणितीय अभिव्यक्ति, वृद्धि वक्र, वृद्धि को प्रभावित करने वाले कारण। संवर्धन तकनीक, संवर्धन के प्रकार– बैच संबर्धन, सतत् संवर्धन, सिंक्रोनस संवर्धन, जीवाण्वीय वृद्धि का मापन।	
Unit-V	(English)	Microbial Nutrition and metabolism - Microbial Metabolism - Concept of Anabolism & catabolism processes. Nitrogen Fixation - types and mechanisms, Microbial disease in plants & Animals (Only General concept). Fermentation Process - Fermenter & its microbes of industrial importance.	09
	(हिन्दी)	सुक्ष्मजीविय पोषण एवं चयापचय– सूक्ष्मजीवीय चयापचय– उपचय एवं अपचय की अवधारणा। नाइट्रोजन स्थिरीकरण– प्रकार एवं क्रियाविधि, पौधों एवं जंतुओं में सूक्ष्म जीवीय रोग (केवल सामान्य अवधारणा)। किण्वीकवण प्रक्रियाः– किण्वन एवं सूक्ष्म जीव के औद्योगिक महत्व	

Laboratory Exercises: BT 103

List of Practicals

1. To study the plant cell structure using various plant materials.
2. To study microbial cell by Monochrome staining and Gram staining.
3. To prepare and study the different stages of mitosis and meiosis.
4. Prepare slide for study of stomata.
5. Study of permanent slides like cell division, prokaryotic and eukaryotic cells. Museles and Nerve cells, T.S. of stomatal cells.
6. To study the animal cell structure using cheek cells.
7. Histochemical localization offlagellin.
8. Viable cell counting using haematocytometer.
9. Measurement of cell by light microscope :-
   Calibration of ocular micrometer, finding out average cell size
10. Separation of cell types from blood by TLC/differential counting.
11. Methods of cell lysis: rupture osmotic/chemical/enzymatic.
12. Study of human and animal chromosomes.
13. Aseptic techniques, cleaning of glassware, Preparation of cotton plugging and sterilization.
14. Isolation of Microbes from Air, Water and Soil.
15. Dilution and plating by Pour plate, Spread Plate Methods.
16. Staining Method _ Gram Staining, Endospore Staining, Fungal Staining, Algal staining.
17. Identification of Bacteria based on staining and size.
18. Antibiotic Senitivity of Microbes by the Use of Antibiotic Discs.
19. Isolation and Identification of aquatic Fungi from Local water body.
20. Isolation and Characterization of green algae from Natural habitats.
21. Measurement of water and soil, pH.

Note : 70% of the above list should be compulsorily performed.

Scheme of Practical Examination **MM : 50**

Duration : 3 Hrs.

1. Major (10)
2. Major (10)
3. Minor (5)
4. Minor (5)
5. Spotting (10)
6. Viva-Voce(5)
7. Practical Record (5)

Suggested Reading

1. Cell and molecular Biology : P. K. Gupta
2. Cell & Molecular biology :S. C. Rastogy
3. Molecular Biology of Cells, (2202), Alberts's et. al.
4. Cell Biology, P. S. Verma & Agarwal
5. Text book of Microbiology by R. C. Dubey
6. A Text book of Microbiology - Dubey and Maheswari
7. Essentials of Microbiology - K.S. Bilgrami / R.K. Sinha
8. Microbiology P. D. Sharma
9. General Microbiology Vol I & II - Pawar & Dagniwala
10. Applied Microbiology - P. D. Sharma
11. Microbiology Fundamentals & Applications - S. S. Purohit
12. Experiments in Microbiology, Plant Pathology & Biotechnology - K. R. Ancja
13. Fundamentals of Microbiology & Immunology By A. K. Banerjee, Nirmalaya Banerjee
14. Modern Concept of Microbiology - H. D. Kumar & Swati Kumar

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Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		2017-18
Class		B.Sc..II Year
Semester		III
Subject	(English)	Biotechnology
	(हिन्दी)	
Paper code		BBT-301
Title of the Paper	(English)	BIOSTATISTICS AND INSTRUMENTATION
	(हिन्दी)	जैव सांख्यिकी एवं यंत्रिकीकरण
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+30 C.C.E.

Unit		Syllabus	Periods
Unit-I	(English)	Introduction, Scope, application and use of statistic collection and classification of data census and sampling graphs and diagrams. Arithmetic mean, median, standard deviation. Probability; definition, Random variable and its distribution. Binomial probability distribution, examples and conditions, mean and variance. Chi-square test.	09
	(हिन्दी)	प्रस्तावना, क्षेत्र, अनुप्रयोग एवं संख्यिकी संग्रह का उपयोग एवं डाटा गणना का वर्गीकरण तथा प्रतिचयन ग्राफ एवं चित्र। समानान्तर माध्य, मध्यिका प्रमाप विचलन। प्रायिकताः परिभाषा यादृच्छिक चर एवं उसका बंटन। द्विपद प्रायिकता बंटन इसके उदाहरण एवं प्रतिबंध। माध्य एवं प्रसरण। काई–वर्ग (x^2) परीक्षण।	
Unit-II	(English)	The set theory properties of subsets, linear and geometric functions, limits of functions, derivatives of functions, The binomial theorem, Logarithms. Differentiations, Integration, Probability calculations, Method of sampling, confidence level.	09

	(हिन्दी)	समुच्चय सिद्धान्तः उपसमुच्य के लक्षण, रेखीय एवं गुणोत्तर फलन, फलन की सीमाऐं, फलन के व्युत्पन्न, द्विपद प्रमेय, लघु गणक, अवकलन, समाकलन, प्रायिकता गणना, प्रतिचयन की विधियाँ, विश्वसनीयता स्तर।	
Unit-III	(English)	Microscopy light & fluorescence microscopy, electron microscopy. Chromatography, Principles and applications. Tracer technique: Centrifugation technique. Principles types & sepration of biological molecule, Radio & non radio labeling, autoradiography.	09
	(हिन्दी)	सूक्ष्मदर्शीः प्रकाश एवं स्फूरदीप्ति सूक्ष्मदर्शी, इलेक्ट्रॉन सूक्ष्मदर्शी। क्रोमेटोग्राफी–सिद्धान्त एवं अनुप्रयोग। ट्रेसर तकनीकः अभिकेन्द्रीय तकनीक। सिद्धान्त, प्रकार एवं जैविक अणुओं का पृथक्करण। रेडियो एवं अरेडियों नामांकन, आटोरेडियोग्राफी।	
Unit-IV	(English)	Principles and application of spectroscopy: Colorimetry, UV visible, Fluorersence and IR	09
	(हिन्दी)	स्पेक्ट्रोस्कोपी के सिद्धान्त एवं अनुप्रयोगः कलरीमेट्री, पराबैगनी दृश्य, स्फुरदीप्ति एवं अवरक्त।	
Unit-V	(English)	Chromatography: Principles and application, Principles and application of electrophoresis. Agrose electrophoresis, Immuno electrophoresis, Blotting: Southren, Western and Northern Blotting.	09
	(हिन्दी)	क्रोमेटोग्राफीः सिद्धान्त एवं अनुप्रयोग, इलेक्ट्रोफोरेसिस के सिद्धान्त एवं अनुप्रयोग। एग्रोस इलेक्ट्रोफोरेसिस। इम्यूनोइलेक्ट्रोफोरेसिस। ब्लाटिंगः सदर्न, वेस्टर्न एवं नादर्न ब्लाटिंग।	

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		2017-18
Class		B.Sc.. II Year
Semester		IV
Subject	(English)	Biotechnology
	(हिन्दी)	
Paper code		BBT-401
Title of the Paper	(English)	GENETICS AND GENETIC ENGINEERING
	(हिन्दी)	अनुवंशिकी एवं अनुवंशिकी अभियांत्रिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+30 C.C.E.

Unit		Syllabus	Periods
Unit-I	(English)	Origin of life: Classical experiments and current concepts. Evolution of biological macromolecules, Evolution of early forms, Median genetics: Mendal's Law, Chromosomal basis of heredity, Chromosomal analysis, allelic variation, dominance, linkage and crossing over.	09
	(हिन्दी)	जीवन की उत्पत्तिः चिरप्रतिष्ठित प्रयोग तथा आधुनिक धारणाऐं। जैव दीर्घाणुओं का विकास, प्रारंभिक रूपों का विकास, मेडल की अनुवंशिकीः मेंडल के सिद्धान्त, वंशानुगति का गुण सूत्र आधार, गुणसूत्र विश्लेषण, एलेलिक विभिन्नताऐं, प्रभाविता, सहलग्नता एवं जीन विनिमय।	
Unit-II	(English)	Microbial genetics: genetics, genetics cross and analysis with special reference to E. Coil conjugation, general and specialized transduction, Bacteriophage lamoda (lytic/lysogenic). Genetic mapping in eukaryotes: Drosophila; maize and Human examples. Sex determination, genetic disorder and chromosomal	09

		abnormalities.	
	(हिन्दी)	माइक्रोबियल अनुवांशिकीः अनुवांशिकी, अनुवांशिकी सहयुग्मन एवं विश्लेषण, विशेषतः ई. कोलाई में संयुग्मन, सामान्य एवं विशेष ट्रान्सडक्शन, लेम्डा जीवाणुभोजी (लाइटिक/लाइसोजेनिक)। यूकेरियोट्स में जीन मापनः उदाहरण ड्रासोफिल्ला, मक्का एवं मानव। लिंग निर्धारण, अनुवांशिकी 'अव्यवस्था एवं गुणसूत्र विसंगति'।	
Unit-III	(English)	Cloning, History of cloning, Isolation and Quantification of DNA vehicles. Plasmids, Bacteriophage, Phagemid & Cosmids. Selection and Screening of Recombinants, Vectors of plants and animals, Expression Vectors, Gene Cloning and expression of foreign gene in bacteria.	09
	(हिन्दी)	क्लोनिंगः क्लोनिंग का इतिहास, डी.एन.ए. वाहनों का पृथककरण एवं मात्रीकरण। फ्लास्मिड्स, जीवाणुभोजी, फेजिमिड्स एवं कास्मिड्स। पुनर्योगज का चयन एवं निरीक्षण, पादपों एवं जन्तुओं के वाहक, अभिव्यक्ति वाहक। जीन क्लोनिंग एवं जीवाणु में विदेशी जीन की अभिव्यक्ति।	
Unit-IV	(English)	Construction of genomic and DNA libraries. Production of transgenic microbes, Animals & plants and their application in Biotechnology. Gene Cloning in medicine, Production of protein from cloned genes.	09
	(हिन्दी)	जीनोमिक तथा डी.एन.ए. लाइब्रेरिस का निर्माण। सूक्ष्मजीवियों, जन्तुओं एवं पादपों का ट्रान्सजेनिक उत्पादन तथा उनका जैव प्रौद्योगिकी में अनुप्रयोग। चिकित्सा में जीन क्लोनिंग, क्लोनड् जीन्स से प्रोटीन्स का उत्पादन।	
Unit-V	(English)	Over expression conditions, production of inclusion bodies, solubilization, insoluble proteins, purification protocol, Determination of purity and activity of over express proteins.	09
	(हिन्दी)	अति अभिव्यक्ति अवस्थाएँ, अन्तर्विष्ट पिण्डों का उत्पादन, विलयीकरण, अघुलनशील प्रोटीन्स, शोधन प्रोटोकॉल, अति अभिव्यक्ति प्रोटीन्स की शुद्धता एवं क्रियाशीलता का निर्धारण।	

Books for Semester-III and IV

1. Principle of Biostatistics: Marcello Pagano,Kineberlee Gauvereau
2. Biostatistics: Mishra & Mishra
3. Biophysics: Mohan P. Arora
4. Molecular biology: Avinash & Kakoli Upadhyay
5. Gene Biotechnology: Jogdand
6. Biotechnology Demystifying the concept :Bourgaize, Jewell& Burser
7. Essential of Biotechnology: S.N.Das
8. Text book of Biotechnology:R.C.Dubey
9. Outline Genetics: Schaumn
10. Biotechnology & genomics : P.K. Gupta
11. Modern concept of Biotech: H.D.Menon
12. Microbial Genetics: Fridfleder
13. Biophysical Chemistry: Upadhyay & Nath
14. A Biologist guide to principles and Techniques Willson & Gounding
15. Biochemical Techniques theory & practical-white, R
16. Genetics, Strickeberger.
17. Molecular Biology-Turner et. al.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		2017-18
Class		B.Sc.III Year
Semester		V
Subject	(English)	Biotechnology
	(हिन्दी)	बायोटेक्नोलाजी
Paper		
Title of the Paper	(English)	Immunology and Molecular Biology
	(हिन्दी)	प्रतिरक्षा विज्ञान एवं आणिवक विज्ञान
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+30CCE

Unit		Syllabus	Periods
Unit-I	(English)	Historical development and evolution of Immunology, Immunological components, Cell types, Structure and function, organization of lymphoid organs. Immune system Structure and properties and function of Antigen-antibody Interactions.	09

	(हिन्दी)	प्रतिरक्षा विज्ञान का ऐतिहासिक विकास एवं उद्विकास प्रतिरक्षा विज्ञान के घटक। कोशिका के प्रकार, संरचना एवं कार्य, लसिकाभ अंगों का संगठन। प्रतिरक्षित प्रणाली की प्रतिरक्षा। प्रतिजन की संरचना एवं गुण। प्रतिरक्षी की संरचना एवं गुण, प्रतिजन–प्रतिरक्षी प्रतिक्रिया।	
Unit-II	(English)	Humoral response and Cell-Mediate immunity, Hypersensitivity, Transplantation and Auto immunity Autoantibodies in human pathogenic mechanism, experimental models and treatment of autoimmune diseases.	10
	(हिन्दी)	ह्यूमोरल अनुक्रिया एवं कोशिका संचालित प्रतिरक्षा, प्रतिरक्षी, अति संवेदनशीलता, प्रतिरोपण एवं स्वप्रतिरक्षा– अंग विशिष्ट स्वप्रतिरक्षित रोग, क्रमबद्ध स्वप्रतिरक्षित रोग, प्रतिरक्षा कार्यविधि का मानव रोगजनक कार्यविधि में स्वप्रतिरक्षी, स्वप्रतिरक्षित रोग के प्रयोगात्मक प्रादर्श एवं उपचार।	
Unit-III	(English)	Macromolecular synthesis Chromosomes structure and replication– DNA structure, DNA replication, Replication of Bacterial Chromosome. RNA structure and function ,Transcription, Processing of mRNA, rRNA, tRNA Reverse transcription, ribosome structure . Protein Synthesis, with ‘Lac’ Operon.. Inhibition of Translation post translation.	10
	(हिन्दी)	वृहद् आण्विक संश्लेषण, गुणसूत्र सरंचना एवं पुनरावृत्ति – डी.एन.ए. की संरचना , डी.एन.ए. पुनरावृत्ति, सूक्ष्मजीव ें गुणसूत्र की ंपुनरावृत्ति,	

		आर.एन.ए.,की सरंचना एवं कार्य, अनुलेखन, एम.आर.एन.ए., आर.आर.एन.ए., टी.आर.एन.ए. का संधान, प्रतिलोम अनुलेखन, राइबोजोम की संरचना। लेक ओपरोन के साथ प्रोटीन संश्लेषण, अनुवादक का अवरोध, पश्च्य अनुवादन।	
Unit-IV	(English)	**Plasmids:** Properties (Replication, Function of on region incompatibility.) **Plasmid Genetics** :Plasmid cloning vectors Recombinant DNA techniques and cloning with Restriction endonuclease and recombinant DNA, ,Cloning Bacterial gene (PCR). .\\	08
	(हिन्दी)	प्लाज्मिडः–लक्षण (क्षेत्रीय अक्षमता के पुनरावृत्ति एवं कार्य) प्लाज्मिड की अनुवांशिकीः प्लाज्मिड क्लोनिंग वाहक। पुनर्योगज डी.एन.ए. तकनीक एवं रेस्ट्रिक्शन इन्डोन्यूकलेज के साथ क्लोनिग एवं रीकाम्बीन्नेट डी.एन.ए., सूक्ष्म जीवयीय जीन की क्लोनिंग(पी.सी.आर.)	
Unit-V	(English)	Mutation, Types of mutations; Point mutation(Base pair change, frame shift, deletion, etc) Transcription, translation and gene expression in eukaryotes (yeast), One gene one enzyme hypothesis.	10
	(हिन्दी)	उत्परिवर्तनः उत्परिवर्तन के प्रकार, बिन्दु उत्परिवर्तन(क्षार युग्म परिवर्तन, फ्रेमशिफ्ट उत्परिवर्तन, विलोपन) यूक्रेरियोटस् (यीस्ट्) में अनुलेखन, अनुवादन एवं जीन अभिव्यक्ति, एक	

		जीन एक विकर परिकल्पना।	

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Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		2017-18
Class		B.Sc.. III Year
Semester		VI
Subject	(English)	Biotechnology
	(हिन्दी)	बायोटेक्नोलाजी
Paper code		BBT-601
Title of the Paper	(English)	Applied Biotechnology
	(हिन्दी)	व्यवहारिक जैवप्रौद्योगिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+30CCE

Unit		Syllabus	Periods
Unit-I	(English)	Introduction to plant tissue culture, Nutritional requirements, In vitro culture, Single cell culture, Somaclonal variations, Anther culture, Ovule culture. Somatic embryogenesis,	09

		Organogenesis	
	(हिन्दी)	पादप ऊतक संवर्धन का परिचय, पोषक आवश्यकताएँ, पात्रे संवर्धन, एकल कोशिका संवर्धन, कायिक क्लोनीय विविधता, पराग संवर्धन,, बीजांक संवर्धन। कायिक भ्रूणजनन, अंगजनन।	
Unit-II	(English)	Somatic hybridization, Genetic manipulation of plants using *Agrobacterium tumefaciens* The engineering of recombinant plastids in higher plants. Isolated Microspore Embryogenesis in cereals.	09
	(हिन्दी)	कायिका संकरण एग्रोबेक्टीरियम ट्यूमेफेशियन्स के उपयोग से पादपों में जेनेटिक मेनीपुलेशन। उच्च पादपों में पुनर्योगज प्लास्टिड की अभियांत्रिकी। अनाजों में पृथक्कृत (निगलित) सूक्ष्मबीजाणु, भ्रूणजनन।	
Unit-III	(English)	Energy transfer in ecosystem, Renewable and non-renewable resources, Role of biotechnology in pollution, Type and management of pollution, Waste water treatment, xenobiotics, Bioremediation, Green house effect, Ozone depletion, Bioleaching, biofertilizers, Biopesticides, Modern fuels, Biogas, Microbial H_2 production.	09
	(हिन्दी)	पारिस्थितिक तंत्र में ऊर्जा स्थानान्तरण, नवीनीकरण एवं अनवीनीकरण संसाधन, प्रदूषण में जैव प्रौद्योगिकी की भूमिका, प्रदूषण के प्रकार एवं प्रबंधन, अपशिष्ट जल का उपचार, जीवेत्तर (जीनोबायोटिक्स), बायोरेमेडिएशन, ग्रीन हाउस प्रभाव,	

		ओजोन क्षरण, जैविक निक्षालन, जैव उर्वरक, जैव कीटनाशी, आदर्श जैव ईधन, जैव गैस, सूक्ष्मजीवीय हाइड्रोजन उत्पादन।	
Unit-IV	(English)	Production of some important bio-products, Antibiotic and beverages. Microbial role in food processes, operation and production, new protein post harvest technology and process of food preservation milk procession operations.	09
	(हिन्दी)	प्रतिरक्षी , पेय पदार्थ एवं महत्वपूर्ण जैवउत्पादों का उत्पादन। खाद्य प्रक्रिया, संक्रिया एवं उत्पादन में सूक्ष्मजीवों की भूमिका, नये प्रोटीन खाद्य–प्रोटीन, फसलोपरांत तकनीक और खाद्य पदार्थों का संरक्षण, दुग्ध संसाधन संक्रिया।	
Unit-V	(English)	Medical application of rDNA technology, Human disorders associated with defects in protein/enzyme biosynthesis, DNA probes and their application in diagnosis of genetic and other disorders. Plant DNA finger printing.	09
	(हिन्दी)	आर.–डी.एन.ए. तकनीक का चिकित्सीय अनुप्रयोग, प्रोटीन/विकर जैव संश्लेषण में दोष से उत्पन्न मानव विकार,, डी.एन.ए. अन्वेषी तथा उनका अनुवांशिक एवं अन्य विकारों के निदान में अनुप्रयोग, पादप डी.एन.ए. फिंगर प्रिंटिग।	

Books for Semester-V, VI

1. Immunology: Tizard
2. Biotechnology An Introduction : Barum
3. Principles of Immunology: Shastri
4. Problems of genetics, Molecular genetics & evolutionary genetics: Pranobh K. Banerjee
5. Fundamentals of Microbiology & Immunology : Banerjee& Banerjee
6. Biotechnology : Mohan P.Arora
7. Immunology : Rao
8. Biotechnology & Genomics : P.K.Gupta
9. Biotechnology : Satyanarayan
10. Plant tissue culture: Bhajwan
11. Introduction to plant tissue culture:Razadan
12. Introduction to Biotech: Chawla
13. Animal Biotechnology: Srivastava, Singh& Yadav.
14. Immunology-Kubey, J.
15. Molecular Biotechnology, Glick & Pasternak.
16. Plant tissue culture-Evance, D.R.
17. Food, Microbiology-Frazier
18. Biotechnology- K. Trahan

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Theory / Practical B.Sc. I year
BT 103 LABORATORY Exercises

Practical as per list provided.

M.M.-50

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2016-17
Theory / Practical
B.Sc. Biotechnology Semester III

BBT 302- LABORATORY- III

Practical as per list provided. **M.M.-50**

1. Fixation, Dehydration and staining of cell.
2. Squash in stain, Embedding and sectioning.
3. Demonstration of Beer Lambert Law (Concentration based exercise)
4. Exercise based on biostatics (SD, SE, 't' test etc.)
5. Chromatographic method for separation of macromolecules (Sugar, amino acids and pigments)
6. Cell content separation by centrifuge.
7. Demonstration of Electrophoresis.
8. Demonstration of ELISA, RIA, ECG, CAT-Scan, Colour dropler and digital X- ray.

Note: 70% of the above list should be compulsorily performed.

Practical Scheme
B.Sc. Biotechnology Semester III

M. Marks 50

Q. -1 Major practical……15

Q. -2 Minor practical…….……10

Q.-3 Spotting…….……10

Q.-4 Viva-voce…….……..05

Q.-5 Record/Sessional…….……10

Total 50

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Theory / Practical B.Sc. Biotechnology Semester IV
BBT 402- LABORATORY- IV

Practical as per list provided. **M.M.-50**

1. Study of plant chromosome (Root tip).
2. Study of animal chromosome (Chironomous larvae)
3. Study of human chromosome (Slide)
4. Estimation of DNA by the diphenylamine reaction.
5. Estimation of RNA by the mean of orcinol reaction.
6. Isolation and DNA from microbial, plant/animal.
7. Isolation of RNA from Yeast.
8. Isolation of chromosome DNA from bacteria.
9. Isolation of plasmid DNA from bacteria.
10. Isolation of nucleic acid (DNA/RNA) from biological material by perchloric acid method.
11. Extraction in saline, buffer and solvent.
12. Effect of UV radiation on microbial cell
13. Demonstration of repair mechanism *in* microbes.
14. Bacteriophage and determination of latent period of infection
15. Isolation of total RNA from Plant tissue by SDS phenol method

Note: 70% of the above list should be compulsorily performed.

Practical Scheme

B.Sc. Biotechnology Semester IV **M. Marks 50**

Q. -1 Major practical…….15

Q. -2 Minor practical…….10

Q.-3 Spotting…….10

Q.-4 Viva-voce……..05

Q.-5 Record/Sessional…….……10

Total 50

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18
Practical Scheme

B.Sc. Biotechnology Semester V

M. Marks 50

Q. -1 Major practical……15

Q. -2 Minor practical…….……10

Q.-3 Spotting…….10

Q.-4 Viva-voce……..05

Q.-5 Record/Sessional…….……10

Total 50

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2017-18

BBT 503-LABORATORY-V

M.M.-75

1. Isolation and purification of protein.
2. Determination of blood group and Rh factor.
3. Test for integrity of the inflammatory response.
4. Demonstration of Direct ELISA through kit.
5. Mast cell preparation and staining.
6. Mcrophages preparation and staining.
7. Isolation of liver cell.
8. Demonstration of pregnancy test HGC, GH etc.
9. Separation of serum from blood (normal diseased).
10. Demonstration of Rocket electrophoresis/Gel electrophoresis.
11. Pathological diagnosis of tuberculosis, malaria, sickle cell anemia and other disease.
12. To detect niterate deducted in leaf extract by immuno diffusion.
13. Elution of plant DNA fragment from agarose gel.
14. Transformation of E-coli cells with recombinant DNA.

Note: 70% of the above list should be compulsorily performed.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2016-17

BBT 603-LABORATORY-VI

M.M.-75

1. Growth of plant tissue into undifferentiated mass of callus.
2. Preparation of animal cell culture media.
3. Separation and culture of lymphocyte from blood.
4. Demonstration of fermentor.
5. Preparation of wine.
6. Effects of toxicants on microbes.
7. Effects of toxicants on animal cell.
8. Extraction of citric acid from *Aspergillus*.
9. Production of ethanol by yeast.
10. Demonstration of PCR.
11. Immobilization of yeast cells.
12. Immobilization of enzyme.
13. Extraction and preparation of lactic acid.
14. Extraction and preparation of citric acid.
15. Demonstration of Radial immuno diffusion analysis.
16. Isolation of microorganism from polluted site/ industrial waste.

Note: 70% of the above list should be compulsorily performed.

Practical Scheme

B.Sc. Biotechnology Semester VI

M. Marks 50

Q. -1 Major practical…….15

Q. -2 Minor practical…….10

Q.-3 Spotting…….10

Q.-4 Viva-voce…….05

Q.-5 Record/Sessional……10

Total 50

Under Graduate Syllabus

2018-2019

Subject: Biotechnology

Details **Page No.**

Under Graduate Level

Theory	**B.Sc.I -Paper I**	**…3-5**
,, ,,	**B.Sc.I-Paper II**	**…6-7**
,, ,,	**B.Sc.II -Paper I**	**…8-9**
,, ,,	**B.Sc.II -Paper II**	**…10-12**
,, ,,	**Semester V**	**…13-14**
,, ,,	**Semester VI**	**…15-16**
Practical	**B.Sc.I**	**…17-18**
,, ,,	**B.Sc.II**	**…19-20**
,, ,,	**Semester V**	**…21**
,, ,,	**Semester VI**	**…22**

Important Note: - Training programs and institutional visits are mandatory

Date of submission in Autonomous Examination cell:

Signature
H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College
Shivaji Nagar, Bhopal - 462016

Syllabus of Biotechnology

(As Recommended by the Board of Studies)

2018-19

Scheme of examination

Course: Biotechnology

B.Sc. (3 Years Degree Course)

Theory Papers/practical	Title of paper	Compulsory/ Optional	Marks
B.Sc. Ist year Annual system			
Paper I	Cell Structure & Biology	Compulsory	50
Paper II	Microbiology	Compulsory	50
	CCE		50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**200**
B.Sc. IInd year Annual system			
Paper I	Biophysics and Biochemistry	Compulsory	50
Paper II	Bioinstrumentation, Biostatistics and Bioinformatics	Compulsory	50
	CCE		50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**200**
SEMESTER V			
Paper	Immunology & Molecular Biology	Compulsory	70+30CCE=100
Practical	Biotechnology Practical	Compulsory	50
Internship	**Training**	**Compulsory**	**100**
Total Marks			**250**
SEMESTER VI			
Paper	Applied Biotechnology	Compulsory	70+30CCE=100
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**150**
Important Note: - Training programs and institutional visits are mandatory			

Signature with date

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal

Under Graduate Annual Pattern of Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2018-19
Theory / Practical

Session		2018-19
Class		**B.Sc. Ist Year**
Subject	(English)	**Biotechnology**
	(हिन्दी)	**जैवप्रौद्योगिकी**
Paper		**I**
Paper code		BT-101
Title of the Paper	(English)	**Cell Structure & Biology**
	(हिन्दी)	**कोशिका** संरचना एवं **जीवविज्ञान**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Period
Unit-I	(English)	Cell structure and Theory, Structure of Prokaryotic cell, Eubacteria and Archaebacteria. Size, shape and arrangement of bacterial cell. Gram positive and Gram negative bacterial cells. Structure of Eukaryotic cell, plant cell, animal cell, Difference between Prokaryotic and Eukaryotic cell.	09
	(हिन्दी)	कोशिका की संरचना एवं सिद्धान्त, प्रोकेरियाटिक कोशिका की संरचना, युबैक्टीरिया एवं आर्कीबेक्टिरिया जीवाणु कोशिका की माप, अकारिकी एवं विन्यास। ग्राम धनात्मक एवं ग्राम ऋणात्मक कोशिकाओं युकेरियॉटिक कोशिका पादंप कोशिकाओं जन्तु कोशिकाओं की संरचना, प्रोकोरियॉटिक एवं युकेरियॉटिक कोशिकाओं में अंतर।	
Unit-II	(English)	Structure and function of bacterial cell- flagella, pili, cell wall, cytoplasmic membrane, nuclear region, mesosomes, ribosomes, vacuoles, metachromatic granule, spores and cysts. Structure and function of eukaryotic cell- cell wall, cell membrane, mitochondria, chloroplast, endoplasmic reticulum, Golgi bodies, nucleus, cytoskeleton, microbodies, centriole, Lysosomes.	09
	(हिन्दी)	जीवाणु कोशिका की संरचाना एवं कार्य, कशाभ (फ्लैजेला), पिलि, कोशिकाभित्ति, जीवद्रव झिल्ली, केन्द्रकीय भाग, मीजोसोम्स राइबोसोम्स, रिक्तिका, मेटाक्रोमेटिक ग्रेन्यूल बीजाणु एवं सिस्ट। युकेरियॉटिक कोशिका की संरचना एवं कार्य, कोशिकाभित्ति, कोशिका झिल्ली, माइटोकॉन्ड्रिया, हरित लवक, एण्डोप्लाज्मिक रेटीकुलम, गॉल्गीकाय, केन्द्रक, साइटोस्केलेटन, माइक्रोबॉडी, सेण्ट्रीयोल, लाइसोसोम।	

Unit-III	(English)	Cell cycle and cell division- mitosis, meiosis. Anomalies in cell division and associated diseases. Cell synchrony, cell-cell interactions, cell locomotion, cell differentiation.	09
	(हिन्दी)	कोशिका चक्र एवं कोशिका विभाजन समसूत्रीय एवं अर्द्धसूत्रीय कोशिका विभाजन, कोशिका विभाजन में असंगतता एवं संबंधित रोग/कोशिकीय ससंजन, कोशिका से कोशिका अन्तःक्रिया, कोशिकीय गति, कोशिका विभेदन।	
Unit-IV	(English)	Transport Process: Cell membrane: Models of membrane structure. Membrane proteins and their properties, membrane carbohydrates and their roles. Transport across membranes, active and passive diffusion mechanisms.	09
	(हिन्दी)	पार अभिगमन प्रक्रिया– कोशिका झिल्ली कोशिका झिल्ली के विभिन्न मॉडल मेम्ब्रेन प्रोटीन एवं उनके गुण मेन्ब्रेन कार्बोहाइड्रेटस एवं उनकी भूमिका झिल्ली के पार परिवहन, सक्रिय एवं निष्क्रिय परिवहन, विसरण क्रियाविधि।	
Unit-V	(English)	Introduction to Necrosis , Senescence, Apoptosis- Programmed cell death , Mechanism of Apoptosis, Intrinsic and Extrinsic pathways of cell death, Apoptosis in relation to Cancer, Oncogenes-Typesof cancer.	09
	(हिन्दी)	नेक्रोसिस का परिचय, जीर्णता, एपॉप्टॉसिस प्रोग्राम्ड सेल डेथ, एपॉप्टॉसिस की क्रियाविधि, कोशिका मृत्यु के इनट्रिन्सिक एवं एक्सट्रिन्सिक मार्ग, कैंसर के संबंध में एपॉप्टॉसिस, ऑन्कोजीन्स, कैंसर के प्रकार।	

SUGGESTED BOOKS

1. Cell and molecular. Biology: P.K.Gupta
2. Modern concept of Microbiology: H.D. Kumar & Swati Kumar
3. A text book of Microbiology: Dubey & Maheshwari
4. Microbial ecology fundamentals and application: Atlas Bartha
5. Biophysics : Mohan P. Arora
6. Biology: Raven, Johnsen, Lasos Singer
7. Cell & Molecular biology: S.C.Rastogy
8. Fundamentals of Microbiology & Immun
   ology: A.K.Banerjee,Nirmalya Banerjee
9. Biochemistry:A.C. Deb
10. Biomolecule:Mohan P.Arora
11. Enviornmental Microbiology & Biotech: D.P.Singh,S.K. Dwivedi
12. Biophysics : Pattabh & Gautham
13. Experiment in microbiology, plant pathology & Biotech : K.R. Aneja
14. General Microbiology Vol. I & II-Power & Dangiwala
15. Molecular Biology of Cells, (2002), Albets's et. al.
16. Lehinger principles of Biochemistry (2005), Nelson & Cox.
17. Microbiology, Prescott, Harley & Klein.

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Session		2018-19
Class		**B.Sc.. Ist Year**
Subject	(English)	**Biotechnology**
	(हिन्दी)	**जैवप्रोद्योगिकी**
Paper		II
Paper code		BT-102
Title of the Paper	(English)	**Microbiology**
	(हिन्दी)	**सूक्ष्मजैविकी**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	Introduction of Microbiology - History, Application & Status of Microbiology in India. Classification of Microorganisms - General Features, systems of Classification. Microbial Taxonomy, Classification and identification of Bacteria according to Bergey's manual.	09
	(हिन्दी)	सूक्ष्मजैविकी का परिचय– इतिहास अनुप्रयोग एवं भारत में सूक्ष्मजीवविज्ञान का स्थान (स्टेटस) सूक्ष्मजीवियों का वर्गीकरण– सामान्य लक्षण, वर्गीकरण, सूक्ष्मजैवकीय वर्गीकृत विज्ञान, बर्गीज मैनुअल के अनुसार जीवाणुओं का वर्गीकरण एवं पहचान के लक्षण।	
Unit-II	(English)	Structure and Diversity of Bacteria & Virus, Microbes in extreme environment. Nutritional requirement of microbes. Bacteriology: Morphology, ultra structure and types of Bacteria. Archaebacteria, structure and function of bacterial cell organelles.	09
	(हिन्दी)	विषाणु एवं जीवाणु की संरचना एवं विविधता, चरम पर्यावरण में सूक्ष्मजीव, सूक्ष्मजीवों की पोषकीय आवश्यकतायें। जीवाणु विज्ञानः– जीवाणु आकारिकीय, सूक्ष्म संरचना एवं प्रकार। आर्कीबैक्टीरिया, बैक्टीरिया कोशिका के अंगकों की संरचना एवं कार्य।	
Unit-III	(English)	Structure and Diversity of Algae, Fungi, Protozoans, Mycoplasmas and Extremophiles. General characteristics, Various methods of staining- simple, Gram staining, endospore, capsule, flagella and negative staining, Fungal stains, Algal stains.	09
	(हिन्दी)	शैवाल, कवक, प्रोटोजोअन्स, माइकोप्लाज्मा एवं एक्स्ट्रीमोफिल्स् की संरचना एवं विविधता। अभिरंजन की विभिन्न विधियाँ – साधारण, ग्राम अभिरंजन, एण्डोस्पोर, कैप्सूल, फ्लैजिला एवं ऋणात्मक अभिरंजन, कवक रंजक, शैवाल	

		रंजक।	
Unit-IV	(English)	Microbial growth - mathematical expression of growth, growth curve, factors affecting growth. Cultivar Technique, Types of cultivar Batch, continuous, synchronous and diauxic growth. Quantification of microbial growth. Control of micro organism - physical & chemical, Evaluation of chemical disinfectants - tube dilution test, agar diffusion test and phenol - coefficient.	09
	(हिन्दी)	सूक्ष्मजीव वृद्धि– वृद्धि की गणितीय अभिव्यक्ति, वृद्धि वक्र, वृद्धि को प्रभावित करने वाले कारण। संवर्धन तकनीक, संवर्धन के प्रकार– बैच संबर्धन, सतत् संवर्धन, सिंक्रोनस संवर्धन, डाइऑक्सीक वृध्दि, सूक्ष्मजीवीय वृद्धि की गणना। सूक्ष्मजीव नियंत्रणः– निष्संक्रामक का भौतिक एवं रसायनिक। रासायनिक निष्संक्रामक का मूल्यांकन – ट्यूब तनुता परीक्षण, अगर विसरण परीक्षण एवं फीनॉल गुणांक।	
Unit-V	(English)	Microbial Nutrition and metabolism - Microbial Metabolism - Concept of Anabolism & catabolism processes. Nitrogen Fixation - types and mechanisms, Microbial disease in plants & animals (Only General concept). Fermentation Process - Fermenter & microbes of industrial importance.	09
	(हिन्दी)	सुक्ष्मजीवीय पोषण एवं चयापचय– सूक्ष्मजीवीय चयापचय– उपचय एवं अपचय की अवधारणा। नाइट्रोजन स्थिरीकरण– प्रकार एवं क्रियाविधि, पौधों एवं जंतुओं में सूक्ष्म जीवीय रोग (केवल सामान्य अवधारणा)। किण्वीकरण प्रक्रियाः– किण्वक एवं सूक्ष्मजीव के औद्योगिक महत्व।	

Suggested Reading -

1. Cell and molecular Biology : P. K. Gupta
2. Cell & Molecular biology :S. C. Rastogy
3. Molecular Biology of Cells, (2202), Alberts's et. al.
4. Cell Biology, P. S. Verma & Agarwal
5. Text book of Microbiology by R. C. Dubey
6. A Text book of Microbiology - Dubey and Maheswari
7. Essentials of Microbiology - K.S. Bilgrami / R.K. Sinha
8. Microbiology P. D. Sharma
9. General Microbiology Vol I & II - Pawar & Dagniwala
10. Applied Microbiology - P. D. Sharma
11. Microbiology Fundamentals & Applications - S. S. Purohit
12. Experiments in Microbiology, Plant Pathology & Biotechnology - K. R. Ancja
13. Fundamentals of Microbiology & Immunology By A. K. Banerjee, Nirmalaya Banerjee
14. Modern Concept of Microbiology - H. D. Kumar & Swati Kumar

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Session		2018-19
Class		B.Sc.II Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		I
Paper code		BT-201
Title of the Paper	(English)	Biophysics and Biochemistry
	(हिन्दी)	जैवभौतिकी एवं जैवरसायन
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	Thermodynamics: Thermodynamics System, Equilibrium, Thermodynamic laws and their applications. Different types of processes, Thermodynamic variables and Entropy. Thermodynamic potentials and relations. Maxwell's Equations, Fundamental equation of heat flow.	09
	(हिन्दी)	ऊष्मागतिकीः ऊष्मागतिकी तंत्र, साम्यावस्था, ऊष्मागतिकी नियम तथा उनके अनुप्रयोग। ऊष्मागतिकी प्रक्रमों के विभिन्न प्रकार, ऊष्मागतिकी चर तथा एंट्रॉपी। ऊष्मागतिकी विभव एवं संबंध। मैक्सवेल का समीकरण, ऊष्मा प्रवाह का मूलभूत समीकरण	
Unit-II	(English)	General Biophysical Methods: Measurement of pH, Radioactive labeling & Counting. Autoradiography. Diffusion, Sedimentation, Osmosis, Viscosity- definitions, factors influencing them and their applications in biology. Bragg's equation. Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure.	09
	(हिन्दी)	सामान्य जैवभौतिकी विधियाँः pH मापन, रेडियोएक्टिव नामांकन एवं गणना, ऑटोरेडियोग्राफी, विसरण, अवसादन, परासरण, श्यानता – परिभाषायें, इन्हें प्रभावित करने वाले कारक, जीवविज्ञान में इनके अनुप्रयोग। ब्रैग का समीकरण, व्युत्क्रम जालक, मिलर जालक तथा इकाई सेल, विभिन्न क्रिस्टल संरचना के प्रकार, क्रिस्टल संरचना ज्ञात करना।	

Unit-III	(English)	Fundamentals of Biochemistry: Biochemistry as molecular logic of living beings. Axioms of living matter, Major organic compounds of animate objects a general view. Chemical elements. Structure of atoms, molecules and chemical bonds, Ionic, covalent, coordinate and hydrogen bonds. Structure, function and properties of water, water as universal solvent, Acids, bases and salts. pH and buffers.	09
	(हिन्दी)	जैवरसायन का आधारः जीवों में आण्विक तर्क के रूप में जैवरसायन। जैवपदार्थ की सूक्तियाँ, सजीवों में वृहद् कार्बनिक यौगिकों का सामान्य परिचय। रसायनिक तत्व, परमाणु की संरचना, अणु तथा रासायनिक बंध, आयनिक, सहसंयोजक, उप सहसंयोजक तथा हाइड्रोजन बंध, जल की संरचना, कार्य तथा गुण, जल सार्वभौमिक विलायक के रूप में, अम्ल, क्षार तथा लवण, pH तथा बफर।	
Unit-IV	(English)	Biomolecules: Introduction and occurrence, classification, properties, importance of carbohydrate, lipids, proteins, amino acids and nucleic acids and various types of RNA's.	09
	(हिन्दी)	जैवअणुः कार्बोहाइड्रेट, लिपिड, प्रोटीन, अमीनो अम्ल तथा न्यूक्लिक अम्ल का परिचय, उपलब्धता, वर्गीकरण, गुण तथा महत्व, RNA के प्रकार।	
Unit-V	(English)	Enzyme: Structure, classification and function- Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of Km-Michaelis Menten equation. Various types of enzyme inhibition and identification using double reciprocal plot, Introduction to Allosterice Enzyme, Definition of holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group and their examples, Concept of ribozyme, multiple forms, isozymes and abzymes.	09
	(हिन्दी)	विकरः संरचना, वर्गीकरण एवं कार्य, सक्रिय स्थल, सक्रियण की ऊर्जा, संक्रमण अवस्था की परिकल्पना, ताला–कुंजी संकल्पना, प्रेरित–जोड़ संकल्पना, Km मिकैलिस मेण्टन समीकरण की अवधारणा, एंजाइम अवरोधन (संदमन) के विभिन्न प्रकार तथा डबल रेसिप्रोकल प्लॉट द्वारा एंजाइम की पहचान। एलोस्टेरिक एंजाइम का परिचय। होलोएंजाइम, एपोएंजाइम, सह–एंजाइम, सह–कारक, प्रोस्थेटिक समूह की परिभाषा तथा इनके उदाहरण। राइबोजाइम, विभिन्न रूप, आइसोजाइम तथा एबजाइम की अवधारणा।	

Sarojini Naidu Govt. Girls P.G. (Autonomous) College,
Shivaji Nagar, Bhopal
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Session		2018-19
Class		B.Sc. II Year
Subject	(English)	Biotechnology
	(हिन्दी)	**जैवप्रोद्योगिकी**
Paper		II
Paper code		BT-202
Title of the Paper	(English)	Bioinstrumentation, Biostatistics and Bioinformatics
	(हिन्दी)	**जैवयांत्रिकी, जैवसांख्यिकी एवं जैवसूचना विज्ञान**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	Microscopy: light, Phase contrast, fluorescence microscopy, electron microscopy. Centrifugation technique. Principles types & separation of biological molecule,	09
	(हिन्दी)	सूक्ष्मदर्शीः प्रकाश, फेज कंट्रास्ट स्फूरदीप्ति सूक्ष्मदर्शी, इलेक्ट्रॉन सूक्ष्मदर्शी। अभिकेन्द्रीय तकनीक। सिद्धान्त, प्रकार एवं जैविक अणुओं का पृथक्करण।	
Unit-II	(English)	Chromatography and Electrophoresis Chromatography: Principles and applications, Principle and application of electrophoresis. Agarose gel electrophoresis, Immuno electrophoresis, Blotting: Southern, Western and Northern Blotting.	09
	(हिन्दी)	क्रोमेटोग्राफी तथा इलेक्ट्रोफोरेसिस – क्रोमेटोग्राफी सिध्दांत एवं अनुप्रयोग, इलेक्ट्रोफोरेसिस – सिध्दांत एवं अनुप्रयोग। एग्रोस इलेक्ट्रोफोरेसिस, इम्यूनो इलेक्ट्रोफोरेसिस। सदर्न,वेस्टर्न एवं नादर्न ब्लॉटिंग।	
Unit-III	(English)	Spectrophotometry. Colorimetry (UV and Visible), Radio & non radio labeling, Autoradiography.	09
	(हिन्दी)	स्पेक्ट्रोफोटोमिट्री। कोलोरीमिट्री (UV and Visible), रेडियो एवं अरेडियों नामांकन, आटोरेडियोग्राफी।	
Unit-IV	(English)	Biostatistics- Introduction, Scope, application and use of statistic collection and classification of data summarization and presentation of data. Arithmetic mean, median, standard deviation. Probability: definition, Random variable and its distribution. Binomial probability distribution.	09
	(हिन्दी)	जैवसांख्यिकीः प्रस्तावना, क्षेत्र, अनुप्रयोग एवं संख्यिकी संग्रह का उपयोग एवं डाटा गणना का वर्गीकरण तथा प्रतिचयन ग्राफ एवं चित्र। समानान्तर माध्य, मध्यिका प्रमाप	

		विचलन। प्रायिकताः परिभाषा यादृच्छिक चर एवं उसका बंटन। द्विपद प्रायिकता बंटन इसके उदाहरण एवं प्रतिबंध।	
Unit-V	(English)	Computer: General introduction (Characteristics, capabilities, generations), Hardware; organization of hardware (input devices, memory, control unit arithmentic logic unit, output devices): software: (System software; application software, languages- low level, high level), internet application. Basic Bioinformatics: Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc) Biological Databases: Sequence databases (EMBL, GenBank, DDBJ – UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK etc). Cluster databases- An Introduction, Specialized databases (KEGG etc), Database technologies (Flat-File), Structural databases (PDB)	09
	(हिन्दी)	कम्प्यूटरः सामान्य परिचय (गुण, क्षमताएं एवं कम्प्यूटर पीढ़ीयाँ) हार्डवेयर, हार्डवेयर का संगठन (इनपूट डिवाइस, मेमोरी कंट्रोल यूनिट, अर्थमेटिक लॉजीक युनिट आउटपूट डिवाइस), सॉफ्टवेयर सिस्टम (सिस्टम सॉफ्टवेयर, एप्लीकेशन सॉफ्टवेयर कम्प्यूटर भाषाएं – निम्न स्तरीय एवं उच्च स्तरीय), इंटरनेट एप्लीकेशन। आधारभूत जैव सूचना विज्ञानः इंटरनेट का परिचय, सर्च इंजन (Google, Yahoo, Entrez आदि) जैविक डाटाबेसः अनुक्रम डाटाबेस (EMBL, GenBank, DDBJ – UNIPROT, PIR, TrEMBL) प्रोटीन फेमिली/डोमेन डाटाबेस (PROSITE, PRINTS, Pfam, BLOCK etc). क्लस्टर डाटाबेस – परिचय, विशेष डाटाबेस (KEGG etc), डाटाबेस तकनीक (Flat-File), संरचनात्मक डाटाबेस (PDB)	

Books for B.Sc. II year

1. A text book of Bioinformatics by Sharma & Munjal & Shankar.
2. Bioinformatics by CSV Muthy
3. Basic Bioinformatics by S.Ignacimuthu. S.J
4. Bioinformatics: Concepts, Skills and Application By S.C. Rastogi, N. Mendiratta & Parag Rastogi.
5. Practical Guide for basic Bioinformatics & Biostatistics By P.Tiwari & P.Pandey.
6. Biostatistics by B.Prasad
7. Statistical Methods by S.P. Gupta.
8. Fundamentals of Statistics By S.C. Gupta
9. Biostatistics by P.N. Arora
10. Principles of Biochemistry, Lehninger
11. Fundamentals of Biochemistry, J.L. Jain
12. Biochemistry, Voet and Voet.
13. Textbook of Biochemistry- S.P. Singh
14. Biophysics: Pattabh & Gautham
15. Biochemistry: A.C. Deb
16. Bimolecule: Mohan P. Arora
17. Principles of Biochemistry (2005), Nelkson & Cox

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2018-19
Theory / Practical

Session		2018-19
Class		B.Sc.III Year
Semester		V
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		
Title of the Paper	(English)	Immunology and Molecular Biology
	(हिन्दी)	प्रतिरक्षा विज्ञान एवं आणिवक विज्ञान
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+30CCE

Unit		Syllabus	Periods
Unit-I	(English)	Historical development and evolution of Immunology, Immunological components, Cell types, Structure and function, organization of lymphoid organs. Immune system Structure and properties and function of Antigen-antibody Interactions.	09
	(हिन्दी)	प्रतिरक्षा विज्ञान का ऐतिहासिक विकास एवं उद्विकास प्रतिरक्षा विज्ञान के घटक। कोशिका के प्रकार, संरचना एवं कार्य, लसिकाभ अंगों का संगठन। प्रतिरक्षित प्रणाली की प्रतिरक्षा। प्रतिजन की संरचना एवं गुण। प्रतिरक्षी की संरचना एवं गुण, प्रतिजन–प्रतिरक्षी प्रतिक्रिया।	
Unit-II	(English)	Humoral response and Cell-Mediate immunity, Hypersensitivity, Transplantation and Auto immunity Autoantibodies in human pathogenic mechanism, experimental models and treatment of autoimmune diseases.	10
	(हिन्दी)	ह्यूमोरल अनुक्रिया एवं कोशिका संचालित प्रतिरक्षा, प्रतिरक्षी, अति संवेदनशीलता, प्रतिरोपण एवं स्वप्रतिरक्षा– अंग विशिष्ट स्वप्रतिरक्षित रोग, क्रमबद्ध स्वप्रतिरक्षित रोग, प्रतिरक्षा कार्यविधि का मानव रोगजनक कार्यविधि में स्वप्रतिरक्षी, स्वप्रतिरक्षित रोग के प्रयोगात्मक प्रादर्श एवं उपचार।	
Unit-III	(English)	Macromolecular synthesis Chromosomes structure and replication– DNA structure, DNA replication, Replication of Bacterial Chromosome. RNA structure and function, Transcription, Processing of mRNA, rRNA, tRNA	10

		Reverse transcription, ribosome structure. Protein Synthesis, with 'Lac' Operon. Inhibition of Translation post translation.	
	(हिन्दी)	वृहद् आण्विक संश्लेषण, गुणसूत्र सरंचना एवं पुनरावृत्ति – डी.एन.ए. की संरचना , डी.एन.ए. पुनरावृत्ति, सूक्ष्मजीवों गुणसूत्र की ंपुनरावृत्ति, आर.एन.ए.,की सरंचना एवं कार्य, अनुलेखन, एम.आर.एन.ए., आर.आर.एन.ए., टी.आर. एन.ए. का संधान, प्रतिलोम अनुलेखन, राइबोजोम की संरचना। लेक ओपरोन के साथ प्रोटीन संश्लेषण, अनुवादक का अवरोध, पश्च्य अनुवादन।	
Unit-IV	(English)	Plasmids: Properties (Replication, Function of on region incompatibility.) Plasmid Genetics :Plasmid cloning vectors Recombinant DNA techniques and cloning with Restriction endonuclease and recombinant DNA, Cloning Bacterial gene (PCR).	08
	(हिन्दी)	प्लाज्मिडः–लक्षण (क्षेत्रीय अक्षमता के पुनरावृत्ति एवं कार्य) प्लाज्मिड की अनुवांशिकीः प्लाज्मिड क्लोनिंग वाहक। पुनर्योगज डी.एन.ए. तकनीक एवं रेस्ट्रिक्शन इन्डोन्यूकलेज के साथ क्लोनिग एवं रीकाम्बीन्नेट डी.एन.ए., सूक्ष्म जीवयीय जीन की क्लोनिंग(पी.सी.आर.)	
Unit-V	(English)	Mutation, Types of mutations; Point mutation(Base pair change, frame shift, deletion, etc) Transcription, translation and gene expression in eukaryotes (yeast), One gene one enzyme hypothesis.	10
	(हिन्दी)	उत्परिवर्तनः उत्परिवर्तन के प्रकार, बिन्दु उत्परिवर्तन(क्षार युग्म परिवर्तन, फ्रेमशिफ्ट उत्परिवर्तन, विलोपन) यूक्रेरियोटस् (यीस्ट) में अनुलेखन, अनुवादन एवं जीन अभिव्यक्ति, एक जीन एक विकर परिकल्पना।	

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2018-19
Theory / Practical

Session		2018-19
Class		B.Sc.. III Year
Semester		VI
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper code		BBT-601
Title of the Paper	(English)	Applied Biotechnology
	(हिन्दी)	व्यवहारिक जैवप्रौद्योगिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+30CCE

Unit		Syllabus	Periods
Unit-I	(English)	Introduction to plant tissue culture, Nutritional requirements, In vitro culture, Single cell culture, Somaclonal variations, Anther culture, Ovule culture. Somatic embryogenesis, Organogenesis	09
	(हिन्दी)	पादप ऊतक संवर्धन का परिचय, पोषक आवश्यकताएँ, पात्रे संवर्धन, एकल कोशिका संवर्धन, कायिक क्लोनीय विविधता, पराग संवर्धन,, बीजांक संवर्धन। कायिक भ्रूणजनन, अंगजनन।	
Unit-II	(English)	Somatic hybridization, Genetic manipulation of plants using Agrobacterium tumefaciens The engineering of recombinant plastids in higher plants. Isolated Microspore Embryogenesis in cereals.	09
	(हिन्दी)	कायिका संकरण एग्रोबेक्टीरियम ट्यूमेफेशियन्स के उपयोग से पादपों में जेनेटिक मेनीपुलेशन। उच्च पादपों में पुनर्योगज प्लास्टिड की अभियांत्रिकी। अनाजों में पृथक्कृत (निगलित) सूक्ष्मबीजाणु, भ्रूणजनन।	
Unit-III	(English)	Energy transfer in ecosystem, Renewable and non-renewable resources, Role of biotechnology in pollution, Type and management of pollution, Waste water treatment, xenobiotics, Bioremediation, Green house effect, Ozone depletion, Bioleaching, biofertilizers, Biopesticides, Modern fuels, Biogas, Microbial H2 production.	09
	(हिन्दी)	पारिस्थितिक तंत्र में ऊर्जा स्थानान्तरण, नवीनीकरण एवं अनवीनीकरण संसाधन, प्रदूषण में जैव प्रौद्योगिकी की भूमिका, प्रदूषण के प्रकार एवं प्रबंधन, अपशिष्ट जल का उपचार, जीवेत्तर (जीनोबायोटिक्स), बायोरेमेडिएशन, ग्रीन हाउस प्रभाव, ओजोन	

		क्षरण, जैविक निक्षालन, जैव उर्वरक, जैव कीटनाशी, आदर्श जैव ईधन, जैव गैस, सूक्ष्मजीवीय हाइड्रोजन उत्पादन।	
Unit-IV	(English)	Production of some important bio-products, Antibiotic and beverages. Microbial role in food processes, operation and production, new protein post harvest technology and process of food preservation milk procession operations.	09
	(हिन्दी)	प्रतिरक्षी , पेय पदार्थ एवं महत्वपूर्ण जैवउत्पादों का उत्पादन। खाद्य प्रक्रिया, संक्रिया एवं उत्पादन में सूक्ष्मजीवों की भूमिका, नये प्रोटीन खाद्य–प्रोटीन, फसलोपरांत तकनीक और खाद्य पदार्थों का संरक्षण, दुग्ध संसाधन संक्रिया।	
Unit-V	(English)	Medical application of rDNA technology, Human disorders associated with defects in protein/enzyme biosynthesis, DNA probes and their application in diagnosis of genetic and other disorders. Plant DNA finger printing.	09
	(हिन्दी)	आर.–डी.एन.ए. तकनीक का चिकित्सीय अनुप्रयोग, प्रोटीन/विकर जैव संश्लेषण में दोष से उत्पन्न मानव विकार,, डी.एन.ए. अन्वेषी तथा उनका अनुवांशिक एवं अन्य विकारों के निदान में अनुप्रयोग, पादप डी.एन.ए. फिंगर प्रिंटिग।	

Books for Semester-V, VI

1. Immunology: Tizard
2. Biotechnology An Introduction : Barum
3. Principles of Immunology: Shastri
4. Problems of genetics, Molecular genetics & evolutionary genetics: Pranobh K. Banerjee
5. Fundamentals of Microbiology & Immunology : Banerjee& Banerjee
6. Biotechnology : Mohan P.Arora
7. Immunology : Rao
8. Biotechnology & Genomics : P.K.Gupta
9. Biotechnology : Satyanarayan
10. Plant tissue culture: Bhajwan
11. Introduction to plant tissue culture:Razadan
12. Introduction to Biotech: Chawla
13. Animal Biotechnology: Srivastava, Singh& Yadav.
14. Immunology-Kubey, J.
15. Molecular Biotechnology, Glick & Pasternak.
16. Plant tissue culture-Evance, D.R.
17. Food, Microbiology-Frazier
18. Biotechnology- K. Trahan

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2018-19
Theory / Practical B.Sc. I year
B.Sc. I year Laboratory Exercises: BT 103

List of Practicals

1. To study the plant cell structure using various plant materials.
2. To study microbial cell by Monochrome staining and Gram staining.
3. To prepare and study the different stages of mitosis and meiosis.
4. Prepare slide for study of stomata.
5. Study of permanent slides like cell division, prokaryotic and eukaryotic cells. Museles and Nerve cells, T.S. of stomatal cells.
6. To study the animal cell structure using cheek cells.
7. Histochemical localization offlagellin.
8. Viable cell counting using haematocytometer.
9. Measurement of cell by light microscope :-
   Calibration of ocular micrometer, finding out average cell size
10. Separation of cell types from blood by TLC/differential counting.
11. Methods of cell lysis: rupture osmotic/chemical/enzymatic.
12. Study of human and animal chromosomes.
13. Aseptic techniques, cleaning of glassware, Preparation of cotton plugging and sterilization.
14. Isolation of Microbes from Air, Water and Soil.
15. Dilution and plating by Pour plate, Spread Plate Methods.
16. Staining Method _ Gram Staining, Endospore Staining, Fungal Staining, Algal staining.
17. Identification of Bacteria based on staining and size.
18. Antibiotic Senitivity of Microbes by the Use of Antibiotic Discs.
19. Isolation and Identification of aquatic Fungi from Local water body.
20. Isolation and Characterization of green algae from Natural habitats.
21. Measurement of water and soil, pH.

Note : 70% of the above list should be compulsorily performed.

B.Sc. I year -Scheme of Practical Examination

MM : 50
Duration : 3 Hrs.

1. Major Exercise (10)
2. Major Exercise (10)
3. Minor Exercise (5)
4. Minor Exercise (5)
5. Spotting (10)
6. Viva-Voce (5)
7. Practical Record (5)

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal

Semester Wise Syllabus of Biotechnology

(As Recommended by the Board of Studies)

2018-19

Theory / Practical

B.Sc. Biotechnology II year

B.Sc.II year BT – 203 Laboratory Exercises

List of Practicals

1. Principles and working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope etc.
2. Qualitative analysis of Carbohydrates, Proteins and Lipids.
3. Qualitative estimation of Protein by Folin-Lowry method.
4. Qualitative estimation of sugar by Nelson Smogyi's method.
5. Determination of enzyme activity by amylase.
6. Study the effect of temperature on enzyme activity.
7. Study the effect of pH on enzyme activity.
8. Separation of amino acids by TLC
9. Separation of leaf pigments by Paper chromatography.
10. Estimation of hemoglobin.
11. RBC counting by haematocytometer.
12. WBC counting by Differential/ or total cell count.
13. Measurement of bleeding and clotting time.
14. Measurement of Hemin Crystals.
15. Estimation of beta carotene in carrots.
16. Estimation of ascorbic acid in lemon juice.
17. Determination of iodine number of fat sample.
18. Determination of phosphorus content in plant material (Colorimetric method).
19. Computer Input and output devices.
20. Prepare a Mark sheet of your class Subjects.
21. Design your class timetable.
22. Prepare a bar chart, pie chart for analysis of Election Result.
23. Exercise based on power point presentation.
24. Design a presentation illustrating insertion of pictures, word art & clip art.
25. Use MS Word to insert a table into document.
26. Problem based on Mean, Median, Mode.
27. Hardy Weinberg Law applied on Population Genetics.
28. Problem based on Probability
29. Exercise based on standard Deviation.
30. Biological data resources and data retrieval.
31. Introduction to NCBI.

32. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.
33. Analyzing Protein Sequences.
34. Analyzing DNA Sequence.

Practical Scheme

B.Sc. Biotechnology II year

M. Marks 50

Q. -1	**Major practical……..**	**10**
Q. -2	**Major practical…….……..**	**10**
Q. -3	**Minor practical……..**	**05**
Q. -4	**Minor practical…….……..**	**05**
Q.5	**Spotting……**	**10**
Q.-6	**Viva-voce……**	**05**
Q.-	**Record/Sessional……..……..**	**05**
	Total	**50**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2018-19

BBT 503-LABORATORY Exercises –V Semester

1. Isolation and purification of protein.
2. Determination of blood group and Rh factor.
3. Test for integrity of the inflammatory response.
4. Demonstration of Direct ELISA through kit.
5. Mast cell preparation and staining.
6. Mcrophages preparation and staining.
7. Isolation of liver cell.
8. Demonstration of pregnancy test HGC, GH etc.
9. Separation of serum from blood (normal diseased).
10. Demonstration of Rocket electrophoresis/Gel electrophoresis.
11. Pathological diagnosis of tuberculosis, malaria, sickle cell anemia and other disease.
12. To detect niterate deducted in leaf extract by immuno diffusion.
13. Elution of plant DNA fragment from agarose gel.
14. Transformation of E-coli cells with recombinant DNA.

Note: 70% of the above list should be compulsorily performed.

Practical Scheme

B.Sc. Biotechnology Semester V

Hours : 03:00 **M. Marks 50**

Q. -1 Major practical…….15

Q. -2 Minor practical…….10

Q.-3 Spotting…….10

Q.-4 Viva-voce…….05

Q.-5 Record/Sessional…….10

Total 50

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2018-19
BBT 603-LABORATORY-VI

1. Growth of plant tissue into undifferentiated mass of callus.
2. Preparation of animal cell culture media.
3. Separation and culture of lymphocyte from blood.
4. Demonstration of fermentor.
5. Preparation of wine.
6. Effects of toxicants on microbes.
7. Effects of toxicants on animal cell.
8. Extraction of citric acid from *Aspergillus*.
9. Production of ethanol by yeast.
10. Demonstration of PCR.
11. Immobilization of yeast cells.
12. Immobilization of enzyme.
13. Extraction and preparation of lactic acid.
14. Extraction and preparation of citric acid.
15. Demonstration of Radial immuno diffusion analysis.
16. Isolation of microorganism from polluted site/ industrial waste.

Note: 70% of the above list should be compulsorily performed.

Practical Scheme

B.Sc. Biotechnology Semester VI

Hours : 03:00 **M. Marks 50**

Q. -1 Major practical…….15

Q. -2 Minor practical…….10

Q.-3 Spotting…….10

Q.-4 Viva-voce…….05

Q.-5 Record/Sessional…….10

Total 50

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE

SHIVAJI NAGAR, BHOPAL

Syllabus of Biotechnology

As Recommended by the Board of Studies 2019-20

Under Graduate Syllabus

2019-2020

Subject: Biotechnology

Details			Page No.
Under Graduate Level			
	Theory	**B.Sc.I -Paper I**	**…5-6**
	,, ,,	**B.Sc.I-Paper II**	**…7-8**
	,, ,,	**B.Sc.II -Paper I**	**…9-10**
	,, ,,	**B.Sc.II -Paper II**	**…11-12**
	,, ,,	**B.Sc. III – Paper I**	**…13-14**
	,, ,,	**B.Sc. III – Paper II**	**…15-17**
	Practical	**B.Sc.I**	**…18-19**
	,, ,,	**B.Sc.II**	**…20-21**
	,, ,,	**B.Sc. III**	**…22-23**

Important Note: - Training programs and institutional visits are mandatory

Date of submission in Autonomous Examination cell:

Signature
H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) Collège
Shivaji Nagar, Bhopal – 462016

Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2019-20
Scheme of examination

Course :Biotechnology **B.Sc. (3 Years Degree Course)**

Theory Papers/practical	**Title of paper**	**Compulsory/ Optional**	**Marks**
B.Sc. Ist year Annual system			
Paper I	Cell Structure & Biology	Compulsory	50
Paper II	Microbiology	Compulsory	50
	CCE		50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**200**
B.Sc. IInd year Annual system			
Paper I	Biophysics and Biochemistry	Compulsory	50
Paper II	Bioinstrumentation, Biostatistics and Bioinformatics	Compulsory	50
	CCE		50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**200**
	B.Sc. IIIrd year Annual system		
Paper I	Molecular Biology &Genetic engineering	Compulsory	50
Paper II	Applied Biotechnology	Compulsory	50
	CCE		50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**200**
Important Note: - Training programs and institutional visits are mandatory			

Member Board of Studies

Name & Signature with date

1.

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Shivaji Nagar, Bhopal
Under Graduate Annual Pattern of Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2019-20
Theory / Practical

Session		2018-19
Class		**B.Sc. Ist Year**
Subject	(English)	**Biotechnology**
	(हिन्दी)	**जैवप्रौद्योगिकी**
Paper		**I**
Title of the Paper	(English)	**Cell Structure & Biology**
	(हिन्दी)	**कोशिका संरचना एवं जीवविज्ञान**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Period
Unit-I	(English)	Cell structure and Theory, Structure of Prokaryotic cell, Eubacteria and Archaebacteria. Size, shape and arrangement of bacterial cell. Gram positive and Gram negative bacterial cells. Structure of Eukaryotic cell, plant cell, animal cell, Difference between Prokaryotic and Eukaryotic cell.	09
	(हिन्दी)	कोशिका की संरचना एवं सिद्धान्त, प्रोकेरियाटिक कोशिका की संरचना, युबैक्टीरिया एवं आर्कीबेक्टिरिया जीवाणु कोशिका की माप, अकारिकी एवं विन्यास। ग्राम धनात्मक एवं ग्राम ऋणात्मक कोशिकाओं युकेरियॉटिक कोशिका पादंप कोशिकाओं जन्तु कोशिकाओं की संरचना, प्रोकोरियॉटिक एवं युकेरियॉटिक कोशिकाओं में अंतर।	
Unit-II	(English)	Structure and function of bacterial cell- flagella, pili, cell wall, cytoplasmic membrane, nuclear region, mesosomes, ribosomes, vacuoles, metachromatic granule, spores and cysts. Structure and function of eukaryotic cell- cell wall, cell membrane, mitochondria, chloroplast, endoplasmic reticulum, Golgi bodies, nucleus, cytoskeleton, microbodies, centriole, Lysosomes.	09
	(हिन्दी)	जीवाणु कोशिका की संरचाना एवं कार्य, कशाभ (फ्लैजेला), पिलि, कोशिकाभित्ति, जीवद्रव झिल्ली, केन्द्रकीय भाग, मीजोसोम्स राइबोसोम्स, रिक्तिका, मेटाक्रोमेटिक ग्रेन्यूल बीजाणु एवं सिस्ट। युकेरियॉटिक कोशिका की संरचना एवं कार्य, कोशिकाभित्ति, कोशिका झिल्ली, माइटोकॉन्ड्रिया, हरित लवक, एण्डोप्लाज्मिक रेटीकुलम, गॉल्गीकाय, केन्द्रक, साइटोस्केलेटन, माइक्रोबॉडी, सेण्ट्रीयोल, लाइसोसोम।	

Unit-III	(English)	Cell cycle and cell division- mitosis, meiosis. Anomalies in cell division and associated diseases. Cell synchrony, cell-cell interactions, cell locomotion, cell differentiation.	09
	(हिन्दी)	कोशिका चक्र एवं कोशिका विभाजन समसूत्रीय एवं अर्द्धसूत्रीय कोशिका विभाजन, कोशिका विभाजन में असंगतता एवं संबंधित रोग/कोशिकीय ससंजन, कोशिका से कोशिका अन्तःक्रिया, कोशिकीय गति, कोशिका विभेदन।	
Unit-IV	(English)	Transport Process: Cell membrane: Models of membrane structure. Membrane proteins and their properties, membrane carbohydrates and their roles. Transport across membranes, active and passive diffusion mechanisms.	09
	(हिन्दी)	पार अभिगमन प्रक्रिया– कोशिका झिल्ली कोशिका झिल्ली के विभिन्न मॉडल मेम्ब्रेन प्रोटीन एवं उनके गुण मेन्ब्रेन कार्बोहाइड्रेटस एवं उनकी भूमिका झिल्ली के पार परिवहन, सक्रिय एवं निष्क्रिय परिवहन, विसरण क्रियाविधि।	
Unit-V	(English)	Introduction to Necrosis , Senescence, Apoptosis- Programmed cell death , Mechanism of Apoptosis, Intrinsic and Extrinsic pathways of cell death, Apoptosis in relation to Cancer, Oncogenes-Typesof cancer.	09
	(हिन्दी)	नेक्रोसिस का परिचय, जीर्णता, एपॉप्टॉसिस प्रोग्राम्ड सेल डेथ, एपॉप्टॉसिस की क्रियाविधि, कोशिका मृत्यु के इनट्रिन्सिक एवं एक्सट्रिन्सिक मार्ग, कैंसर के संबंध में एपॉप्टॉसिस, ऑन्कोजीन्स, कैंसर के प्रकार।	

SUGGESTED BOOKS

1. Cell and molecular. Biology: P.K.Gupta
2. Modern concept of Microbiology: H.D. Kumar & Swati Kumar
3. A text book of Microbiology: Dubey & Maheshwari
4. Microbial ecology fundamentals and application: Atlas Bartha
5. Biophysics : Mohan P. Arora
6. Biology: Raven, Johnsen, Lassos Singer
7. Cell & Molecular biology: S.C.Rastogy
8. Fundamentals of Microbiology & Immunology: AK Banerjee, Nirmalya Banerjee
9. Biochemistry:A.C. Deb
10. Biomolecule:Mohan P. Arora
11. Environmental Microbiology & Biotech: D.P.Singh,S.K. Dwivedi
12. Biophysics : Pattabh & Gautham
13. Experiment in microbiology, plant pathology & Biotech : K.R. Aneja
14. General Microbiology Vol. I & II-Power & Dangiwala
15. Molecular Biology of Cells, (2002), Albert's et. al.
16. Lehninger principles of Biochemistry (2005), Nelson & Cox.
17. Microbiology, Prescott, Harley & Klein.

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Theory / Practical

Session		2018-19
Class		**B.Sc. Ist Year**
Subject	(English)	**Biotechnology**
	(हिन्दी)	**जैवप्रोद्योगिकी**
Paper		II
Title of the Paper	(English)	**Microbiology**
	(हिन्दी)	**सूक्ष्मजैविकी**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	Introduction of Microbiology - History, Application & Status of Microbiology in India. Classification of Microorganisms - General Features, systems of Classification. Microbial Taxonomy, Classification and identification of Bacteria according to Bergey's manual.	09
	(हिन्दी)	सूक्ष्मजैविकी का परिचय– इतिहास अनुप्रयोग एवं भारत में सूक्ष्मजीवविज्ञान का स्थान (स्टेटस) सूक्ष्मजीवियों का वर्गीकरण– सामान्य लक्षण, वर्गीकरण, सूक्ष्मजैवकीय वर्गीकृत विज्ञान, बर्गीज मैनुअल के अनुसार जीवाणुओं का वर्गीकरण एवं पहचान के लक्षण।	
Unit-II	(English)	Structure and Diversity of Bacteria & Virus, Microbes in extreme environment. Nutritional requirement of microbes. Bacteriology: Morphology, ultra structure and types of Bacteria. Archaebacteria, structure and function of bacterial cell organelles.	09
	(हिन्दी)	विषाणु एवं जीवाणु की संरचना एवं विविधता, चरम पर्यावरण में सूक्ष्मजीव, सूक्ष्मजीवों की पोषकीय आवश्यकतायें। जीवाणु विज्ञानः– जीवाणु आकारिकीय, सूक्ष्म संरचना एवं प्रकार। आर्कीबैक्टीरिया, बैक्टीरिया कोशिका के अंगकों की संरचना एवं कार्य।	
Unit-III	(English)	Structure and Diversity of Algae, Fungi, Protozoan's, Mycoplasmas and Extremophiles. General characteristics, Various methods of staining-simple, Gram staining, Endospore, capsule, flagella and negative staining, Fungal stains, Algal stains.	09
	(हिन्दी)	शैवाल, कवक, प्रोटोजोअन्स, माइकोप्लाज्मा एवं एक्स्ट्रीमोफिल्स् की संरचना एवं विविधता। अभिरंजन की विभिन्न विधियाँ – साधारण, ग्राम अभिरंजन, एण्डोस्पोर, कैप्सूल, फ्लैजिला एवं ऋणात्मक अभिरंजन, कवक रंजक, शैवाल रंजक।	
	(English)	Microbial growth - mathematical expression of growth, growth curve,	09

IV		factors affecting growth. Cultivar Technique, Types of cultivar Batch, continuous, synchronous and diauxic growth. Quantification of microbial growth. Control of micro organism - physical & chemical, Evaluation of chemical disinfectants - tube dilution test, agar diffusion test and phenol - coefficient.	
	(हिन्दी)	**सूक्ष्मजीव वृद्धि–** वृद्धि की गणितीय अभिव्यक्ति, वृद्धि वक्र, वृद्धि को प्रभावित करने वाले कारण। संवर्धन तकनीक, संवर्धन के प्रकार– बैच संबर्धन, सतत् संवर्धन, सिंक्रोनस संवर्धन, डाइऑक्सीक वृध्दि, सूक्ष्मजीवीय वृद्धि की गणना। **सूक्ष्मजीव नियंत्रणः**– निष्संक्रामक का भौतिक एवं रसायनिक। रासायनिक निष्संक्रामक का मूल्यांकन – ट्यूब तनुता परीक्षण, अगर विसरण परीक्षण एवं फीनॉल गुणांक।	
Unit-V	(English)	Microbial Nutrition and metabolism - Microbial Metabolism - Concept of Anabolism & catabolism processes. Nitrogen Fixation - types and mechanisms, Microbial disease in plants & animals (Only General concept). Fermentation Process - Fermentor & microbes of industrial importance.	09
	(हिन्दी)	सुक्ष्मजीवीय पोषण एवं चयापचय– सूक्ष्मजीवीय चयापचय– उपचय एवं अपचय की अवधारणा। नाइट्रोजन स्थिरीकरण– प्रकार एवं क्रियाविधि, पौधों एवं जंतुओं में सूक्ष्म जीवीय रोग (केवल सामान्य अवधारणा)। किण्वीकरण प्रक्रियाः– किण्वक एवं सूक्ष्मजीव के औद्योगिक महत्व।	

Suggested Reading -

1. Cell and molecular Biology : P. K. Gupta
2. Cell & Molecular biology :S. C. Rastogy
3. Molecular Biology of Cells, (2202), Alberts's et. al.
4. Cell Biology, P. S. Verma & Agarwal
5. Text book of Microbiology by R. C. Dubey
6. A Text book of Microbiology - Dubey and Maheswari
7. Essentials of Microbiology - K.S. Bilgrami / R.K. Sinha
8. Microbiology P. D. Sharma
9. General Microbiology Vol I & II - Pawar & Dagniwala
10. Applied Microbiology - P. D. Sharma
11. Microbiology Fundamentals & Applications - S. S. Purohit
12. Experiments in Microbiology, Plant Pathology & Biotechnology - K. R. Ancja
13. Fundamentals of Microbiology & Immunology By A. K. Banerjee, Nirmalaya Banerjee
14. Modern Concept of Microbiology - H. D. Kumar & Swati Kumar

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Theory / Practical

Session		2018-19
Class		B.Sc.II Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		I
Title of the Paper	(English)	Biophysics and Biochemistry
	(हिन्दी)	जैवभौतिकी एवं जैवरसायन
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Thermodynamics:** Thermodynamics System, Equilibrium, Thermodynamic laws and their applications. Different types of processes, Thermodynamic variables and Entropy. Thermodynamic potentials and relations. Maxwell's Equations, Fundamental equation of heat flow.	09
	(हिन्दी)	ऊष्मागतिकीः ऊष्मागतिकी तंत्र, साम्यावस्था, ऊष्मागतिकी नियम तथा उनके अनुप्रयोग। ऊष्मागतिकी प्रक्रमों के विभिन्न प्रकार, ऊष्मागतिकी चर तथा एंट्रॉपी। ऊष्मागतिकी विभव एवं संबंध। मैक्सवेल का समीकरण, ऊष्मा प्रवाह का मूलभूत समीकरण।	
Unit-II	(English)	**General Biophysical Methods:** Measurement of pH, Radioactive labeling & Counting. Autoradiography. Diffusion, Sedimentation, Osmosis, Viscosity- definitions, factors influencing them and their applications in biology. Bragg's equation. Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure.	09
	(हिन्दी)	सामान्य जैवभौतिकी विधियाँः pH मापन, रेडियोएक्टिव नामांकन एवं गणना, ऑटोरेडियोग्राफी, विसरण, अवसादन, परासरण, श्यानता – परिभाषायें, इन्हें प्रभावित करने वाले कारक, जीवविज्ञान में इनके अनुप्रयोग। ब्रैग का समीकरण, व्युत्क्रम जालक, मिलर जालक तथा इकाई सेल, विभिन्न क्रिस्टल संरचना के प्रकार, क्रिस्टल संरचना ज्ञात करना।	
Unit-III	(English)	**Fundamentals of Biochemistry:** Biochemistry as molecular logic of living beings. Axioms of living matter, Major organic compounds of animate objects a general view. Chemical elements. Structure of atoms,	09

		molecules and chemical bonds, Ionic, covalent, coordinate and hydrogen bonds. Structure, function and properties of water, water as universal solvent, Acids, bases and salts. pH and buffers.	
	(हिन्दी)	जैवरसायन का आधारः जीवों में आण्विक तर्क के रूप में जैवरसायन। जैवपदार्थ की सूक्तियाँ, सजीवों में वृहद् कार्बनिक यौगिकों का सामान्य परिचय। रसायनिक तत्व, परमाणु की संरचना, अणु तथा रासायनिक बंध, आयनिक, सहसंयोजक, उप सहसंयोजक तथा हाइड्रोजन बंध, जल की संरचना, कार्य तथा गुण, जल सार्वभौमिक विलायक के रूप में, अम्ल, क्षार तथा लवण, pH तथा बफर।	
Unit-IV	(English)	**Biomolecules:** Introduction and occurrence, classification, properties, importance of carbohydrate, lipids, proteins, amino acids and nucleic acids and various types of RNA's.	09
	(हिन्दी)	जैवअणुः कार्बोहाइड्रेट, लिपिड, प्रोटीन, अमीनो अम्ल तथा न्यूक्लिक अम्ल का परिचय, उपलब्धता, वर्गीकरण, गुण तथा महत्व, RNA के प्रकार।	
Unit-V	(English)	**Enzyme**: Structure, classification and function- Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of Km-Michaels Menten equation. Various types of enzyme inhibition and identification using double reciprocal plot, Introduction to Allosteric Enzyme, Definition of holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group and their examples, Concept of ribozyme, multiple forms, isozymes and abzymes.	09
	(हिन्दी)	विकरः संरचना, वर्गीकरण एवं कार्य, सक्रिय स्थल, सक्रियण की ऊर्जा, संक्रमण अवस्था की परिकल्पना, ताला–कुंजी संकल्पना, प्रेरित–जोड़ संकल्पना, Km मिकैलिस मेण्टन समीकरण की अवधारणा, एंजाइम अवरोधन (संदमन) के विभिन्न प्रकार तथा डबल रेसिप्रोकल प्लॉट द्वारा एंजाइम की पहचान। एलोस्टेरिक एंजाइम का परिचय। होलोएंजाइम, एपोएंजाइम, सह–एंजाइम, सह–कारक, प्रोस्थेटिक समूह की परिभाषा तथा इनके उदाहरण। राइबोजाइम, विभिन्न रूप, आइसोजाइम तथा एबजाइम की अवधारणा।	

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Theory / Practical

Session		2018-19
Class		B.Sc. II Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		II
Title of the Paper	(English)	Bioinstrumentation, Biostatistics and Bioinformatics
	(हिन्दी)	जैवयांत्रिकी, जैवसांख्यिकी एवं जैवसूचना विज्ञान
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Microscopy:** light, Phase contrast, fluorescence microscopy, electron microscopy. Centrifugation technique. Principles types & separation of biological molecule,	09
	(हिन्दी)	सूक्ष्मदर्शीः प्रकाश, फेज कंट्रास्ट स्फूरदीप्ति सूक्ष्मदर्शी, इलेक्ट्रॉन सूक्ष्मदर्शी। अभिकेन्द्रीय तकनीक। सिद्धान्त, प्रकार एवं जैविक अणुओं का पृथक्करण।	
Unit-II	(English)	**Chromatography and Electrophoresis** Chromatography: Principles and applications, Principle and application of electrophoresis. Agarose gel electrophoresis, Immuno electrophoresis, Blotting: Southern, Western and Northern Blotting.	09
	(हिन्दी)	क्रोमेटोग्राफी तथा इलेक्ट्रोफोरेसिस – क्रोमेटोग्राफी सिध्दांत एवं अनुप्रयोग, इलेक्ट्रोफोरेसिस – सिध्दांत एवं अनुप्रयोग। एग्रोस इलेक्ट्रोफोरेसिस, इम्यूनो इलेक्ट्रोफोरेसिस। सदर्न,वेस्टर्न एवं नादर्न ब्लॉटिंग।	
Unit-III	(English)	**Spectrophotometry.** Colorimetry (UV and Visible), Radio & non radio labeling, Autoradiography.	09
	(हिन्दी)	स्पेक्ट्रोफोटोमिट्री। कोलोरीमिट्री (UV and Visible), रेडियो एवं अरेडियों नामांकन, आटोरेडियोग्राफी।	
Unit-IV	(English)	**Biostatistics**- Introduction, Scope, application and use of statistic collection and classification of data summarization and presentation of data. Arithmetic mean, median, standard deviation. Probability: definition, Random variable and its distribution. Binomial probability distribution.	09
	(हिन्दी)	जैवसांख्यिकीः प्रस्तावना, क्षेत्र, अनुप्रयोग एवं संख्यिकी संग्रह का उपयोग एवं डाटा	

		गणना का वर्गीकरण तथा प्रतिचयन ग्राफ एवं चित्र। समानान्तर माध्य, मध्यिका प्रमाप विचलन। प्रायिकताः परिभाषा यादृच्छिक चर एवं उसका बंटन। द्विपद प्रायिकता बंटन इसके उदाहरण एवं प्रतिबंध।	
Unit-V	(English)	**Computer:** General introduction (Characteristics, capabilities, generations), Hardware; organization of hardware (input devices, memory, control unit arithmentic logic unit, output devices): software: (System software; application software, languages- low level, high level), internet application. Basic Bioinformatics: Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc) Biological Databases: Sequence databases (EMBL, GenBank, DDBJ – UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK etc). Cluster databases- An Introduction, Specialized databases (KEGG etc), Database technologies (Flat-File), Structural databases (PDB)	09
	(हिन्दी)	कम्प्यूटरः सामान्य परिचय (गुण, क्षमताएं एवं कम्प्यूटर पीढ़ीयाँ) हार्डवेयर, हार्डवेयर का संगठन (इनपूट डिवाइस, मेमोरी कंट्रोल यूनिट, अर्थमेटिक लॉजीक युनिट आउटपूट डिवाइस), सॉफ्टवेयर सिस्टम (सिस्टम सॉफ्टवेयर, एप्लीकेशन सॉफ्टवेयर कम्प्यूटर भाषाएं – निम्न स्तरीय एवं उच्च स्तरीय), इंटरनेट एप्लीकेशन। आधारभूत जैव सूचना विज्ञानः इंटरनेट का परिचय, सर्च इंजन (Google, Yahoo, Entrez आदि) जैविक डाटाबेसः अनुक्रम डाटाबेस (EMBL, GenBank, DDBJ – UNIPROT, PIR, TrEMBL) प्रोटीन फेमिली/डोमेन डाटाबेस (PROSITE, PRINTS, Pfam, BLOCK etc). क्लस्टर डाटाबेस – परिचय, विशेष डाटाबेस (KEGG etc), डाटाबेस तकनीक (Flat-File), संरचनात्मक डाटाबेस (PDB)	

Books for B.Sc. II year

1. A text book of Bioinformatics by Sharma & Munjal & Shankar.
2. Bioinformatics by CSV Muthy
3. Basic Bioinformatics by S.Ignacimuthu. S.J
4. Bioinformatics: Concepts, Skills and Application by S.C. Rastogi, N. Mendiratta & Parag Rastogi.
5. Practical Guide for basic Bioinformatics & Biostatistics by P. Tiwari & P. Pandey.
6. Biostatistics by B. Prasad
7. Statistical Methods by S.P. Gupta.
8. Fundamentals of Statistics By S.C. Gupta
9. Biostatistics by P.N. Arora
10. Principles of Biochemistry, Lehninger
11. Fundamentals of Biochemistry, J.L. Jain
12. Biochemistry, Voet and Voet.
13. Textbook of Biochemistry- S.P. Singh
14. Biophysics: Pattabh & Gautham
15. Biochemistry: A.C. Deb
16. Biomolecules: Mohan P. Arora
17. Principles of Biochemistry (2005), Nelkson & Cox

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Under Graduate Annual Pattern Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2019-20
Theory / Practical

Session		2019-20
Class		B.Sc.III Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		I
Title of the Paper	(English)	Molecular Biology & Genetic engineering
	(हिन्दी)	आण्विक विज्ञान एवं अनुवंशिक अभियांत्रिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	DNA and RNA, Chemical Structure, Types and properties, Experimental proof of DNA as genetic material, Genome – Concept, Plant, Animal, Bacterial and Viral Genome, DNA Replication. Types, Experimental proof of semi conservative replication, Replicon-Concept. Proteins and enzymes involved in replication in prokaryotes and eukaryotes, Modes of DNA replication. Unidirectional, Bidirectional, Types of DNA replication. Y shaped. Ø mode. Rolling circle mechanism.	09
	(हिन्दी)	डीएनए और आरएनए, रासायनिक संरचना, प्रकार और गुण, आनुवंशिक सामग्री के रूप में डीएनए का प्रायोगिक प्रमाण, जीनोम - संकल्पना, पादप , प्राणी , जीवाणु और वायरल जीनोम, डीएनए पुनरावृत्ति, प्रकार, अर्धसंरक्षी पुनरावृत्ति का प्रायोगिक प्रमाण,, पुनरावृत्ति - संकल्पना , प्रोकैरियोट्स और यूकेरियोट्स में पुनरावृत्ति में भाग लेने वाले प्रोटीन तथा एंजाइम, डी.एन.ए. पुनरावृत्ति की प्रणाली– एकदिशीय, द्विदिशीय पुनरावृत्ति के प्रकार, Y आकार, Ø मोड, रोलिंग चक्र तंत्र ।	
Unit-II	(English)	Eukaryotic chromosomal organization, Euchromatin, Heterochromatin, chromatin structure, nucleosomes, Histone and non Histone proteins. Histone modification, Introduction to epigenetic.	10
	(हिन्दी)	यूकेरियोटिक गुणसूत्र संगठन, यूक्रोमैटिन, हेटेरोक्रोमैटिन, क्रोमैटिन संरचना, न्यूक्लियोसोम, हिस्टोन और **नॉन** हिस्टोन प्रोटीन। हिस्टोन **रूपांतरण,** एपिजेनेटिक्स का परिचय।	
Unit-III	(English)	Origin of life: Classical experiments and current concepts. Evolution of biological macromolecules, Evolution of early forms, Mendelian genetics: Mendel's law. Chromosomal basis of heredity, Chromosomal analysis, allelic variation, dominance, linkage and crossing over.	10
	(हिन्दी)	जीवन की उत्पत्ति: शास्त्रीय प्रयोग और वर्तमान अवधारणाएँ। जैविक	

		मैक्रोमोलिक्युलस का विकास, प्रारंभिक रूपों का विकास, **मेन्डिलियन** आनुवंशिकी: मेंडल का नियम। आनुवंशिकता का क्रोमोसोमल आधार, क्रोमोसोमल विश्लेषण, एलील भिन्नता, प्रभुत्व, लिंकेज और क्रॉसिंगओवर।	
Unit-IV	(English)	Introduction to Recombinant DNA technology , Scope & importance, Gene Cloning, PCR, Introduction to Restriction endonuclease, Vectors for DNA transfer and their types: Plasmids, Phasmids, Cosmids, BAC. Gene amplification.	08
	(हिन्दी)	पुनर्संयोजक डीएनए प्रौद्योगिकी **का परिचय, परिक्षेत्र** और महत्व, जीन क्लोनिंग, पीसीआर, प्रतिबंध एंडोन्यूक्लाइज का परिचय, डीएनए हस्तांतरण के लिए वैक्टर और उनके प्रकार: प्लास्मिड, **फैज**मिड्स, कॉस्मिड्स, बीएसी, जीन प्रवर्धन।	
Unit-V	(English)	Plasmids Types, Properties and cloning vectors. Recombinant DNA techniques and cloning with Restriction endonuclease and recombinant DNA. Mutation, Types of mutation : point mutation (Base pair change, frame shift, deletion) Transcription, translation and gene expression in eukaryotes (yeast), Alternate splicing.	10
	(हिन्दी)	**प्लास्मिड्स के** प्रकार, गुण और क्लोनिंग वैक्टर, संयोजक डीएनए तकनीक और प्रतिबंध एंडोन्यूक्लाइज और पुनः संयोजक डीएनए के साथ क्लोनिंग। उत्परिवर्तन, उत्परिवर्तन के प्रकार: बिंदु उत्परिवर्तन (बेस जोड़ी परिवर्तन, फ्रेम शिफ्ट, विलोपन) यूकेरियोट्स (**यीस्ट**) में प्रतिलेखन, अनुवाद और जीन अभिव्यक्ति, वैकल्पिक **स्प्लाईसिंग**।	

Shivaji Nagar, Bhopal

Under Graduate Annual Pattern Syllabus of Biotechnology

(As Recommended by the Board of Studies)

2019-20

Theory / Practical

Session		2018-19
Class		B.Sc. III Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		II
Title of the Paper	(English)	Applied Biotechnology
	(हिन्दी)	व्यवहारिक जैवप्रौद्योगिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Microbial Biotechnology-** Food Microbiology- Microbial contamination & Spoilage, Food preservation. Industrial Production of Ethyl Alcohol, Penicillin, Cynocobalamin, Glutamic Acid, Citric Acid, Amylase, Protease.	09
	(हिन्दी)	**माइक्रोबियल बायोटेक्नोलॉजी -** फूड माइक्रोबायोलॉजी- माइक्रोबियल संदूषण और स्पॉयलेज, खाद्य संरक्षण। औद्योगिक उत्पादन- इथाइल अल्कोहल, पेनिसिलिन, सिनोकोबलामिन, ग्लूटामिक एसिड, साइट्रिक एसिड, एमाइलेज, प्रोटीएज।	
Unit-II	(English)	**Plant Biotechnology-** Introduction to plant tissue culture, Nutritional requirements, In vitro culture, Single cell culture, Anther culture, Ovule culture, Somatic embryogenesis, Organogenesis, Protoplast culture. Somatic hybridization, Genetic manipulation of plants using Agro bacterium tumefaciens.	09
	(हिन्दी)	पादप जैवप्रोद्योगिकी:– पादप ऊतक संवर्धन का परिचय, पोषण संबंधी आवश्यकताऐं, इन विट्रो संवर्धन, एकल कोशिका संवर्धन, ऐन्थर संवर्धन, ओव्यूल संवर्धन, कायिक भ्रूणजनन, ऑर्गेनोजेनेसिस, प्रोटोप्लास्ट संवर्धन, कायिक संकरण, एग्रोबैक्टीरियम टूमफेशियन्स का उपयोग कर पादपों की आनुवंशिक हेरफेर।	
Unit-III	(English)	**Immunology and Animal Biotechnology-** Immunity- Innate and Acquired , Host defense mechanism – Infection and its types, Organs and Cells of Immune system, Vaccines and its types. Antigens- Properties and types, Adjuvant. Immunoglobulin's- Structure, types and functions. Generation of Antibodies, Primary and Secondary response, Agglutination and Precipitation reactions. History, Equipment and materials for animal cell culture technology.	09

		Physical requirement for animal cell and their growth curve in culture. Commonly used cell lines- their organization and characteristics, Differentiation of cells. Organ culture- techniques, advantage and applications. Applications of animal biotechnology: Methods of Transfection and cell fusion of animal cells, Selectable markers, HAT selection, Transgenic animals. Stem cell culture. Transplantation of cultured cells, Bioreactors for large scale production of animal cells.	
	(हिन्दी)	**इम्यूनोलॉजी और प्राणी जैव प्रौद्योगिकी-** प्रतिरक्षा - इन्नेट और एक्वायर्ड प्रतिरक्षा, होस्ट डिफेंस मैकेनिज्म - संक्रमण और इसके प्रकार, ऑर्गन्स और इम्यून सिस्टम के सेल, टीके और इसके प्रकार। एंटीजन- गुण और प्रकार एवं उनके सहायक। इम्युनोग्लोबुलिन- संरचना, प्रकार और कार्य। प्रतिपिंडों की उत्पत्ति, प्राथमिक और द्वितीयक प्रतिक्रिया, एकत्रीकरण और अवक्षेपण प्रतिक्रियाएँ। प्राणी कोशिका संवर्धन तकनीक, इतिहास, उपकरण और सामग्री। प्राणी कोशिका के लिए भौतिक आवश्यकता और संवर्धन में उनके वृद्धि वक्र। आमतौर पर इस्तेमाल की जाने वाली सेल लाइन्स- उनके संगठन और विशेषताऐं, कोशिकाओं का विभेदन । ऑर्गन संवर्धन - तकनीक, लाभ और अनुप्रयोग। प्राणी जैव प्रौद्योगिकी के अनुप्रयोग: पशु कोशिकाओं के चयन और कोशिका संलयन के तरीके, चयनकर्ता मार्कर, HAT चयन, ट्रांसजेनिक प्राणी । स्टेम कोशिका संवर्धन। प्राणी कोशिका संवर्धन का प्रत्यारोपण , प्राणी कोशिका के बड़े पैमाने पर उत्पादन के लिए बायोरिएक्टर।	
Unit-IV	(English)	**Fermentation Technology-** Fermentation Technology, Primary and Secondary Screening, Strain Improvement. Inoculums Development, Industrial Sterilization process, Scale-up and Harvest and Recovery. Types of fermentation – batch, continuous, fed batch process; Submerged and Solid State fermentation process, Basic design of a Fermentor and factors affecting Fermentor design. Types of fermentors- Fluidized, Packed Bed, Air lift Fermentor, Tray Fermentor and Tower Fermentor.	09
	(हिन्दी)	**किण्वन प्रौद्योगिकी-** किण्वन प्रौद्योगिकी, प्राथमिक और द्वितीयक स्क्रीनिंग, स्ट्रैन में सुधार। इनोकुलम विकास, औद्योगिक बंध्याकरण प्रक्रिया, स्केल-अप और हार्वेस्ट और रिकवरी। किण्वन के प्रकार - बैच, निरंतर, फेड बैच प्रक्रिया; जलमग्न और ठोस अवस्था किण्वन प्रक्रिया, किण्वक की मूल डिजाइन और किण्वक डिजाइन को प्रभावित करने वाले कारक। किण्वक के प्रकार- द्रवित, पैक्ड बेड, एयर लिफ्ट किण्वक, ट्रे किण्वक और टॉवर किण्वक।	
Unit-V	(English)	**Environment Biotechnology-** Environment: Basic concept, Significance, Public awareness, Environmental pollution, Assessment of water quality, Treatment of waste- water - Primary, Secondary and tertiary treatment. Solid waste management (composting, vermi- composting, methane production). Biopesticides – Bacterial and Fungal, Genetically modified crops, Biofertilizers – Nitrogen fixers, PSB, Mycorrhiza and VAM, Microbial	09

		leaching, Microbial Enhanced Oil Recovery. Bioremediation and Biodeterioration. Modern fuels – Methanogenic bacteria and biogas , microbial hydrogen production	
	(हिन्दी)	**<u>पर्यावरण जैव प्रौद्योगिकी-</u>** पर्यावरण: बुनियादी अवधारणा, महत्व, सार्वजनिक जागरूकता, पर्यावरण प्रदूषण, पानी की गुणवत्ता का आकलन, अपशिष्ट जल का उपचार – प्राथमिक,; द्वितीयक और तृतीयक उपचार। ठोस अपशिष्ट प्रबंधन (खाद बनाने की प्रक्रिया ,वर्मी–खाद बनाने की प्रक्रिया, मीथेन उत्पादन)। बायोपेस्टीसाइड्स – बैक्टीरियल और फंगल, आनुवंशिक रूप से संशोधित फसलें, जैव उर्वरक – नाइट्रोजन फिक्सर, पीएसबी, माइकोराइजा और वीएएम, माइक्रोबियल लीचिंग, माइक्रोबियल एन्हांस्ड ऑयल रिकवरी। आधुनिक ईंधन – मीथेनोजैनिक जीवाणु एवं बायोगैस, माइक्रोबियल हाइड्रोजन उत्पादन।	

Books for B.Sc. III YEAR

1. Immunology: Tizard
2. Biotechnology An Introduction : Barum
3. Principles of Immunology: Shastri
4. Problems of genetics, Molecular genetics & evolutionary genetics: Pranobh K. Banerjee
5. Fundamentals of Microbiology & Immunology : Banerjee& Banerjee
6. Biotechnology : Mohan P.Arora
7. Immunology : Rao
8. Biotechnology & Genomics : P.K.Gupta
9. Biotechnology : Satyanarayan
10. Plant tissue culture: Bhojwani
11. Introduction to plant tissue culture: Razadan
12. Introduction to Biotech: Chawla
13. Animal Biotechnology: Shrivastava, Singh& Yadav.
14. Immunology-Kubey, J.
15. Molecular Biotechnology, Glick & Pasternak.
16. Plant tissue culture-Evance, D.R.
17. Food, Microbiology-Frazier
18. Biotechnology- K. Trahan

B.Sc. I year Laboratory Exercises

List of Practical's

1. To study the plant cell structure using various plant materials.
2. To study microbial cell by Monochrome staining and Gram staining.
3. To prepare and study the different stages of mitosis and meiosis.
4. Prepare slide for study of stomata.
5. Study of permanent slides like cell division, prokaryotic and eukaryotic cells. Muscles and Nerve cells, T.S. of stomatal cells.
6. To study the animal cell structure using cheek cells.
7. Histochemical localization offlagellin.
8. Viable cell counting using haematocytometer.
9. Measurement of cell by light microscope :-
   Calibration of ocular micrometer, finding out average cell size
10. Separation of cell types from blood by TLC/differential counting.
11. Methods of cell lysis: rupture osmotic/chemical/enzymatic.
12. Study of human and animal chromosomes.
13. Aseptic techniques, cleaning of glassware, Preparation of cotton plugging and sterilization.
14. Isolation of Microbes from Air, Water and Soil.
15. Dilution and plating by pour plate, Spread Plate Methods.
16. Staining Method _ Gram Staining, Endospore Staining, Fungal Staining, Algal staining.
17. Identification of Bacteria based on staining and size.
18. Antibiotic Sensitivity of Microbes by the Use of Antibiotic Discs.
19. Isolation and Identification of aquatic Fungi from Local water body.
20. Isolation and Characterization of green algae from Natural habitats.
21. Measurement of water and soil, pH.

Note : 70% of the above list should be compulsorily performed.

Syllabus of Biotechnology
(As Recommended by the Board of Studies)
Practical scheme 2019-20(based on Paper I&II)

B.Sc. I Year

M.Marks-50

B.Sc. I Year- Scheme of practical examination based on paper I&II

Time: 3 hrs Marks: 50

MM: 50
Duration: 3 Hrs.

1. Major Exercise (10)
2. Major Exercise (10)
3. Minor Exercise (5)
4. Minor Exercise (5)
5. Spotting (10)
6. Viva-Voce (5)
7. Practical Record (5)

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2019-20
Theory / Practical
B.Sc.II year Laboratory Exercises

List of Practical's

1. Principles and working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope etc.
2. Qualitative analysis of Carbohydrates, Proteins and Lipids.
3. Qualitative estimation of Protein by Folin-Lowry method.
4. Qualitative estimation of sugar by Nelson Smogyi's method.
5. Determination of enzyme activity by amylase.
6. Study the effect of temperature on enzyme activity.
7. Study the effect of pH on enzyme activity.
8. Separation of amino acids by TLC
9. Separation of leaf pigments by Paper chromatography.
10. Estimation of hemoglobin.
11. RBC counting by haematocytometer.
12. WBC counting by Differential/ or total cell count.
13. Measurement of bleeding and clotting time.
14. Measurement of Hemin Crystals.
15. Estimation of beta carotene in carrots.
16. Estimation of ascorbic acid in lemon juice.
17. Determination of iodine number of fat sample.
18. Determination of phosphorus content in plant material (Colorimetric method).
19. Computer Input and output devices.
20. Prepare a Mark sheet of your class Subjects.
21. Design your class timetable.
22. Prepare a bar chart, pie chart for analysis of Election Result.
23. Exercise based on power point presentation.
24. Design a presentation illustrating insertion of pictures, word art & clip art.
25. Use MS Word to insert a table into document.
26. Problem based on Mean, Median, Mode.
27. Hardy Weinberg Law applied on Population Genetics.
28. Problem based on Probability
29. Exercise based on standard Deviation.
30. Biological data resources and data retrieval.
31. Introduction to NCBI.
32. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.
33. Analyzing Protein Sequences.
34. Analyzing DNA Sequence.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal

Under Graduate Annual Pattern Syllabus of Biotechnology

(As Recommended by the Board of Studies)

2019-20

Theory / Practical

B.Sc. Biotechnology II year

Practical Scheme

B.Sc. Biotechnology II year

M. Marks 50

Q. -1	Major practical……..	10
Q. -2	Major practical……..	10
Q. -3	Minor practical……..	05
Q. -4	Minor practical……..	05
Q.5	Spotting……	10
Q.-6	Viva-voce……	05
Q.-	Record/Sessional……..	05
	Total	50

Under Graduate Annual Pattern Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2019-20
Theory / Practical
B.Sc. Biotechnology III year
LIST OF PRACTICALS

1. **Chromosomal DNA isolation from plant cells**
2. **Chromosomal DNA isolation from animal cells**
3. **Genomic DNA isolation from Micro-Organisms.**
4. **Analysis of isolated DNA by Agarose gel electrophoresis.**
5. **Spectrophotometric analysis of DNA & DNA melting**
6. **UV as a physical mutagen**
7. **Gradient plate technique**
8. **Estimation of DNA using diphenylamine method**
9. **Estimation of RNA using Orcinol method.**
10. **Isolation of RNA from yeast.**
11. **Isolation of plasmid DNA from bacteria.**
12. **Effect of UV radiation on microbial cell.**
13. **Demonstration of repair mechanism in microbes.**
14. **Bacteriophage and determination of latent period in infection**
15. **Isolation of total RNA from plant tissue by SDS phenol method.**
16. **Elution of DNA from agarose gel band**
17. **Transformation in E. coli cell.**
18. **Growth of plant tissue into undifferentiated mass of callus.**
19. **Preparation of animal cell culture media**
20. **Separation and culture of lymphocyte from blood**
21. **Demonstration of Fermentor**
22. **Preparation of wine**
23. **Extraction of citric acid from *Aspergillus***
24. **Production of ethanol by yeast**
25. **Demonstration of PCR**
26. **Immobilization Of Microbial Cell**
27. **Extraction and Preparation of lactic acid**
28. **Extraction and Preparation of citric acid**
29. **Demonstration of Radial immunodiffusion ana*lysis***
30. **Isolation of microorganism from polluted site/industrial waste**
31. **Blood group analysis**
32. **Differential count of WBC**
33. **To examine flocculation reaction using VDRL test**
34. **To observe the agglutination reaction using WIDAL test**
35. **Determine the concentration of u8nknown antigen using Radial Immunodiffusion technique.**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Under Graduate Annual Pattern Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2019-20
Theory / Practical
B.Sc. Biotechnology III year

Practical Scheme
B.Sc. Biotechnology III year

M. Marks 50

Q. -1	**Major practical……**	**10**
Q. -2	**Major practical……**	**10**
Q. -3	**Minor practical……**	**05**
Q. -4	**Minor practical……**	**05**
Q.5	**Spotting……**	**10**
Q.-6	**Viva-voce……**	**05**
Q.-5	**Record/Sessional……**	**05**
	Total	**50**

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE
SHIVAJI NAGAR, BHOPAL

Syllabus of Biotechnology

As Recommended by the Board of Studies
2020-21

Under Graduate Syllabus

2020-2021

Subject: Biotechnology

Details			Page No.
Under Graduate Level			
	Theory	**B.Sc.I -Paper I**	**…5-7**
	,, ,,	**B.Sc.I-Paper II**	**…8-9**
	,, ,,	**B.Sc.II -Paper I**	**…10-11**
	,, ,,	**B.Sc.II -Paper II**	**…12-14**
	,, ,,	**B.Sc. III – Paper I**	**…15-16**
	,, ,,	**B.Sc. III – Paper II**	**…17-20**
	Practical	**B.Sc.I**	**…21-22**
	,, ,,	**B.Sc.II**	**…23-24**
	,, ,,	**B.Sc. III**	**…25-26**

Important Note: - Training programs and institutional visits are mandatory

Date of submission in Autonomous Examination cell:

Signature
H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) Collège
Shivaji Nagar, Bhopal – 462016

Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2020-21
Scheme of examination

Course:Biotechnology **B.Sc. (3 Years Degree Course)**

Theory Papers/practical	**Title of paper**	**Compulsory/ Optional**	**Marks**
B.Sc. Ist year Annual system			
Paper I	Cell Structure & Biology	Compulsory	50
Paper II	Microbiology	Compulsory	50
	CCE		50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**200**
B.Sc. IInd year Annual system			
Paper I	Biophysics and Biochemistry	Compulsory	50
Paper II	Bioinstrumentation, Biostatistics and Bioinformatics	Compulsory	50
	CCE		50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**200**
	B.Sc. IIIrd year Annual system		
Paper I	Molecular Biology &Genetic engineering	Compulsory	50
Paper II	Applied Biotechnology	Compulsory	50
	CCE		50
Practical	Biotechnology Practical	Compulsory	50
Total Marks			**200**
Important Note: - Training programs and institutional visits are mandatory			

Member Board of Studies: **Signature with date**

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Shivaji Nagar, Bhopal
Under Graduate Annual Pattern of Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2020-21
Theory / Practical

Session		2020-21
Class		**B.Sc. Ist Year**
Subject	(English)	**Biotechnology**
	(हिन्दी)	**जैवप्रौद्योगिकी**
Paper		**I**
Title of the Paper	(English)	**Cell Structure & Biology**
	(हिन्दी)	**कोशिका संरचना एवं जीवविज्ञान**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Period
Unit-I	(English)	Cell structure and Theory, Structure of Prokaryotic cell, Eubacteria and Archaebacteria. Size, shape and arrangement of bacterial cell. Gram positive and Gram negative bacterial cells. Structure of Eukaryotic cell, plant cell, animal cell, Difference between Prokaryotic and Eukaryotic cell.	09
	(हिन्दी)	कोशिका की संरचना एवं सिद्धान्त, प्रोकेरियाटिक कोशिका की संरचना, युबैक्टीरिया एवं आर्कीबेक्टिरिया जीवाणु कोशिका की माप, अकारिकी एवं विन्यास। ग्राम धनात्मक एवं ग्राम ऋणात्मक कोशिकाओं युकेरियॉटिक कोशिका पादंप कोशिकाओं जन्तु कोशिकाओं की संरचना, प्रोकोरियॉटिक एवं युकेरियॉटिक कोशिकाओं में अंतर।	
Unit-II	(English)	Structure and function of bacterial cell- flagella, pili, cell wall, cytoplasmic membrane, nuclear region, mesosome, ribosome, vacuole, metachromatic granule, spore and cyst. Structure and function of eukaryotic cell- cell wall, cell membrane, mitochondria, chloroplast, endoplasmic reticulum, Golgi bodies, nucleus, cytoskeleton, microbodies, centriole, Lysosomes.	09
	(हिन्दी)	जीवाणु कोशिका की संरचाना एवं कार्य, कशाभ (फ्लैजेला), पिलि, कोशिकाभित्ति, जीवद्रव झिल्ली, केन्द्रकीय भाग, मीजोसोम्स राइबोसोम्स, रिक्तिका, मेटाक्रोमेटिक ग्रेन्यूल बीजाणु एवं सिस्ट। युकेरियॉटिक कोशिका की संरचना एवं कार्य, कोशिकाभित्ति, कोशिका झिल्ली, माइटोकॉन्ड्रिया, हरित लवक, एण्डोप्लाज्मिक रेटीकुलम, गॉल्गीकाय, केन्द्रक, साइटोस्केलेटन, माइक्रोबॉडी, सेण्ट्रीयोल, लाइसोसोम।	

Unit-III	(English)	Cell cycle and cell division- mitosis, meiosis. Anomalies in cell division and associated diseases. Cell synchrony, cell-cell interactions, cell locomotion, cell differentiation.	09
	(हिन्दी)	कोशिका चक्र एवं कोशिका विभाजन समसूत्रीय एवं अर्द्धसूत्रीय कोशिका विभाजन, कोशिका विभाजन में असंगतता एवं संबंधित रोग/कोशिकीय ससंजन, कोशिका से कोशिका अन्तःक्रिया, कोशिकीय गति, कोशिका विभेदन।	
Unit-IV	(English)	Transport Process: Cell membrane,Models of membrane structure. Membrane proteins and their properties, membrane carbohydrates and their roles. Transport across membranes, active and passive diffusion mechanisms.	09
	(हिन्दी)	पार अभिगमन प्रक्रिया– कोशिका झिल्ली कोशिका झिल्ली के विभिन्न मॉडल मेम्ब्रेन प्रोटीन एवं उनके गुण मेन्ब्रेन कार्बोहाइड्रेटस एवं उनकी भूमिका झिल्ली के पार परिवहन, सक्रिय एवं निष्क्रिय परिवहन, विसरण क्रियाविधि।	
Unit-V	(English)	Introduction to Necrosis , Senescence, Apoptosis- Programmed cell death , Mechanism of Apoptosis, Intrinsic and Extrinsic pathways of cell death, Apoptosis in relation to Cancer, Oncogenes-Types of cancer.	09
	(हिन्दी)	नेक्रोसिस का परिचय, जीर्णता, एपॉप्टॉसिस प्रोग्राम्ड सेल डेथ, एपॉप्टॉसिस की क्रियाविधि, कोशिका मृत्यु के इनट्रिन्सिक एवं एक्सट्रिन्सिक मार्ग, कैंसर के संबंध में एपॉप्टॉसिस, ऑन्कोजीन्स, कैंसर के प्रकार।	

SUGGESTED BOOKS

1. Cell and molecular Biology: P.K.Gupta

2. Modern concept of Microbiology: H.D. Kumar & Swati Kumar

3. A text book of Microbiology: Dubey & Maheshwari

4. Microbial ecology fundamentals and application: Atlas Bartha

5. Biophysics : Mohan P. Arora

6. Biology: Raven, Johnsen, Lassos Singer

7. Cell & Molecular biology: S.C.Rastogy

8. Fundamentals of Microbiology & Immunology: AK Banerjee, Nirmalya Banerjee

9. Biochemistry:A.C. Deb

10. Biomolecule:Mohan P. Arora

11. Environmental Microbiology & Biotech: D.P.Singh,S.K. Dwivedi

12. Biophysics : Pattabh & Gautham

13. Experiment in microbiology: plant pathology & Biotech : K.R. Aneja

14. General Microbiology Vol. I & II:Power & Dangiwala

15. Molecular Biology of Cells, (2002): Albert's et. al.

16. Lehninger principles of Biochemistry (2005): Nelson & Cox.

17. Microbiology, Prescott: Harley & Klein.

Shivaji Nagar, Bhopal

Under Graduate Annual Pattern Syllabus of Biotechnology

(As Recommended by the Board of Studies)

2020-21

Theory / Practical

Session		2020-21
Class		**B.Sc... Ist Year**
Subject	(English)	**Biotechnology**
	(हिन्दी)	**जैवप्रोद्योगिकी**
Paper		II
Title of the Paper	(English)	**Microbiology**
	(हिन्दी)	**सूक्ष्मजैविकी**
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	Introduction to Microbiology - History, Applications & Status of Microbiology in India. Classification of Microorganisms - General Features, systems of Classification. Microbial Taxonomy, Classification and identification of Bacteria according to Bergey's manual.	09
	(हिन्दी)	सूक्ष्मजैविकी का परिचय– इतिहास अनुप्रयोग एवं भारत में सूक्ष्मजीवविज्ञान का स्थान (स्टेटस) सूक्ष्मजीवियों का वर्गीकरण– सामान्य लक्षण, वर्गीकरण, सूक्ष्मजैवकीय वर्गीकृत विज्ञान, बर्गीज मैनुअल के अनुसार जीवाणुओं का वर्गीकरण एवं पहचान के लक्षण।	
Unit-II	(English)	Structure and Diversity of Bacteria & Virus, Microbes in extreme environment. Nutritional requirement of microbes. Bacteriology-Morphology, ultra structure and types of Bacteria. Archaebacteria: structure and function of bacterial cell organelles.	09
	(हिन्दी)	विषाणु एवं जीवाणु की संरचना एवं विविधता, चरम पर्यावरण में सूक्ष्मजीव, सूक्ष्मजीवों की पोषकीय आवश्यकतायें। जीवाणु विज्ञानः– जीवाणु आकारिकीय, सूक्ष्म संरचना एवं प्रकार। आर्कीबैक्टीरिया, बैक्टीरिया कोशिका के अंगकों की संरचना एवं कार्य।	
Unit-III	(English)	Structure and Diversity of Algae, Fungi, Protozoan, Mycoplasmas and Extremophiles. General characteristics, Various methods of staining, Gram staining, staining techniques for endospore , capsule, acid flagella Endospore, capsule, flagella , negative staining, Fungal stains, Algal stains.	09
	(हिन्दी)	शैवाल, कवक, प्रोटोजोअन्स, माइकोप्लाज्मा एवं एक्स्ट्रीमोफिल्स् की संरचना एवं विविधता। अभिरंजन की विभिन्न विधियाँ – साधारण, ग्राम अभिरंजन, एण्डोस्पोर, कैप्सूल, फ्लैजिला एवं ऋणात्मक अभिरंजन, कवक	

		रंजक, शैवाल रंजक।	
Unit-IV	(English)	Microbial growth - mathematical expression of growth, growth curve, factors affecting growth. Cultivar Technique, types of cultivar- batch, continuous, synchronous and diauxic growth. Quantification of microbial growth. Control of microorganisms - physical & chemical. Evaluation of chemical disinfectants - tube dilution test, agar diffusion test and phenol - coefficient.	09
	(हिन्दी)	**सूक्ष्मजीव वृद्धि–** वृद्धि की गणितीय अभिव्यक्ति, वृद्धि वक्र, वृद्धि को प्रभावित करने वाले कारण। संवर्धन तकनीक, संवर्धन के प्रकार– बैच संबर्धन, सतत् संवर्धन, सिंक्रोनस संवर्धन, डाइऑक्सीक वृध्दि, सूक्ष्मजीवीय वृद्धि की गणना। **सूक्ष्मजीव नियंत्रणः**– निष्संक्रामक का भौतिक एवं रसायनिक। रासायनिक निष्संक्रामक का मूल्यांकन – ट्यूब तनुता परीक्षण, अगर विसरण परीक्षण एवं फीनॉल गुणांक।	
Unit-V	(English)	Microbial Nutrition and metabolism - Microbial Metabolism : Concept of anabolism & catabolism processes. Nitrogen Fixation - types and mechanisms. Microbial disease in plants & animals (Only general concept). Fermentation Process - Fermentor & microbes of industrial importance.	09
	(हिन्दी)	सुक्ष्मजीवीय पोषण एवं चयापचय– सूक्ष्मजीवीय चयापचय– उपचय एवं अपचय की अवधारणा। नाइट्रोजन स्थिरीकरण– प्रकार एवं क्रियाविधि, पौधों एवं जंतुओं में सूक्ष्म जीवीय रोग (केवल सामान्य अवधारणा)। किण्वीकरण प्रक्रियाः– किण्वक एवं सूक्ष्मजीव के औद्योगिक महत्व।	

Suggested Reading -

1. Cell and molecular Biology : P. K. Gupta
2. Cell & Molecular biology :S. C. Rastogy
3. Molecular Biology of Cells, (2202), Alberts's et. al.
4. Cell Biology: P. S. Verma & Agarwal
5. Text book of Microbiology :R. C. Dubey
6. A Text book of Microbiology :Dubey and Maheswari
7. Essentials of Microbiology : K.S. Bilgrami / R.K. Sinha
8. Microbiology: P. D. Sharma
9. General Microbiology Vol I & II : Pawar & Dagniwala
10. Applied Microbiology : P. D. Sharma
11. Microbiology Fundamentals & Applications : S. S. Purohit
12. Experiments in Microbiology, Plant Pathology & Biotechnology : K. R. Ancja
13. Fundamentals of Microbiology & Immunology : A. K. Banerjee, Nirmalaya Banerjee
14. Modern Concept of Microbiology : H. D. Kumar & Swati Kumar

Under Graduate Annual Pattern Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2020-21
Theory / Practical

Session		2020-21
Class		B.Sc.II Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		I
Title of the Paper	(English)	Biophysics and Biochemistry
	(हिन्दी)	**जैवभौतिकी एवं जैवरसायन**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Thermodynamics:** Thermodynamics system, equilibrium, Thermodynamic laws and their applications. Different types of processes, Thermodynamic variables and Entropy. Thermodynamic potentials and relations. Maxwell's Equations, Fundamental equation of heat flow.	09
	(हिन्दी)	ऊष्मागतिकीः ऊष्मागतिकी तंत्र, साम्यावस्था, ऊष्मागतिकी नियम तथा उनके अनुप्रयोग। ऊष्मागतिकी प्रक्रमों के विभिन्न प्रकार, ऊष्मागतिकी चर तथा एंट्रॉपी। ऊष्मागतिकी विभव एवं संबंध। मैक्सवेल का समीकरण, ऊष्मा प्रवाह का मूलभूत समीकरण	
Unit-II	(English)	**General Biophysical Methods:** Measurement of pH, Radioactive labeling & counting. Autoradiography. Diffusion, Sedimentation, Osmosis, Viscosity- definitions, factors influencing them and their applications in biology. Bragg's equation. Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure.	09
	(हिन्दी)	सामान्य जैवभौतिकी विधियाँः pH मापन, रेडियोएक्टिव नामांकन एवं गणना, ऑटोरेडियोग्राफी, विसरण, अवसादन, परासरण, श्यानता – परिभाषायें, इन्हें प्रभावित करने वाले कारक, जीवविज्ञान में इनके अनुप्रयोग। ब्रैग का समीकरण, व्युत्क्रम जालक, मिलर जालक तथा इकाई सेल, विभिन्न क्रिस्टल संरचना के प्रकार, क्रिस्टल संरचना ज्ञात करना।	

Unit-III	(English)	**Fundamentals of Biochemistry:** Biochemistry as molecular logic of living beings. Axioms of living matter, Major organic compounds of animate objects a general view. Chemical elements. Structure of atoms, molecules and chemical bonds, Ionic, covalent, coordinate and hydrogen bonds. Structure, function and properties of water, water as universal solvent, Acids, bases and salts. pH and buffers.	09
	(हिन्दी)	जैवरसायन का आधारः जीवों में आण्विक तर्क के रूप में जैवरसायन। जैवपदार्थ की सूक्तियाँ, सजीवों में वृहद् कार्बनिक यौगिकों का सामान्य परिचय। रसायनिक तत्व, परमाणु की संरचना, अणु तथा रासायनिक बंध, आयनिक, सहसंयोजक, उप सहसंयोजक तथा हाइड्रोजन बंध, जल की संरचना, कार्य तथा गुण, जल सार्वभौमिक विलायक के रूप में, अम्ल, क्षार तथा लवण, pH तथा बफर।	
Unit-IV	(English)	**Biomolecules:** Introduction and occurrence, classification, properties, importance of carbohydrate, lipids, proteins, amino acids and nucleic acids and various types of RNA's.	09
	(हिन्दी)	जैवअणुः कार्बोहाइड्रेट, लिपिड, प्रोटीन, अमीनो अम्ल तथा न्यूक्लिक अम्ल का परिचय, उपलब्धता, वर्गीकरण, गुण तथा महत्व, RNA के प्रकार।	
Unit-V	(English)	**Enzyme**: Structure, classification and function- Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of Km-Michaels Menten equation. Various types of enzyme inhibition and identification using double reciprocal plot, Introduction to Allosteric Enzyme, Definition of holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group and their examples, Concept of ribozyme, multiple forms, isozymes and abzymes.	09
	(हिन्दी)	विकरः संरचना, वर्गीकरण एवं कार्य, सक्रिय स्थल, सक्रियण की ऊर्जा, संक्रमण अवस्था की परिकल्पना, ताला–कुंजी संकल्पना, प्रेरित–जोड़ संकल्पना, Km मिकैलिस मेण्टन समीकरण की अवधारणा, एंजाइम अवरोधन (संदमन) के विभिन्न प्रकार तथा डबल रेसिप्रोकल प्लॉट द्वारा एंजाइम की पहचान। एलोस्टेरिक एंजाइम का परिचय। होलोएंजाइम, एपोएंजाइम, सह–एंजाइम, सह–कारक, प्रोस्थेटिक समूह की परिभाषा तथा इनके उदाहरण। राइबोजाइम, विभिन्न रूप, आइसोजाइम तथा एबजाइम की अवधारणा।	

Session		2020-21
Class		B.Sc. II Year
Subject	(English)	Biotechnology
	(हिन्दी)	**जैवप्रोद्योगिकी**
Paper		II
Title of the Paper	(English)	Bioinstrumentation, Biostatistics and Bioinformatics
	(हिन्दी)	**जैवयांत्रिकी, जैवसांख्यिकी एवं जैवसूचना विज्ञान**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Microscopy:** light, Phase contrast, fluorescence microscopy, electron microscopy. Centrifugation technique. Principles,types & separation of biological molecule,	09
	(हिन्दी)	सूक्ष्मदर्शीः प्रकाश, फेज कंट्रास्ट स्फूरदीप्ति सूक्ष्मदर्शी, इलेक्ट्रॉन सूक्ष्मदर्शी। अभिकेन्द्रीय तकनीक। सिद्धान्त, प्रकार एवं जैविक अणुओं का पृथक्करण।	
Unit-II	(English)	**Chromatography and Electrophoresis** Chromatography: Principles and applications, Principle and application of electrophoresis. Agarose gel electrophoresis, Immuno electrophoresis, Blotting: Southern, Western and Northern Blotting.	09
	(हिन्दी)	क्रोमेटोग्राफी तथा इलेक्ट्रोफोरेसिस – क्रोमेटोग्राफी सिध्दांत एवं अनुप्रयोग, इलेक्ट्रोफोरेसिस – सिध्दांत एवं अनुप्रयोग। एग्रोस इलेक्ट्रोफोरेसिस, इम्यूनो इलेक्ट्रोफोरेसिस। सदर्न,वेस्टर्न एवं नादर्न ब्लॉटिंग।	
Unit-III	(English)	**Spectrophotometry.** Colorimetry (UV and Visible), Radio & non-radio labeling, Autoradiography.	09
	(हिन्दी)	स्पेक्ट्रोफोटोमिट्री। कोलोरीमिट्री (UV and Visible), रेडियो एवं अरेडियों नामांकन, आटोरेडियोग्राफी।	
Unit-IV	(English)	**Biostatistics**- Introduction, Scope, application and use of statistic collection and classification of data summarization and presentation of data. Arithmetic mean, median, standard deviation. Probability: definition, Random variable and its distribution. Binomial probability distribution.	09

	(हिन्दी)	जैवसांख्यिकीः प्रस्तावना, क्षेत्र, अनुप्रयोग एवं संख्यिकी संग्रह का उपयोग एवं डाटा गणना का वर्गीकरण तथा प्रतिचयन ग्राफ एवं चित्र। समानान्तर माध्य, मध्यिका प्रमाप विचलन। प्रायिकताः परिभाषा यादृच्छिक चर एवं उसका बंटन। द्विपद प्रायिकता बंटन इसके उदाहरण एवं प्रतिबंध।	
Unit-V	(English)	**Computer:** General introduction (Characteristics, capabilities, generations), Hardware; organization of hardware (input devices, memory, control unit arithmentic logic unit, output devices): software: (System software; application software, languages- low level, high level), internet application. Basic Bioinformatics: Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc) Biological Databases: Sequence databases (EMBL, GenBank, DDBJ – UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK etc). Cluster databases- An Introduction, Specialized databases (KEGG etc), Database technologies (Flat-File), Structural databases (PDB)	09
	(हिन्दी)	कम्प्यूटरः सामान्य परिचय (गुण, क्षमताएं एवं कम्प्यूटर पीढ़ीयाँ) हार्डवेयर, हार्डवेयर का संगठन (इनपूट डिवाइस, मेमोरी कंट्रोल यूनिट, अर्थमेटिक लॉजीक युनिट आउटपूट डिवाइस), सॉफ्टवेयर सिस्टम (सिस्टम सॉफ्टवेयर, एप्लीकेशन सॉफ्टवेयर कम्प्यूटर भाषाएं – निम्न स्तरीय एवं उच्च स्तरीय), इंटरनेट एप्लीकेशन। आधारभूत जैव सूचना विज्ञानः इंटरनेट का परिचय, सर्च इंजन (Google, Yahoo, Entrez आदि) जैविक डाटाबेसः अनुक्रम डाटाबेस (EMBL, GenBank, DDBJ – UNIPROT, PIR, TrEMBL) प्रोटीन फेमिली/डोमेन डाटाबेस (PROSITE, PRINTS, Pfam, BLOCK etc). क्लस्टर डाटाबेस – परिचय, विशेष डाटाबेस (KEGG etc), डाटाबेस तकनीक (Flat-File), संरचनात्मक डाटाबेस (PDB)	

Books for B.Sc. II year

1. A text book of Bioinformatics by Sharma & Munjal & Shankar.
2. Bioinformatics by CSV Muthy
3. Basic Bioinformatics by S.Ignacimuthu. S.J
4. Bioinformatics: Concepts, Skills and Application by S.C. Rastogi, N. Mendiratta & Parag Rastogi.
5. Practical Guide for basic Bioinformatics & Biostatistics by P. Tiwari & P. Pandey.
6. Biostatistics by B. Prasad
7. Statistical Methods by S.P. Gupta.
8. Fundamentals of Statistics By S.C. Gupta
9. Biostatistics by P.N. Arora
10. Principles of Biochemistry, Lehninger
11. Fundamentals of Biochemistry, J.L. Jain
12. Biochemistry, Voet and Voet.
13. Textbook of Biochemistry- S.P. Singh
14. Biophysics: Pattabh & Gautham
15. Biochemistry: A.C. Deb
16. Biomolecules: Mohan P. Arora
17. Principles of Biochemistry (2005), Nelkson & Cox

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Session		2020-21
Class		B.Sc.III Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		I
Title of the Paper	(English)	Molecular Biology & Genetic engineering
	(हिन्दी)	आण्विक विज्ञान एवं अनुवंशिक अभियांत्रिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	DNA and RNA: Chemical Structure, types and properties. Experimental proof of DNA as genetic material. Genome: Concept, Plant, Animal, Bacterial and Viral Genome. DNA replication: experimental proof of semi conservative replication, Replicon-concept. Proteins and enzymes involved in replication in prokaryotes and eukaryotes. Models of DNA replication: unidirectional, bidirectional, types of DNA replication. Y shaped. Ø mode. Rolling circle mechanism.	09
	(हिन्दी)	डीएनए और आरएनए, रासायनिक संरचना, प्रकार और गुण, आनुवंशिक सामग्री के रूप में डीएनए का प्रायोगिक प्रमाण, जीनोम - संकल्पना, पौधे, पशु, जीवाणु और वायरल जीनोम, डीएनए पुनरावृत्ति। प्रकार, अर्धसंरक्षी पुनरावृत्ति का प्रायोगिक प्रमाण,, पुनरावृत्ति - संकल्पना का प्रायोगिक प्रमाण। प्रोकैरियोट्स और यूकेरियोट्स में पुनरावृत्ति में भाग लेने वाले प्रोटीन तथा एंजाइम, पुनरावृत्ति की प्रणाली– एकदिशीय द्विदिशीय पुनरावृत्ति के प्रकार, Y आकार, Ø मोड, रोलिंग चक्र तंत्र ।	
Unit-II	(English)	Eukaryotic chromosomal organization: Euchromatin, heterochromatin, chromatin structure, nucleosomes, histone and non-histone proteins, histone modification, Introduction to epigenetic.	10

	(हिन्दी)	यूकेरियोटिक गुणसूत्र संगठन, यूक्रोमैटिन, हेटेरोक्रोमैटिन, क्रोमैटिन संरचना, न्यूक्लियोसोम, हिस्टोन और **नॉन** हिस्टोन प्रोटीन। हिस्टोन **रूरूपांतरण,** एपिजेनेटिक्स का परिचय।	
Unit-III	(English)	Origin of life: Classical experiments and current concepts. Evolution of biological macromolecules. Evolution of early forms. Mendelian genetics: Mendel's law. Chromosomal basis of heredity, chromosomal analysis, allelic variation, dominance, linkage and crossing over.	10
	(हिन्दी)	जीवन की उत्पत्ति: शास्त्रीय प्रयोग और वर्तमान अवधारणाएँ। जैविक मैक्रो**मोलि**क्युलस का विकास, प्रारंभिक रूपों का विकास, **मेनडिलियन** आनुवंशिकी: मेंडल का नियम। आनुवंशिकता का क्रोमोसोमल आधार, क्रोमोसोमल विश्लेषण, एलील भिन्नता, प्रभुत्व, लिंकेज और क्रॉसिंगओवर।	
Unit-IV	(English)	Introduction to Recombinant DNA technology, scope & importance, gene cloning. PCR, Introduction to restriction endonuclease, vectors for DNA transfer and their types: Plasmids, Phagemids, Cosmids, BAC. Gene amplification.	08
	(हिन्दी)	पुनर्संयोजक डीएनए प्रौद्योगिकी, स्कोप और महत्व, जीन क्लोनिंग, पीसीआर, प्रतिबंध एंडोन्यूक्लाइज का परिचय, डीएनए हस्तांतरण के लिए वैक्टर और उनके प्रकार: प्लास्मिड, **फैज**मिड्स, कॉस्मिड्स, बीएसी। जीन प्रवर्धन।	
Unit-V	(English)	Plasmids: Types, properties and cloning vectors. Recombinant DNA techniques and cloning with Restriction endonuclease and recombinant DNA. Mutation: Types of mutation, point mutation (Base pair change, frame shift, deletion) Transcription, translation and gene expression in eukaryotes (yeast), alternate splicing.	10
	(हिन्दी)	प्लास्मिड प्रकार, गुण और क्लोनिंग वैक्टर। संयोजक डीएनए तकनीक और प्रतिबंध एंडोन्यूक्लाइज और पुनः संयोजक डीएनए के साथ क्लोनिंग। उत्परिवर्तन, उत्परिवर्तन के प्रकार: बिंदु उत्परिवर्तन (बेस जोड़ी परिवर्तन, फ्रेम शिफ्ट, विलोपन) यूकेरियोट्स (खमीर) में प्रतिलेखन, अनुवाद और जीन अभिव्यक्ति, वैकल्पिक **स्प्लाईसिंग**	

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Session		2020-21
Class		B.Sc. III Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		II
Title of the Paper	(English)	Applied Biotechnology
	(हिन्दी)	व्यवहारिक जैवप्रौद्योगिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Microbial Biotechnology-** Food Microbiology: Microbial contamination & spoilage, food preservation. Industrial Production of Ethyl Alcohol, Penicillin, Cynocobalamin, Glutamic Acid, Citric Acid, Amylase, Protease.	09
	(हिन्दी)	**माइक्रोबियल बायोटेक्नोलॉजी -** फूड माइक्रोबायोलॉजी- माइक्रोबियल संदूषण और स्पॉयलेज, खाद्य संरक्षण। औद्योगिक उत्पादन इथाइल अल्कोहल, पेनिसिलिन, सिनोकोबलामिन, ग्लूटामिक एसिड, साइट्रिक एसिड, एमाइलेज, प्रोटीज।	
Unit-II	(English)	**Plant Biotechnology-** Introduction to plant tissue culture, Nutritional requirements, In vitro culture, Single cell culture, Anther culture, Ovule culture, Somatic embryogenesis, Organogenesis, Protoplast culture, Somatic hybridization. Genetic manipulation of plants using Agro bacterium tumefaciens.	09
	(हिन्दी)	**प्लांट बायोटेक्नोलॉजी -** पौध ऊतक **संवर्धन** पोषण संबंधी आवश्यकताओं, इन विट्रो **संवर्धन**, एकल कोशिका **संवर्धन, ऐंथर संवर्धन**, **ओव्यूल संवर्धनए** दैहिक भ्रूणजनन, ऑर्गेनोजेनेसिस, प्रोटोप्लास्ट **संवर्धन** का परिचय। दैहिक संकरण, एग्रोबैक्टीरियम टूमफेशियन्स का उपयोग कर पौधों की आनुवंशिक हेरफेर।	
Unit-III	(English)	**Immunology and Animal Biotechnology-** Immunity: Innate and acquired, host defense mechanism, Infection and its types, organs and cells of Immune system. Vaccines and its types. Antigens- properties and types, adjuvant. Immunoglobulin's-structure, types and functions. Generation of antibodies, primary and	09

		secondary response, agglutination and precipitation reactions. History, equipment and materials for animal cell culture technology. Physical requirement for animal cell culture and their growth curve in culture. Commonly used cell lines- their organization and characteristics, differentiation of cells. Organ culture- techniques, advantage and applications. Applications of animal biotechnology- methods of transfection and cell fusion of animal cells, selectable markers, HAT selection, transgenic animals. Stem cell culture, transplantation of cultured cells. Bioreactors for large scale production of animal cells.	
	(हिन्दी)	**<u>इम्यूनोलॉजी और पशु जैव प्रौद्योगिकी-</u>** प्रतिरक्षा - **इन्नेट** और एक्वायर्ड प्रतिरक्षा, होस्ट डिफेंस मैकेनिज्म - संक्रमण और इसके प्रकार, ऑर्गन्स और इम्यून सिस्टम के सेल, टीके और इसके प्रकार। एंटीजन- गुण और प्रकार, **एवं उनके** सहायक। इम्युनोग्लोबुलिन- संरचना, प्रकार और कार्य। प्रतिपिंडों की उत्पत्ति, प्राथमिक और द्वितीयक प्रतिक्रिया, एकत्रीकरण और **अवक्षेपण** प्रतिक्रियाएँ। **प्राणी कोशिका संवर्धन तकनीक, इतिहास,** उपकरण और सामग्री। **प्राणी कोशिका** के लिए भौतिक आवश्यकता और **संवर्धन** में **उनके** वृद्धि वक्र। आमतौर पर इस्तेमाल की जाने वाली सेल लाइन्स- उनके संगठन और **विशेषताऐं**, कोशिकाओं का विभेदन । ऑर्गन **संवर्धन** - तकनीक, लाभ और अनुप्रयोग। पशु जैव प्रौद्योगिकी के अनुप्रयोग: पशु कोशिकाओं के चयन और कोशिका संलयन के तरीके, चयनकर्ता मार्कर, HAT चयन, ट्रांसजेनिक **प्राणी** । **स्टेम** कोशिका **संवर्धन। प्राणी कोशिका संवर्धन का प्रत्यारोपण , प्राणी कोशिका** के बड़े पैमाने पर उत्पादन के लिए बायोरिएक्टर।	
Unit-IV	(English)	**<u>Fermentation Technology-</u>** Fermentation Technology: Primary and secondary screening, strain improvement, inoculum development, industrial sterilization process, scale-up and harvest and recovery. Types of fermentation- batch, continuous, fed batch process. Submerged and solid State fermentation process, basic design of a fermentor and factors affecting fermentor design. Types of fermentors- fluidized, packed bed, air lift, tray and tower fermentors.	09
	(हिन्दी)	**<u>किण्वन प्रौद्योगिकी-</u>** किण्वन प्रौद्योगिकी, प्राथमिक और **द्वितीयक** स्क्रीनिंग, **स्ट्रैन** में सुधार। इनोकुलम विकास, औद्योगिक बंध्याकरण प्रक्रिया, स्केल-अप और हार्वेस्ट और रिकवरी। किण्वन के प्रकार - बैच, निरंतर, **फेड** बैच प्रक्रिया; जलमग्न और ठोस **अवस्था** किण्वन प्रक्रिया, किण्वक की मूल डिजाइन और किण्वक डिजाइन को प्रभावित करने वाले कारक। किण्वक के प्रकार- द्रवित, पैक्ड बेड, एयर लिफ्ट किण्वक, ट्रे किण्वक और टॉवर किण्वक।	
Unit-V	(English)	**<u>Environment Biotechnology-</u>** Environment: Basic concept, significance, public awareness, environmental pollution, assessment of water quality. Treatment of waste water- primary, secondary and tertiary treatment. Solid waste management: Composting, vermin-composting, methane production.	09

		Biopesticides– bacterial and fungal. Genetically modified crops. Biofertilizers– nitrogen fixers, PSB, mycorrhiza and VAM. Microbial leaching, microbial enhanced oil recovery. Bioremediation and biodeterioration. Modern fuels– Methanogenic bacteria and biogas, microbial hydrogen production	
	(हिन्दी)	**<u>पर्यावरण जैव प्रौद्योगिकी-</u>** पर्यावरण: बुनियादी अवधारणा, महत्व, सार्वजनिक जागरूकता, पर्यावरण प्रदूषण, पानी की गुणवत्ता का आकलन, अपशिष्ट जल का उपचार – प्राथमिक,; **द्वितीयक** और तृतीयक उपचार। ठोस अपशिष्ट प्रबंधन (खाद **बनाने की प्रक्रिया ,वर्मी-**खाद **बनाने की प्रक्रिया**, मीथेन उत्पादन)। बायोपेस्टीसाइड्स – बैक्टीरियल और फंगल, आनुवंशिक रूप से संशोधित फसलें, जैव उर्वरक – नाइट्रोजन फिक्सर, पीएसबी, माइकोराइजा और वीएएम, माइक्रोबियल लीचिंग, माइक्रोबियल एन्हांस्ड ऑयल रिकवरी। **आधुनिक ईंधन – मीथेनोजैनिक जीवाणु एवं बायोगैस, माइक्रोबियल हाइड्रोजन उत्पादन।**	

Books for B.Sc. III YEAR

1. Immunology: Tizard
2. Biotechnology An Introduction : Barum
3. Principles of Immunology: Shastri
4. Problems of genetics, Molecular genetics & evolutionary genetics: Pranobh K. Banerjee
5. Fundamentals of Microbiology & Immunology : Banerjee& Banerjee
6. Biotechnology : Mohan P.Arora
7. Immunology : Rao
8. Biotechnology & Genomics : P.K.Gupta
9. Biotechnology : Satyanarayan
10. Plant tissue culture: Bhojwani
11. Introduction to plant tissue culture: Razadan
12. Introduction to Biotech: Chawla
13. Animal Biotechnology: Shrivastava, Singh& Yadav.
14. Immunology: Kubey, J.
15. Molecular Biotechnology: Glick & Pasternak.
16. Plant tissue culture: Evance, D.R.
17. Food, Microbiology: Frazier
18. Biotechnology: K. Trahan

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal

Under Graduate Annual Pattern Syllabus of Biotechnology

(As Recommended by the Board of Studies)

2020-21

Theory / Practical's

B.Sc. I year Laboratory Exercises

List of Practical's

1. To study the plant cell structure using various plant materials.
2. To study microbial cell by Monochrome staining and Gram staining.
3. To prepare and study the different stages of mitosis and meiosis.
4. Prepare slide for study of stomata.
5. Study of permanent slides like cell division, prokaryotic and eukaryotic cells. Muscles and Nerve cells, T.S. of stomatal cells.
6. To study the animal cell structure using cheek cells.
7. Histochemical localization of flagellin.
8. Viable cell counting using haematocytometer.
9. Measurement of cell by light microscope :-
   Calibration of ocular micrometer, finding out average cell size
10. Separation of cell types from blood by TLC/differential counting.
11. Methods of cell lysis: rupture osmotic/chemical/enzymatic.
12. Study of human and animal chromosomes.
13. Aseptic techniques, cleaning of glassware, Preparation of cotton plug and sterilization.
14. Isolation of Microbes from Air, Water and Soil.
15. Dilution and plating by pour plate, Spread Plate Methods.
16. Staining Method _ Gram Staining, Endospore Staining, Fungal Staining, Algal staining.
17. Identification of Bacteria based on staining and size.
18. Antibiotic Sensitivity of Microbes by the Use of Antibiotic Discs.
19. Isolation and Identification of aquatic Fungi from Local water body.
20. Isolation and Characterization of green algae from Natural habitats.
21. Measurement of water and soil, pH.

Note : 70% of the above list should be compulsorily performed.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal

Under Graduate Annual Pattern Syllabus of Biotechnology

Syllabus of Biotechnology
(As Recommended by the Board of Studies)
Practical scheme 2020-21(based on Paper I&II)

B.Sc. I Year

M.Marks-50

B.Sc. I Year- Scheme of practical examination based on paper I&II

Time: 3 hrs Marks: 50

MM: 50
Duration: 3 Hrs.

1. Major Exercise (10)
2. Major Exercise (10)
3. Minor Exercise (5)
4. Minor Exercise (5)
5. Spotting (10)
6. Viva-Voce (5)
7. Practical Record (5)

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Under Graduate Annual Pattern Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2020-21
Theory / Practical
B.Sc.II year Laboratory Exercises

List of Practical's

1. Principles and working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope etc.
2. Qualitative analysis of Carbohydrates, Proteins and Lipids.
3. Qualitative estimation of Protein by Folin-Lowry method.
4. Qualitative estimation of sugar by Nelson Smogyi's method.
5. Determination of enzyme activity by amylase.
6. Study the effect of temperature on enzyme activity.
7. Study the effect of pH on enzyme activity.
8. Separation of amino acids by TLC
9. Separation of leaf pigments by Paper chromatography.
10. Estimation of hemoglobin.
11. RBC counting by haematocytometer.
12. WBC counting by Differential/ or total cell count.
13. Measurement of bleeding and clotting time.
14. Measurement of Hemin Crystals.
15. Estimation of beta carotene in carrots.
16. Estimation of ascorbic acid in lemon juice.
17. Determination of iodine number of fat sample.
18. Determination of phosphorus content in plant material (Colorimetric method).
19. Computer Input and output devices.
20. Prepare a Mark sheet of your class Subjects.
21. Design your class timetable.
22. Prepare a bar chart, pie chart for analysis of Election Result.
23. Exercise based on power point presentation.
24. Design a presentation illustrating insertion of pictures, word art & clip art.
25. Use MS Word to insert a table into document.
26. Problem based on Mean, Median, Mode.
27. Hardy Weinberg Law applied on Population Genetics.
28. Problem based on Probability
29. Exercise based on standard Deviation.
30. Biological data resources and data retrieval.
31. Introduction to NCBI.
32. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.

33. Analyzing Protein Sequences.
34. Analyzing DNA Sequence.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal

Under Graduate Annual Pattern Syllabus of Biotechnology

(As Recommended by the Board of Studies)

2020-21

Theory / Practical

B.Sc. Biotechnology II year

Practical Scheme

B.Sc. Biotechnology II year

M. Marks 50

Q. -1	**Major practical……..**	**10**
Q. -2	**Major practical……..……..**	**10**
Q. -3	**Minor practical……..**	**05**
Q. -4	**Minor practical……..……..**	**05**
Q.5	**Spotting……..……**	**10**
Q.-6	**Viva-voce……..……**	**05**
Q.-	**Record/Sessional……..……..**	**05**
	Total	**50**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Under Graduate Annual Pattern Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2020-21
Theory / Practical
B.Sc. Biotechnology III year
LIST OF PRACTICALS

1. **Chromosomal DNA isolation from plant cells**
2. **Chromosomal DNA isolation from animal cells**
3. **Genomic DNA isolation from Micro-Organisms.**
4. **Analysis of isolated DNA by Agarose gel electrophoresis.**
5. **Spectrophotometric analysis of DNA & DNA melting**
6. **UV as a physical mutagen**
7. **Gradient plate technique**
8. **Estimation of DNA using diphenylamine method**
9. **Estimation of RNA using Orcinol method.**
10. **Isolation of RNA from yeast.**
11. **Isolation of plasmid DNA from bacteria.**
12. **Effect of UV radiation on microbial cell.**
13. **Demonstration of repair mechanism in microbes.**
14. **Bacteriophage and determination of latent period in infection**
15. **Isolation of total RNA from plant tissue by SDS phenol method.**
16. **Elution of DNA from agarose gel band**
17. **Transformation in E. coli cell.**
18. **Growth of plant tissue into undifferentiated mass of callus.**
19. **Preparation of animal cell culture media**
20. **Separation and culture of lymphocyte from blood**
21. **Demonstration of Fermentor**
22. **Preparation of wine**
23. **Extraction of citric acid from *Aspergillus***
24. **Production of ethanol by yeast**
25. **Demonstration of PCR**
26. **Immobilization of Microbial Cell**
27. **Extraction and Preparation of lactic acid**
28. **Extraction and Preparation of citric acid**
29. **Demonstration of Radial immunodiffusion ana*lysis***
30. **Isolation of microorganism from polluted site/industrial waste**
31. **Blood group analysis**
32. **Differential count of WBC**
33. **To examine flocculation reaction using VDRL test**
34. **To observe the agglutination reaction using WIDAL test**
35. **Determine the concentration of unknown antigen using Radial Immunodiffusion technique.**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Under Graduate Annual Pattern Syllabus of Biotechnology
(As Recommended by the Board of Studies)
2020-21
Theory / Practical
B.Sc. Biotechnology III year

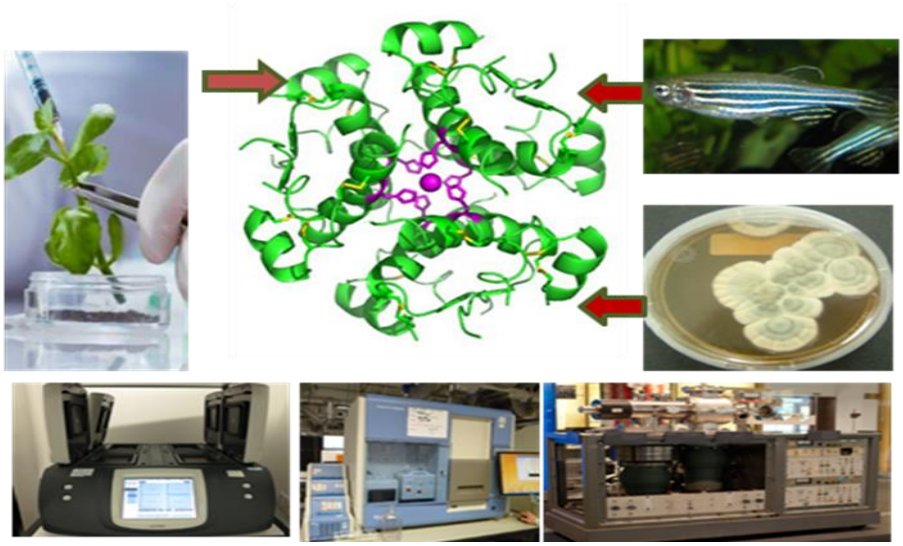
Practical Scheme
B.Sc. Biotechnology III year

M. Marks 50

Q. -1	**Major practical……**	**10**
Q. -2	**Major practical……**	**10**
Q. -3	**Minor practical……**	**05**
Q. -4	**Minor practical……**	**05**
Q.5	**Spotting……**	**10**
Q.-6	**Viva-voce……**	**05**
Q.-5	**Record/Sessional……**	**05**
	Total	**50**

SAROJINI NAIDU GOVT. GIRL'S P.G. (AUTONOMOUS) COLLEGE, SHIVAJI NAGAR, BHOPAL

(Accredited 'A' Grade by NAAC)



Syllabus of Biotechnology

(As Recommended by the Central Board of Studies and approved by Governor of M.P.)

2021-22

Under Graduate Syllabus

2021-2022

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Subject: Biotechnology

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Important Note: - Training programs and institutional visits are mandatory

Date of submission in Autonomous Examination cell:

Signature H.O.D.

Programme specific outcomes

Programme specific outcomes (PSOs) - The successful completion of a Bachelor's degree in Biotechnology would enable students to-

PLO 1 Think critically, analyze and solve problems within the scope of UG Biotechnology. The skill and the proficiency thus acquired to solve industry related problems would help students to lead a successful career in industry and research institutes;

PLO 2 Understand the need and impact of biotechnological solutions on environment and societal context, keeping in view the need for sustainable solutions;

PLO 3 Be equipped with practical skills and the ability to apply their theoretical concepts to design, perform experiments, analyze and interpret data and thus develop proficiency in laboratory management;

PLO 4 Incline towards research through the compulsory internship in industry/research/academic institutes which promote and inculcate professional ethics and code of practice among students, enabling them to work in a team with a multidisciplinary approach.

Outline of course structure

Course Code - C062(BTC), C067(ZTC)

Theory Papers/practical	Title of paper /Code of Paper	Marks		Theory Marks	Total
		CCE1	CCE2		
B.Sc. Ist year Annual system					
Paper I	Cell Biology and Biochemistry (CORE-TH-1-SI-BTE C1T)	10 (Assignment and presentation)	20 (Class Test)	70	100
Paper II	CORE-TH-2-SI-BTE C2T	10	20	70	100
Practical I	CORE-PR-1-SI-BTE C1P	30 (Internal Assesment)		70 (External Assesment)	100
Practical II	CORE-PR-2-SI-BTE C2P	30 (Internal Assesment)		70 (External Assesment)	100
Total Marks					**400**
B.Sc. IInd year Annual system					
Paper I	Biophysics and Biochemistry	10	15	50	75
Paper II	Bioinstrumentation, Biostatistics and Bioinformatics	10	15	50	75
Practical	Biotechnology Practical				50
Total Marks					**200**
	B.Sc. IIIrd year Annual system				
Paper I	Molecular Biology & Genetic Engineering	10	15	50	75
Paper II	Applied Biotechnology	10	15	50	75
Practical	Biotechnology Practical				50
Total Marks					**200**
Important Note: - Training programs and institutional visits are mandatory					

Member Board of Studies: **Signature with date**

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Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

सैध्दांतिक प्रश्नपत्र के पाठ्यक्रम

Part A- Introduction **भाग अ – परिचय**			
Program: Certificate कार्यक्रमः प्रमाण पत्र	Class : B.Sc. I st year कक्षा : बी.एस.सी. प्रथम	Year: 2021 वर्षः 2021	Session: 2021-22 सत्रः 2021–22
Subject: Biotechnology **विषयः जैव प्रौद्योगिकी**			

1	**Course Code**	CORE TH-1-SI-BTE-C1T
	पाठ्यक्रम का कोड	CORE TH-1-SI-BTE C1 T
2	**Course Title**	Cell Biology and Biochemistry
	पाठ्यक्रम का शीर्षक	कोशिका जैविकी एवं जैवरसायन
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Core Course
	पाठ्यक्रम का प्रकारः (कोर कोर्स/इलेक्टिव/जेनेरिक इलेक्टिव/बोकेशनल/.....)	कोर कोर्स
4	**Pre-requisite (if any)**	To Study this course, a student must have had the subject Biology in class 12th.
	पूर्वापेक्षा	इस पाठ्यक्रम का अध्ययन करने के लिये, छात्र ने विषय जीवविज्ञान का अध्ययन कक्षा 12वीं/प्रमाण पत्र/डिप्लोमा में किया हो।
5	**Course Learning Outcomes (CLO)**	Course Objective :- The Main Objective of the course will be to build the basic foundation for studying Biotechnology. The Demand For Trained workforce in Biotechonology is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectors also Require Interdisciplinary trained manpower to foster the Biotechnology Revolution. The restructured syllabus combines basic principles of Chemical and Biological sciences in light of advancements in technology. The curriculum aims to

		impart basic knowledge with emphasis on its applications to make the students ready for industries and research work in concerned field. **Learning Outcome :-** At the end of the paper a student should be able to: • Understand basics of cell biology • Appreciate the importance of bonding and spatial arrangements of molecules for proper functioning and stability • Understand both the physical as well as chemical properties or biomolecules • The student could pursue a career in biochemical testing. The decrease or increase in the amount of some of the biomolecules can have clinical significance. • Students can also go in for medical Laboratory Technique Courses. Opening opportunities in hospital and pathological laboratories.
	पाठ्यक्रम अध्ययन की परिलब्धियां	पाठ्यक्रम के उद्देश्य – इस पाठ्यक्रम का मुख्य उद्देश्य जैव प्रौद्योगिकी के अध्ययन हेतु आधारभूत बुनियाद तैयार करना है। मौलिक शोध एवं औद्योगिकी क्षेत्र में जैव तकनीकी में प्रशिक्षित कार्यकर्ताओं की मांग भी तेजी से बढ़ रही है। जैव प्रौद्योगिकी क्रान्ति को बढ़ावा देने हेतु शैक्षणिक एवं शोध क्षेत्र में अर्न्तविषयक प्रशिक्षित जनों की आवश्यकता है। पुर्नसंरचित पाठ्यक्रम में रसायन एवं जीव विज्ञान के बुनियादी सिद्धान्तों को तेजी से वृद्धि कर रही तकनीकी के प्रकाश में समावेशित किया गया है। इसके अनुप्रयोगों पर जोर देते हुये इसका समावेशित किया गया है। इसके अनुप्रयोगों पर जोर देते हुये इसका बुनियादी ज्ञान छात्रों को प्रदान करना इसका मुख्य उद्देश्य है जिससे उनको सम्बन्धित क्षेत्र में उद्योगों एवं शोध कार्यों हेतु तैयार किया जा सके। **अध्ययन के प्रतिफल :** पाठ्यक्रम अध्ययन के फलस्वरूप छात्र योग्य होगा : • कोशिका जैविकी के आधार को समझने में। • उचित क्रिया एवं स्थिरता हेतु अणुओं के मध्य बंधुता एवं स्थानिक व्यवस्था की आवश्यकता को समझने में। • जैविक अणुओं के भौतिक एवं रसायनिक दोनों प्रकार के गुणों को समझने में। • छात्र जैव रसायनिक परीक्षणों में अपना केंरियर बना सकता है। कुछ जैविक अणुओं की मात्रा में

		उतार–चढ़ाव के चिकित्सीय महत्व का ज्ञान प्राप्त कर सकता है। ● छात्र चिकित्सीय प्रयोगशाला तकनीकि कोर्स में जा सकते हैं, अस्पतालों और रोग परीक्षण प्रयोगशालाओं में सेवायें देने का अवसर पा सकते हैं।	
6	**Credit Value**	Theory -4	
	क्रेडिट मान	सैद्धान्तिक–4	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35
	कुल अंक	अधिकतम अंकः 30+70	न्यूनतम उत्तीर्ण अंकः 35

Part B- Content of the course
भाग ब – पाठ्यक्रम की विषयवस्तु

Total No. of Lectures(In hours per week) - 02 Hours per week Total Lectures: 60 hours

व्याख्यानों की कुल संख्या : 02 घण्टे प्रति सप्ताह कुल व्याख्यान : 60 घण्टे

Unit	Topic	No. of Lecture
इकाई	**विषयवस्तु**	**व्याख्यान**
I	**Cell as a Basic Unit:** **1-Historical background of the Cell** 1.1 History of Cell Biology 1.2 Cell Structure 1.3 Cell Theory **2- Prokaryotic Cell and Cell Organcells:** 2.1 Ultrastructure of Prakaryotic Cell. 2.2 Structure and function of cell organelles: Flagella, Pili, Cell wall, Cytoplasmic membrane, Nuclear region, Ribosomes, Vacuoles, Metachromatic granules, Spores and Cysts, Microtubules, Microfilaments, Centriole. 2.3 Difference between Prokaryotic and Eukaryotic cells **Key words :-** Cell theory, Prokaryotic Cell	12
I	कोशिका एक मूलभूत इकाई के रूप में : 1. कोशिका की ऐतिहासिक पृष्ठभूमि – 1.1 कोशिका जैविकी का इतिहास	12

	1.2 कोशिका संरचना 1.3 कोशिका सिद्धान्त 2. प्रोकेरियोटिक कोशिका एवं कोशिका अंगक – 2.1 प्रोकेरियोटिक कोशिका की अतिसूक्ष्म संरचना 2.2 कोशिका अंगको की संरचना एवं कार्य : कशाभिकोंये, पिलाई, कोशिकाभित्ति, कोशिकाद्रव्यीय झिल्ली, नाभिकीय क्षेत्र, राइबोसोम, रिक्तिकायें, मेटाक्रोमेटिक कणिकायें, बीजाणु एवं पुटी, सूक्ष्ममनलिकायें, सूक्ष्मतन्तु, तारककेन्द्रक 2.3 प्रोकेरिओटिक एवं यूकेरिओटिक कोशिकाओं में अन्तर। **सारबिन्दु (की वर्ड)/टैग :–** कोशिका सिद्धान्त, प्रोकेरिओटिक कोशिका	
II	**Cell Organelles and Cell Cycle :** **1- Eukaryotic Cell and Cell Organells:** 1.1 Ultratructure of Eukaryotic cell (Plant and Animal cells). 1.2 Structure and function of cell organelles: Cell membrane, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi bodies, Lysosomes, Peroxisomes, Nucleus. **2- Cell Cycles:** 2.1 Cell cycle and Cell division 2.2 Apoptosis or Cell death **Keywords:-** Eukaryotic cell, Cell organelles, Cell cycle, Apoptosis	12
II	**कोशिका अंगक एवं कोशिका चक्र :–** **1. यूकेरिओटिक कोशिका एवं कोशिका अंगक –** 1.1 यूकेरिओटिक कोशिका की अति सूक्ष्म संरचना (पादप एवं जन्तु कोशिका) 1.2 कोशिका अंगको की संरचना एवं कार्यः कोशिका झिल्ली, माइटोकान्ड्रिया, हरित लवक, अन्तः प्रद्रव्यी जालिका, गोंल्जी काय, लाइसोसोम, परऑक्सीसोग, नाभिक **2. कोशिका चक्र –**	12

	2.1 कोशिका चक्र एवं कोशिका विभाजन 2.2 एपोप्टोसिस या कोशिका मृत्यु **सारबिन्दु (की वर्ड)/टैग :–** यूकैरिओटिक कोशिका, कोशिका अंगक, कोशिका चक्र, एपोप्टोसिस	
III	**Molecular Structure of Water :-** **1- Water structure and Buffer:** 1.1 Properties of Water 1.2 Interaction of Water 1.3 Role of Water in Bio molecular Structure 1.4 Acid and Bases, Buffer Structure **2- Chemical Bonds:** 2.1 Chemical Bonds (Ionic Bond, Covalent Bond, Co-ordinate Bond, Non Covalent Bonds, Hydrogen Bond) **Key words:-** Water, Buffer, Chemical Bonds.	12
III	**जल की आणविक संरचना :–** **1. जल की संरचना एवं बफर –** 1.1 जल के गुणधर्म 1.2जल की पारस्परिक क्रियायें 1.3जैविक अणुओं की संरचना में जल का महत्व 1.4अम्ल एवं क्षार, बफर विलयन। **2. रासायनिक बन्ध–** 2.1 रासायनिक बंध (आयनिक बन्ध,सहसंयोजक बन्ध, असह–संयोजक बन्ध, उपसहसंयोजी बन्ध, हाइड्रोजन बन्ध)। **सारबिन्दु (की वर्ड)/टैग**:–जल, बफर, रसायनिक बन्ध	12
IV	**Biomlecules:** Sources, Nomenclature , Classification, Structures, Characteristics, and Functions:- 1- Carbohydrates, 2- Lipids, 3- Proteins 4- Nucleic Acids.	12

	Key words:- Carbohydrates, Proteins, Lipids, Nucleic Acids.	
IV	**जैविक अणु :–** स्त्रोत, नामकरण, वर्गीकरण, संरचना, लक्षण एवं कार्य : 1. कार्बोहाउड्रेट्स, 2. प्रोटीन्स, 3. लिपिड्स 4. नाभिकीय अम्ल **सारबिन्दु (की वर्ड)/टैग** :– कार्बोहाइड्रेट्स, प्रोटीन्स, लिपिड्स, नाभिकीय अम्ल	12
V	**Tools and Techniques :** 1.1 Principle and Applications of 1. Light Microscopy, 2. Centrifugation, 3. Chromatography (Paper, Thin layer and Column), 4. Colorimeter and Spectrophotometer. **Keywords:-**Microscope, Chromatography, Spectrophotometer.	12
V	**उपकरण एवं तकनीकी :–** **उपकरणों के सिद्धान्त एवं अनुप्रयोग** 1. प्रकाश माइक्रोस्कोपी 2. सेन्ट्रीफ्यूगेशन 3. क्रोमेटोग्राफी (पेपर, थिनलेयर एवं स्तम्भीय), 4. कोलोरीमीटर, स्पेक्ट्रोफोटोमीटर **सारबिन्दु (की वर्ड)/टैग** :–सूक्ष्मदर्शी (माइक्रोस्कोप), क्रोमेटोग्राफी, स्पेक्ट्रोफोटोमीटर	12

Part C- Suggested Learning Resources

भाग स – अनुशंसित अध्ययन संसाधन

Text Books, Reference Books, Other resources

पाठ्यपुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

Suggested Readings:

1. कोशिका विज्ञान एवं आनुवांशिकी– पी.के.गुप्ता– रस्तोगी प्रकाशक
2. कोशिका जीवविज्ञान–डॉ मनीष कुमार शर्मा–निखिल प्रकाशक

3. जैव रसायन–भाटिया एवं कोहली –आर.डी.बी.प्रकाशक

4. कोशिका जैविकी, आनुवांशिकी, जैवप्रौद्योगिकी शर्मा, त्रिवेदी.आर.डी.बी प्रकाशक

5. जीवरसायनविज्ञान, डॉ विजय कुमार, महेन्द्रप्रसाद–जे.पी.बी.प्रकाशक

6.प्रायोगिक जैव रसायन–भाटिया एवं कोहली–आर.डी.बी.प्रकाशक

7- Industrial Biotechnology- B.D.Singh

8- Textbook of Biochemistry- S.P.Singh

9- Cell and Molecular Biology – P.K.Gupta

10- Cell Biology- P.S.Verma and Agrawal

11- Cell and Molecular Biology- S.C.Rastogy

12- Cell Biology- P.S.Verma and Agrawal

अनुशंसित सहायक पुस्तकें/ग्रन्थ/अन्य पाठ्यसंसाधन/पाठ्यसामग्रीः

1. कोशिका जीवविज्ञान – डॉ. मनीष कुमार शर्मा–निखिल प्रकाशन–आगरा
2. मौलिक पादप रसायन–टी.बी.सिंह–रामा पब्लिशिंग हाउस–मेरठ
3. कोशिका जैविकी, अनुवांशिकी, जैव प्रौद्योगिकी–शर्मा त्रिवेदी–आर.बी.डी.प्रकाशन–जयपुर
4. जीव रसायन विज्ञान– डॉ. विजय कुमार, महेन्द्र प्रसाद–जे.पी.प्रकाशन–दिल्ली
5. जैव रसायन–भाटिया एवं कोहली–आर.बी.डी.प्रकाशन–जयपुर
6. कोशिका विज्ञान एवं अनुवांशिकी–पी.के.गुप्ता–रस्तोगी पब्लीकेशन्स्–मेरठ
7. पादप जैव प्रौद्योगिकी के प्रारूप – वी.के.प्रसाद–एन.सी.ई.आर.टी.

Suggested equivalent online courses:

1. http://pubs.acs.org/loi/bichaw (for Biochemistry)
2. http://pubs.acs.org/loi/bipret, http://guides.lib.uh.edu/biotech (for Biotechnology)
3. http://www.freebookcentre.net/Biology/BioTechnology-Books.html e books on Biotechnology
4. http://www.phindia.com/Books/ShoweBooks/MTExNA/Biotechnology e books on Biotechnology
5. http://bookauthority.org/books/best-biotechnology-ebooks e books on Biotechnology

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रमः

1. http://pubs.acs.org/loi/bichaw (जैव रसायन)
2. http://pubs.acs.org/loi/bipret, http://guides.lib.uh.edu/biotech (जैव प्रौद्योगिकी)
3. http://www.freebookcentre.net/Biology/BioTechnology-Books.html e books on (जैव प्रौद्योगिकी)
4. http://www.phindia.com/Books/ShoweBooks/MTExNA/Biotechnology e books on

(जैवप्रौद्योगिकी)

5. http://bookauthority.org/books/best-biotechnology-ebooks e books on (जैव प्रौद्योगिकी)

Part D- Assessment and Evaluation

भाग द – अनुशंसित मूल्यांकन विधियाँ

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Internal Assessment: Continuous Comprehensive Evaluation(CCE): 30	Class Test Assignment/ Presentation	20 10 Total = 30
External Assessment: Annual Exam Section: 70 Time: 03.00 Hours	**Section (A):** Five Objective Type Questions **Section (B):** Five Short Answer Type Questions (200 Words each) **Section (C):** Three Long Answer Type Questions (500 Words each)	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 Total = 70

Any remarks/suggestions:

अनुशंसित सतत् मूल्यांकन विधियाँ:

अधिकतम अंक: 100

आंतरिक मूल्यांकन: सतत् व्यापक मूल्यांकन(CCE) : **30**	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण	20 10 कुल अंक : 30
आकलन: वार्षिक परीक्षा : 70 समय– 03.00 घंटे	**अनुभाग (अ):** पॉच वैकल्पिक प्रश्न **अनुभाग (ब):** पॉच लघु उत्तरीय प्रश्न (प्रत्येक 200 शब्द) **अनुभाग (स):** तीन दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 कुल अंक = 70

कोई टिप्पणी / सुझाव:

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2021-22

प्रायोगिक प्रश्नपत्र के पाठ्यक्रम

Part A- Introduction **भाग ए – परिचय**			
Program: Certificate कार्यक्रमः प्रमाण पत्र	Class : B.Sc. I st year कक्षा : बी.एस.सी. प्रथम	Year: 2021 वर्षः 2021	Session: 2021-22 सत्रः 2021–22
Subject: Biotechnology **विषयः जैव प्रौद्योगिकी**			

1	**Course Code**	CORE-PR-1-SI-BTE C1 P
	पाठ्यक्रम का कोड	CORE-PR-1-SI-BTE C1 P
2	**Course Title**	Labwork for Cell Biology and Biochemistry
	पाठ्यक्रम का शीर्षक	कोशिका जैविकी एवं जैवरसायन हेतु प्रयोगशाला कार्य
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Core Course
	पाठ्यक्रम का प्रकारः (कोर कोर्स/इलेक्टिव/जेनेरिक इलेक्टिव/वोकेशनल/.....)	कोर कोर्स
4	**Pre-requisite (if any)**	To Study this course, a student must have had the subject Biology in class 12th.
	पूर्वापेक्षा	इस पाठ्यक्रम का अध्ययन करने के लिये, छात्र ने विषय जीवविज्ञान का अध्ययन कक्षा 12वीं/प्रमाण पत्र/डिप्लोमा में किया हो।
5	**Course Learning Outcomes (CLO)**	**Course Objective :-** The Main Objective of the course will be to to give hands-on practical knowledge in Biotechnology. The Demand for trained workforce in Biotechnology is ever growing in Fundamental Research and Industry Sector. Academic and Research Sectores also

		Require Interdisciplinary trained manpower to foster the Biotechnology Revolution. The curriculum aims to impart basic knowledge with emphasis on its applications to make the students ready for industries and research work in concerned field. **Learning Outcome :-** At the end of the paper a student should be able to: • Understand basic techniques of cell biology • Know the physical as well as chemical properties of biomolecules • Pursue a career in biochemical testin. The decrease of increase in the amount of some of the biomolecules can have clinical signicance. • Take medical Laboratory Technique Courses, opening opportunities in hospitals and pathological laboratories.	
	पाठ्यक्रम अध्ययन की परिलब्धियां	**पाठ्यक्रम के उद्देश्य** – स्वयं के द्वारा प्राप्त जैवतकनीकी का प्रायोगिक ज्ञान ही इस पाठ्यक्रम का मुख्य उद्देश्य है। मौलिक शोध एवं औद्योगिक क्षेत्र में जैव तकनीकी में प्रशिक्षित कार्यकर्ताओं की मांग भी तेजी से बढ़ रही है। जैव प्रोद्योगिकी क्रान्ति को बढ़ावा देने हेतु शैक्षणिक एवं शोध क्षेत्र में अर्न्तविषयक प्रशिक्षित जनों की आवश्यकता है। इसके अनुप्रयोगों पर जोर देते हुये इसका बुनियादी ज्ञान छात्रों को देना इसका मुख्य उद्देश्यक है। जिससे उनको संबंधित क्षेत्र में उद्योगों एवं शोध कार्यो हेतु तैयार किया जा सके। **अध्ययन के प्रतिफल :** पाठ्यक्रम अध्ययन के फलस्वरूप छात्र योग्य होगा : • कोशिका जैविकी के आधारीय तकनीक को समझने में। • छात्र जैव रसायनिक परीक्षणों में अपना केरियर बना सकता है। • छात्र चिकित्सीय प्रयोगशाला तकनीकी कोर्स में जा सकते हैं, अस्पतालों और रोग परीक्षण प्रयोगशालाओं में सेवायें देने का अवसर पा सकते हैं।	
6	**Credit Value**	Practical-2	
	क्रेडिट मान	सैद्धान्तिक–2	
7	**Total Marks**	Max. Marks: 100 (30+70)	Min. Passing Marks: 35
	कुल अंक	अधिकतम अंकः 100 (30+70)	न्यूनतम उत्तीर्ण अंकः 35
Part B- Content of the Practical course			

भाग बी – कोर्स की सामग्री	
Total No. of Lectures(In hours per week) - 02 Hours per week **Credits – 2 (Practical:30 hours)**	
व्याख्यानों की कुल संख्या : 02 घण्टे प्रति सप्ताह	
Scheme of Practical Examination:- **(A)** **Internal Assesment.:-** 1- Class Interaction 2- Quiz 3- Seminar 4- Assignments **(**Charts, Rural Service Technology Dissemination/Excursion/Lab Visit/Industrial Training) **(B)** **External Assesment :-** 1- Major experiment 2- Minor experiment-1 3- Minor experiment-2 4- Spotting 5- Viva-Voce 6- Practical Record	**Max Marks (30+70=100)** Max Marks-30 **Max. Marks: 70**
अनुशंसित सतत मूल्यांकन विधियां अ) आंतरिक मूल्यांकन 1. कक्षा में संवाद/प्रश्नोत्तरी 2. उपस्थिति 3. असाइनमेंट (चार्ट/मोंडल/सेमिनार/भ्रमण (एक्सकर्शन) की रिपोर्ट/सर्वेक्षण/प्रयोगशाला भ्रमण (लैब विजिट)/औद्योगिक यात्रा ब) बाह्य मूल्यांकन 1. प्रायोगिक मौखिकी (वायवा) 2. प्रायोगिक रिकार्ड फाइल टेबल वर्क/प्रयोग 1. मेजर प्रयोग 2. माइनर प्रयोग–1	**30+70=100** **Total - 30** **Total – 70**

3.	माइनर प्रयोग–2	
4.	स्पॉटिंग	

List of Experiments/Exercise.

1- To study the plant cell structure using various plant materials

2- To study the animal cell structure using cheek cells

3- To prepare Onion root tip for the stages of Mitosis

4- To prepare and study the different stages of Mitosis and Meiosis

5- To analyze Carbohydrates Quantitatively

6- To analyze proteins Quantitatively

7- To analyze lipids Quantitatively

8- To Prepare Buffers

9- To Separate plant pigments by Paper Chromatography

10- To Separate amino acids by TLC

अभ्यास/प्रयोग की सूचीः–

1. विभिन्न पादप सामग्री का उपयोग कर पादप कोशिका की संरचना का अध्ययन
2. चूजे की कोशिकाओं द्वारा जन्तु कोशिका की संरचना का अध्ययन
3. अर्धसूत्री विभाजन की अवस्थाओं के अध्ययन हेतु प्याज की जड़ों की टिप तैयार करना
4. अर्धसूत्री एवं समसूत्री कोशिका विभाजन की विभिन्न अवस्थायें तैयार कर अध्ययन करना
5. कार्बोहाइड्रेट्स का मात्रात्मक विश्लेषण
6. प्रोटीन्स का मात्रात्मक विश्लेषण
7. लिपिड्स का मात्रात्मक विश्लेषण
8. कार्यिक बफर तैयार करना
9. पेपर क्रोमेटोग्राफी द्वारा पादप रंजको का पृथक्करण
10. टी.एल.सी. द्वारा अमीनों अम्लों का पृथक्करण

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प्रायोगिक प्रश्नपत्र के पाठ्यक्रम

Part A- Introduction **भाग अ – परिचय**			
Program: Certificate कार्यक्रमः प्रमाण पत्र	Class : B.Sc. I st year कक्षा : बी.एस.सी. प्रथम	Year: 2021 वर्षः 2021	Session: 2021-22 सत्रः 2021–22

Subject: Biotechnology **विषयः जैव प्रौद्योगिकी**		
1	**Course Code**	CORE TH-2-SI-BTE-C2 T
	पाठ्यक्रम का कोड	CORE TH-2-SI-BTE C2 T
2	**Course Title**	Microbiology and Immunology
	पाठ्यक्रम का शीर्षक	सूक्ष्मजीवविज्ञान एवं प्रतिरक्षाविज्ञान
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Core Course
	पाठ्यक्रम का प्रकारः (कोर कोर्स/इलेक्टिव/जेनेरिक इलेक्टिव/बोकेशनल/.....)	कोर पाठ्यक्रम
4	**Pre-requisite (if any)**	To Study this course, a student must have had the subject Biology in class 12th.
	पूर्वापेक्षा	इस पाठ्यक्रम का अध्ययन करने के लिये, छात्र ने जीवविज्ञान विषय का अध्ययन कक्षा 12 वीं में किया हो।
5	**Course Learning Outcomes (CLO)**	**Course Objective :-** To create general understanding about microbiology and immunology **1-** The students will be able to understand microbial diversity and Nutrition. **2-** The students will be able to understand immune system, immune responses and Vaccination. **3-** The students will be able to describe role of immune system **4-** The students will be able to understand

		immunological techniques. **Course Learning Outcome :-** At the end of the Course student will familiar with - **1-** Microbial diversity and nutrition. **2-** Immune system, its properties and types **3-** Immunoglobulin structure, types and functions and can apply the concept of hypersensitivity and vaccination for different diseases. **4-** Perform various immunological techniques.	
	पाठ्यक्रम अध्ययन की परिलब्धियां	**पाठ्यक्रम का उद्देश्य –** सूक्ष्म जीवविज्ञान एवं प्रतिरक्षाविज्ञान की सामान्य समझ विकसित करना। 1. विद्यार्थी सूक्ष्मजीवों की विविधता और पोषण के बारे में समझ सकेंगे। 2. विद्यार्थी प्रतिरक्षा तंत्र, प्रतिरक्षा प्रतिक्रिया और टीकाकरण के बारे में समझ सकेंगे। 3. विद्यार्थी प्रतिरक्षा तंत्र की स्वास्थ्य बनाये रखने एवं रोग में इसके योगदान की भूमिका को समझा सकेंगे। 4. विद्यार्थी प्रतिरक्षीय तकनीकों के बारे में समझ सकेंगे। **कोर्स अधिगम उपलब्धिः** पाठ्यक्रम के अंत में छात्र इससे परिचित होंगे – 1. सूक्ष्मजीव विविधता और पोषण 2. प्रतिरक्षा तंत्र के गुणधर्म और प्रकार वर्णन करने में सक्षम होंगे। 3. इम्युनाग्लोबुलिन की संरचना, प्रकार, कार्य एवं अतिसंवेदनशीलता तथा को विभिन्न रोगों पर टीकाकरण की अवधारणा को समझ कर लागू कर सकेंगे। 4. विभिन्न इम्यूनोलॉजिकल तकनीकों का निष्पादन करना,	
6	**Credit Value**	04 credit	
	क्रेडिट मान	04 credit	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35
	कुल अंक	अधिकतम अंकः 30+70	न्यूनतम उत्तीर्ण अंकः 35
Part B- Content of the course			

भाग ब – पाठ्यक्रम की विषयवस्तु		
Total No. of Lectures Hours-60 Hours		
व्याख्यानों की कुल संख्या –ट्युटोरियल–प्रायोगिक (प्रति सप्ताह घंटे में) : 60 घण्टे		
Unit	**Topic**	**No. of Lecture**
इकाई	**विषयवस्तु**	**व्याख्यान**
I	**History, Basic concepts of Microbiology and Culture Media preparation** **1- History, Basic concepts of Microbiology:** 1.1 Fundamental, History and evolution of microbiology, Development of microbiology, Application of microbiology in human welfare 1.2 Classification, General characteristic and structure of Bacteria, Fungi and Viruses. **2- Media Preparation:** 1.1 Methods and Types: Culture, Minimal, Selective, differential, Transport Media. 1.2 Synchronous, Batch and Continuous culture **Key words: -** Classification of Microorganisms, Media Preparation.	12
I	सूक्ष्मजीवविज्ञान का इतिहास, मूल अवधारणाएं एवं कल्चर मीडिया का निर्माण : 1. सूक्ष्म जीव विज्ञान का इतिहास, मूल अवधारणायें – 1.1 सूक्ष्म जीव विज्ञान के मूल तत्व, इतिहास एवं उद्भव (क्रमागत उन्नति) सूक्ष्म जीव विज्ञान का विकास, मानव कल्याण में सूक्ष्मजीवविज्ञान के अनुप्रयोग 1.2 जीवाणु, कवक एवं विषाणु का वर्गीकरण, सामान्य लक्षण एवं संरचना 2. कल्चर मीडिया का निर्माण – 2.1 विधियाँ एवं प्रकारः संवर्धन, न्यूनतक, चयनात्मक, विभेदन, परिवहन मीडिया 2.2 तुल्यकालिक, बैच (जत्था) एवं सतत मीडिया	12

	सारबिन्दु (की वर्ड)/टैग :– सूक्ष्मजीवों का वर्गीकरण, सामान्य लक्षण, कल्चर मीडिया	
II	**Microbial Growth and Growth measurement :** 1. **Microbial Growth:** 1.1 Definition of growth, Mathematical expression of growth, Growth Curve, Generation time, Growth yield, Effect of nutrients of growth. 1.2 Factor affection growth: Nutrient, Temperature, Oxygen, pH, Osmotic pressure. **2- Growth measurement:** 2.1 Measurement of Growth (Direct and Indirect methods): cell number, Cell Mass and Cell Activity. 2.2 Cell count: Turbidometric method, Plate count method, Membrane count method, Dry weight and Wet method by measurement of celluar activity. **Keywords:-** Growth, Measurement.	14
II	**सूक्ष्मजैविक वृद्धि एवं वृद्धि का मापन :–** 1. **सूक्ष्मजैविक वृद्धि –** 1.1 वृद्धि की परिभाषा, वृद्धि की गणितीय अभिव्यक्ति, वृद्धि चक्र, उत्पादन समय, वृद्धि उपज. वृद्धि पर पोषक तत्वों का प्रभाव 1.2 वृद्धि को प्रभावित करने वाले कारकः पोषण, तापमान, ऑक्सीजन, पीएच, परासरण दाब 2. **वृद्धि के मापन –** 2.1 वृद्धि का मापन (प्रत्यक्ष और अप्रत्यक्ष विधियाँ), कोशिका संख्या, कोशिका द्रव्यमान, कोशिका गतिविधि 2.2 कोशिका की गणनाः टर्बिडीमेट्रिक विधि, प्लेट काउंट विधि, झिल्ली गणना विधि, शुष्क वजन और गीला वजन विधियों द्वारा कोशिकीय गतिविधियों का मापन **सारबिन्दु (की वर्ड)/टैग :–** वृद्धि, मापन	14
III	**Basic of immunology :-**	10

	1. Basics of immunology: **1.1** Concept of Innate and Acquired Immunity Phygocytosis complement and Inflammatory responses. **1.2** Immune cells and organs: Structure, Function and Properties of immune cells-Stem cell, T-cell, B-cell, NK-cell, Macrophagus, Neutrophil, Eosinophil, Basophil, Mastcell, Dentric Cell. **1.3** Immune organ: Bone marrow, Thymus, Lymph Node, Spleen, Lymphatic System. **Key words:-** Immunity, Immune cells.	
III	**प्रतिरक्षाविज्ञान के मूलतत्व :–** **1. प्रतिरक्षाविज्ञान के मूलतत्व –** 1.1 जन्मजात और उपार्जित प्रतिरक्षा की अवधारणा, कोशिका भक्षकाणविक, पूरक एवं उत्तेजक प्रतिक्रियाएं 1.2 प्रतिरक्षा कोशिकायें एवं अंगः प्रतिरक्षा कोशिकाओं की संरचना, कार्य एवं गुणधर्म, स्टेम कोशिका, टी–कोशिका, एनके– कोशिका, बृहतभक्षानु, न्युट्रोफिल, इस्त्रोफिल, बेसोफिल, मास्ट कोशिका, दुमिका कोशिका 1.3 प्रतिरक्षा अंगः अस्थि मज्जा, थाइमस, लसीकागांठ, प्लीहा, लसीकातंत्र **सारबिन्दु (की वर्ड)/टैगः**–प्रतिरक्षा, प्रतिरक्षा कोशिकायें	10
IV	**Immunoglobulins and Immune response:** **1- Immunoglobulins** 1.1 Antigens: Characteristics of an antigen: Foreignness, Molecular size, Chemical composition and Hererogeneity, Antigen Adjuvants, Epitopes, Haptens. 1.2 Antibodies: Structure, Types, Functions and Properties of antibodies Antigenic determinant on antibodies (Isotypic, Allotypic, Idiotypic), Monoclonal, Polyclonal and Chimeric antibody.	15

	2 Immune response: 2.1 Generation of immune response: Primary and Secondary immune response, generation of Humoral response (Plasma and Memory cell), Generation of cell mediated immune response (self MHC restriction, T-cell activation, co-stimulatory signals), Killing Mechanisms by CTL and NK cells, Introduction to tolerance. **Key words:-** Antigens, Antibody.	
IV	**प्रतिरक्षाग्लोबुलिन एवं प्रतिरक्षा प्रतिक्रिया :–** **1. प्रतिरक्षागलोबुलिनः** 1.1 प्रतिजनः प्रतिजन के लक्षण, विजातीयता, आणविक अमाप, रासायनिक संरचना एवं विवधता, प्रतिजन सहायक, एपिटोपस, हेप्टेन्स 1.2 प्रतिरक्षीः संरचना, प्रकार, कार्य एवं गुणधर्म, प्रतिरक्षकों पर प्रतिजन निर्धारक (आइसोटाइपिक, एलोटाइपिक, इडियोटाइप), मोनोक्लोनल, पॉलीक्लोनल, एवं कैमेरिक एंटीबॉडी. **2. प्रतिरक्षा की प्रतिक्रिया उत्पादन :** 2.1 प्राथमिक एवं द्वितीयक प्रतिरक्षा प्रतिक्रिया, शरीर द्रव विषयक प्रतिक्रिया उत्पादन, (प्लाज्मा एवं स्मृति कोशिका), कोशिका मध्यस्थता प्रतिरक्षा प्रतिक्रिया की उत्पत्ति (स्वतः एमएससी प्रतिबंध, टी–कोशिका सक्रियता, सह–उत्तेजक संकेत), सी.टी.एल. एवं एन के कोशिका द्वारा मारक कार्यविधि, सहिष्णुता का परिचय, **सारबिन्दु (की वर्ड)/टैग** :– प्रतिजन, प्रतिरक्षी	15
V	**Microbial, Immunological Techniques and Vaccination :** **1- Microbial Techniques:** **1.1** Principle, Working and applications of instruments-Laminar airflow, Autoclave, Hot air oven. **2- Immunological techniques:** **2.1** RIA, ELISA, Western blotting, Principles of	10

	Precipitation, Agglutination, Immunodiffsion, Immunoelectophorosis. **3- Vaccination:** **3.1** Vaccines and Vaccination: Rubella, Varicella (Chickenpos), Polio, Dipthria, Hepatitis vaccine. **Keywords:-** RIA, ELISA, Laminar air flow, Autoclave, Vaccine.	
V	**सूक्ष्मजैविकी, इम्यूनोलॉजिकल तकनीक एवं टीकाकरण :–** **1. सूक्ष्मजैविकी तकनीक :** 1.1 उपकरणों के कार्यचालन, अनुप्रयोग एवं सिद्धान्त–लैमीनर वायु प्रवाह, आटोक्लेव, गर्म हवा ओवन, 1.2 इम्यूनोलॉजिकल तकनीकः त्प्।ए म्स्प्।, वेस्टर्न ब्लॉटिंग, अवक्षेपण के सिद्धान्त समूहन, प्रतिरक्षा प्रसार, इम्यूनोइलेक्ट्रोफोरेसिस, 1.3 टीका एवं टीकाकरणः रूबेला, वेरिसेला (छोटी चेचक), पोलियो, डिप्थीरिया हेपेटाइटिस टीका, **सारबिन्दु(की वर्ड)/टैग :–**RIA, ELISA, लैमीनर वायु प्रवाह, आटोक्लेव, टीका	10

Part C- Learning Resources

भाग सी – अनुशंसित अध्ययन संसाधन

Text Books, Reference Books, Other resources

पाठ्यपुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

Suggested Readings:

अनुसंशित सहायक पुस्तकें/ग्रन्थ/अन्य पाठ्य संसाधन/पाठ्य सामग्री :

1- Fundamentals of microbiology and immunology; A.K.Banerjee and Nirmalaya Banerjee, New Central Book Agency, New Delhi

2- Modern concepts of microbiology: H.D.Kumar and Swati Kumar, Vikas Publishing House Pvt Ltd. 2nd Edition.

3- Microbiology; M.J.Pelczar, E.C.S. Chan and N.R.Krieg, McGraw Hill Book company, 1993, 5th edition

4- A text book of microbiology; R.C.Dubey and D.K.Maheshwari, S.Chand and Company Ltd 2004,

1st Edition

5- Microbiology; P.D.Sharma, Rastogi Publication, Meerut.

6- General Microbiology Vol I and Ii; C.B.Powar and H.F.Dagniwala, Himalaya Publication.

7- Microbiology Fundamental and Applications; S.S.Purohit, Agrobias, 7th Edition.

8- Immunology; K.R.Joshi, Agrobios, 5th edition

9- प्रतिरक्षाविज्ञान, सूक्ष्मजैविकी एवं जैव प्रौद्योगिकी, अरविंदलाल भाटिया, नरेन्द्र जैन, महासिंह, RBD Publication, New Delhi

10. पर्यावरण एवं प्रौद्योगिकी, प्रवीणचन्द्र त्रिवेदी– हिन्दी पीडीएफ पुस्तक

11. सूक्ष्म जीव विज्ञान, इम्तियाज वानी, मनीष शर्मा, पुष्पेन्द्र चौधरी, S.Vikas and Company, Jalandhar.

12. आण्विक जैविकी एवं प्रौद्योगिकी पी.के.गुप्ता Rastogi Publication, Meerut.

Suggested equivalent online courses:

अनुसंशित डिजिटल प्लेटफॉर्म वेब लिंक :

- **http://www.freebookcentre.net>...free microbiology books download ebooks online**
- **http://open.oregonstate.education>...General Microbiology- Open Textbook- Open Textbooks**
- **http://www.freebookcentre.net>...Immune System and Immunology (PDF63P) download book**
- **http://hmmcollege.ac.in>3...PDF Introduction to Immunology**
- **http://www.malecentrum.sk>...PDF Immunology&Microbiology**

Suggested Equivalent Courses:

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रमः

Part D- Assessment and Evaluation

भाग द – अनुशंसित मूल्यांकन विधियाँ

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Internal Assessment: Continuous Comprehensive Evaluation(CCE): 30	Class Test Assignment/ Presentation	20 10 Total = 30
External Assessment: Annual Exam Section: 70	**Section (A):** Five Objective Type Questions	05 x 02 = 10

Time: 03.00 Hours	**Section (B):** Five Short Answer Type Questions (200 Words each) **Section (C):** Three Long Answer Type Questions (500 Words each)	05 x 06 = 30 03 x 10 = 30 Total = 70

Any remarks/suggestions:

अनुशंसित सतत् मूल्यांकन विधियाँः

अधिकतम अंकः 100

आंतरिक मूल्यांकनः सतत् व्यापक मूल्यांकन(CCE) : **30**	क्लास टेस्ट असाइनमेंट / प्रस्तुतीकरण	20 10 कुल अंक : 30
आकलनः वार्षिक परीक्षा : 70 समय– 03.00 घंटे	**अनुभाग (अ):** पॉच वैकल्पिक प्रश्न **अनुभाग (ब):** पॉच लघु उत्तरीय प्रश्न (प्रत्येक 200 शब्द) **अनुभाग (स):** तीन दीर्घ उत्तरीय प्रश्न (प्रत्येक 500 शब्द)	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 कुल अंक = 70

कोई टिप्पणी / सुझावः

Any remarks/suggestions: Table work / Experiments based on availability of resources at local level.

कोई टिप्पणी / सुझावः टेबल कार्य / प्रयोग स्थानीय स्तर पर उपलब्ध संसाधन पर आधारित होंगे।

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

प्रायोगिक प्रश्नपत्र के पाठ्यक्रम

Part A- Introduction **भाग अ – परिचय**			
Program: Certificate कार्यक्रमः प्रमाण पत्र	Class : B.Sc. I st year कक्षा : बी.एस.सी. प्रथम	Year: 2021 वर्षः 2021	Session: 2021-22 सत्रः 2021–22

Subject: Biotechnology **विषयः जैव प्रौद्योगिकी**		
1	**Course Code**	CORE TH-2-SI-BTE-C2 P
	पाठ्यक्रम का कोड	CORE TH-2-SI-BTE C2 P
2	**Course Title**	Microbiology and Immunology
	पाठ्यक्रम का शीर्षक	सूक्ष्मजीवविज्ञान एवं प्रतिरक्षाविज्ञान पर प्रयोगशाला,
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Core Course
	पाठ्यक्रम का प्रकारः (कोर कोर्स / इलेक्टिव / जेनेरिक इलेक्टिव / बोकेशनल / .....)	कोर पाठ्यक्रम
4	**Pre-requisite (if any)**	To Study this course, a student must have had the subject Biology in class 12th.
	पूर्वापेक्षा	इस पाठ्यक्रम का अध्ययन करने के लिये, छात्र के पास 12 वीं कक्षा में जीन विज्ञान विषय होना चाहिये।
5	**Course Learning Outcomes (CLO)**	**Course Objective :-** The objective of the course is to prepare students competent in subject through in-depth lecture and laboratory practices- 1. The students will be able to identify microbes using modern techniques. 2. The students will acquire skill and competence in microbiological and immunological laboratory practices applicable to microbiological research or clinical methods of immunology including accurately reporting obeservations and

		analysis. **Course Learning Outcome :-** On completion of this course, learners will be able to have sufficient scientific understanding of microbiology and immunology- 1. Students apply concepts, Principle and types of sterilization methods viz performing microbiological experiments. 2. Students apply the concept and characteristics of antiseptic disinfected and their mode of action in day to day life. 3. Students will apply principle, working and applications of instruments - Laminar airflow, Autoclave, Hot air oven etc.	
	पाठ्यक्रम अध्ययन की परिलब्धियां	**पाठ्यक्रम का उद्देश्य –** इस पाठ्यक्रम का उद्देश्य है विद्यार्थियों को गहन व्याख्यान एवं प्रयोगशाला अभ्यासों के माध्यम से विषय में सक्षम बनाना 1. विद्यार्थी आधुनिक तकनीकों का उपयोग कर, सूक्ष्मजीवों की पहचान कर सकेगा। 2. विद्यार्थी सूक्ष्म जीवविज्ञान एवं प्रतिरक्षाविज्ञान प्रयोगशाला अभ्यासों से प्राप्त कौशल एवं क्षमता के द्वारा सूक्ष्मजैविक अनुसंधान अथवा प्रतिरक्षाविज्ञान के नैदानिक तरीकों, सटीक प्रतिवेदन, अवलोकन तथा विश्लेषण कर सकेगा। **पाठ्यक्रम के प्रतिफल :** पाठ्यक्रम के अंत में विद्यार्थी को सूक्ष्म जीव विज्ञान एवं प्रतिरक्षाविज्ञान की वैज्ञानिक समझ होगीश – 1. विद्यार्थी सूक्ष्मजीवविज्ञान प्रयोगों में विसंक्रमण विधियों की अवधारणा, सिद्धान्त एवं प्रकारों का निष्पादन करेगा। 2. विद्यार्थी दैनिक जीवन में कीटाणु रहित क्रियाओं के तरीके की अवधारणा एवं विशेषताओं को लागू करेगा। 3. विद्यार्थी उपकरणों के सिद्धान्त कार्यप्रणाली और अनुप्रयोगों को लागू करेगा। लैमिनार एयरफ्लो, आटोक्लेव, हॉट एयर ओवन आदि	
6	**Credit Value**	2	
	क्रेडिट मान	2	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35

	कुल अंक	अधिकतम अंकः 30+70	न्यूनतम उत्तीर्ण अंकः 35

Part B- Content of the course
भाग ब – पाठ्यक्रम की विषयवस्तु

Total No. of Lectures (In Hours) : 30

व्याख्यानों की कुल संख्या– ट्यूटोरियल– प्रायोगिक (प्रति सप्ताह घंटें में): 30

Topics	**Hours.**
विषय	घंटे
List of Practicals 1. To perform aseptic technique, cleaning of glassware's, preparation of cotton plugging and sterilization. 2. To prepare Bacterial and fungal media. 3. To isolate microbes from Air, Water and Soil. 4. To study dilution and plating by pour plate, spread plate methods. 5. To study microorganisms by staining method- simple staining, gram staining, endospore staining, fungal staining, negative staining. 6. To identify bacteria based on staining, shape and size. 7. To enumerate microorganism- total and viable count. 8. To study antibiotic sensitivity of microbes by the use of antibiotic discs. 9. To isolate and identify pathogenic bacteria from sewage and waste water. 10. To determine growth curve and generation time of E.Coli. 11. To identify of human blood groups. 12. To enumerate total WBC of the given blood sample by hemocytometer. 13. To enumerate differential Leukocyte of the given blood sample. 14. To enumerate total RBC of the given blood sample by hemocytometer. 15. To isolate and identify aquatic fungi from local water body.	30
प्रयोग कार्यों की सूचीः 1. एसेप्टिक तकनीक, ग्लासवेयर की सफाई, कॉटन प्लगिंग और स्टरलाइजेशन(विसंक्रमण) की तैयारी करना। 2. बैक्टीरियल (जीवाणु) और फंगल (कवक) मीडिया तैयार करना। 3. वायु, जल और मिट्टी से सूक्ष्मजीवों को पृथक करना। 4. पोर प्लेट, स्प्रेड प्लेट विधियों द्वारा तनुकरण एवं लेपन का अध्ययन करना।	30

5. अभिरंजन विधि द्वारा सूक्ष्मजीवों का अध्ययन करना– साधारण अभिरंजन, ग्राम अभिरंजन, एंडोस्पोर अभिरंजन, कवक अभिरंजन, नकारात्मक अभिरंजन।
6. अभिरंजन विधि द्वारा जीवाणुओं का आकार एवं परिमाण की पहचान करना।
7. सूक्ष्मजीवों की गणना करना– कुल और जीवक्षम गणना।
8. एंटीबायोटिक डिस्क के उपयोग द्वारा रोगाणुओं की एंटीबायोटिक संवेदनशीलता का अध्ययन करना।
9. सीवेज(मल) और अपशिष्ट जल से रोगजनक बैक्टीरिया को अलग करना और उनकी पहचान करना।
10. ई कोलाई के विकास वक्र और उत्पादन समय का निर्धारण करना।
11. मानव रक्त समूहों की पहचान करना।
12. हीमोसाइटोमीटर द्वारा दिये गये रक्त के नमूने के कुल श्वेत रक्त कोशिकायें (डब्लूबीसी) की गणना करना।
13. दिये गये रक्त के नमूने के विभेदक ल्यूकोसाइट की गणना करना।
14. हीमोसाइटोमीटर द्वारा दिये गये रक्त के नमूने के कुल लाल रक्त कोशिका (आरबीसी) की गणना करना।
15. जलीय कवक को स्थानीय जल निकाय से अलग करना और पहचानना।

Part C- Learning Resources

भाग स – अनुशंसित अध्ययन संसाधन

Text Books, Reference Books, Other resources

पाठ्यपुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

Suggested Readings-

1. Laboratory Techniques in Modern Biology; N. Swarup, S.C. Pathak, S.Arora, Kalyani Publication, NewDelhi.
2. Integrated Methodologies in Biology; Shashi Shrivastava, P. Banerjee, Arun Prakashan, Gwalior.
3. Experiment in Microbiology Plant Pathology and Biotechnology; K.R. Anejaa, New Age International, New Delhi, 2007.
4. Laboratory Manual of Biotechnology; P.N. Swamy, Rastogi Publication, Meerut.
5. Practical Microbiology; R.C. Dubey, D.K. Maheshwari, S. Chand and Company, Delhi.
6. Manual of Experiments in Biotechnology; Leena Lakhani, Sheeba Khan, Kailash Pustak Sadan, Bhopal.

अनुशंसित सहायक पुस्तकें/ग्रंथ/अन्य पाठ्यसंसाधन/पाठ्यसामग्रीः

1. Laboratory techniques in modern Biology; N. Swarup, S.C. Pathak, S.Arora, Kalyani Publication , NewDelhi.
2. Integrated Methodologies in Biology; Shashi Shrivastava, P. Banerjee, Arun Prakashan, Gwalior.
3. Experiment in Microbiology Plant Pathology and Biotechnology; K.R. Anejaa, New Age International, New Delhi, 2007.
4. Laboratory Manual of Biotechnology; P.N. Swamy, Rastogi Publication, Meerut.
5. Practical Microbiology; R.C. Dubey, D.K. Maheshwari, S. Chand and Company, Delhi.
6. Manual of Experiments in Biotechnology; Leena Lakhani, Sheeba Khan, Kailash Pustak Sadan, Bhopal.

Suggested digital platforms web links

अनुशंसित डिजिटल प्लेफॉर्म वेब लिंकः

1. http://lipguides.uphsc.edu>...ebooks Microbiology Immunology and Biochemistry
2. http://bookauthority.org>...Microbiogy eBook

Suggested equivalent online courses:

अनुशंसित समकक्ष ऑनलाइन पाठ्यक्रमः

Part D- Assessment and Evaluation

भाग द – अनुशंसित मूल्यांकन विधियाँ

Suggested Continuous Evaluation Methods:

Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction/ Quiz		Viva Voce on Practical	
Attendance		Practical Record File	
Assignments (Charts/Model/Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visit/ Survey/ Idustrial Visit)		Table Work/ Experiments	
Total = 100	**30**		**70**

Any remarks/suggestions:

अनुशंसित सतत् मूल्यांकन विधियाँः

आंतरिक मूल्यांकन	अंक	बाह्य मूल्यांकन	अंक
कक्षा में संवाद / प्रश्नोत्तरी		प्रायोगिक मौखिकी	
उपस्थिति		प्रायोगिक रिकॉर्ड फाइल	
असाइनमेंट (चार्ट / मॉडल / सेमिनार / ग्रामीण सेवा / प्रौद्योगिकी प्रसार / भ्रमण(कस्कर्शन) / रिपोर्ट / सर्वेक्षण / प्रयोगशाला भ्रमण (लैब विजिट) / औद्योगिक यात्रा)		टेबल वर्क / प्रयोग(कृपया नीचे दी गयी तालिका देखें)	
कुल अंक 100	30		70

Scheme of Table Work/ Experiments:

SNo.	Table Work/ Experiments	Max. Marks
1	Major Experiment	
2	Minor Experiment - 1	
3	Minor Experiment - 2	
4	Spotting	
5	Viva-Voce	
6	Practical Record	

टेबल वर्क / प्रयोगों की योजना

क्र.	टेबल वर्क / प्रयोग	अधिकतम अंक
1	प्रमुख प्रयोग	
2	लघुप्रयोग– 01	
3	लघु प्रयोग– 02	
4	स्पॉटिंग	
5	मौखिक	
6	प्रायोगिक रिकोर्ड	

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2021-22

Theory

Session		2021-22
Class		B.Sc. IInd Year
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		**I**
Title of the Paper	(English)	**Biophysics and Biochemistry**
	(हिन्दी)	जैवभौतिकी एवं जैवरसायन
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

COURSE OUTCOME

CO1 Students learn basic principles of thermodynamics and biophysical methods;

CO2 They acquire a fairly broad knowledge of biochemistry as applicable to biotechnology;

CO3 They gain basic knowledge of various biomolecules including DNA, RNA, Proteins and enzymes.

Unit		Syllabus	Periods
Unit I	(English)	**Thermodynamics:** Thermodynamics system, equilibrium, thermodynamic laws and their applications. Different types of processes, thermodynamic variables and Entropy. Thermodynamic potentials and relations. Maxwell's Equations, fundamental equation of heat flow.	09
	(हिन्द	**ऊष्मागतिकीः** ऊष्मागतिकी तंत्र, साम्यावस्था, ऊष्मागतिकी नियम तथा उनके अनुप्रयोग। ऊष्मागतिकी प्रक्रमों के विभिन्न प्रकार, ऊष्मागतिकी चर तथा एंट्रॉपी। ऊष्मागतिकी विभव एवं संबंध। मैक्सवेल का समीकरण, ऊष्मा प्रवाह का मूलभूत समीकरण	
Unit-II	(English)	**General Biophysical Methods:** Measurement of pH, Radioactive labeling & counting. Autoradiography, Diffusion, Sedimentation, Osmosis. **Viscosity:** Definitions, factors influencing them and their applications in biology. Bragg's equation. Reciprocal lattice, Miller indices and Unit cell, Concept of different crystal structure, determination of crystal structure.	09
	(हिन्दी)	**सामान्य जैवभौतिक विधियाँः** pH मापन, रेडियोएक्टिव नामांकन एवं गणना, ऑटोरेडियोग्राफी, विसरण, अवसादन, परासरण। **श्यानता** - परिभाषायें, इन्हें प्रभावित करने वाले कारक, जीवविज्ञान में इनके अनुप्रयोग। ब्रैग का समीकरण, व्युत्क्रम जालक, मिलर सूचकांक तथा इकाई सेल, विभिन्न क्रिस्टल संरचना के प्रकार, क्रिस्टल संरचना का निर्धारण।	

Unit-III	(English)	**Fundamentals of Biochemistry:** Biochemistry as molecular logic of living beings. Axioms of living matter. Major organic compounds of animate objects- a general view. Chemical elements. Structure of atoms, molecules and chemical bonds. Ionic, covalent, coordinate and hydrogen bonds. Structure, function and properties of water. Water as universal solvent. Acids, bases and salts. pH and buffers.	09
	(हिन्दी)	**जैवरसायन का आधारः** जीवों में आण्विक तर्क के रूप में जैवरसायन। जैवपदार्थ की सूक्तियाँ, सजीवों में वृहद् कार्बनिक यौगिकों का सामान्य परिचय। रासायनिक तत्व, परमाणु की संरचना, अणु तथा रासायनिक बंध, आयनिक, सहसंयोजक, उप सहसंयोजक तथा हाइड्रोजन बंध, जल की संरचना, कार्य तथा गुण, जल सार्वभौमिक विलायक के रूप में, अम्ल, क्षार तथा लवण, pH तथा बफर।	
Unit-IV	(English)	**Biomolecules:** Introduction and occurrence, classification, properties, importance of carbohydrate, lipids, proteins, amino acids and nucleic acids and various types of RNA's.	09
	(हिन्दी)	**जैवअणुः** कार्बोहाइड्रेट, लिपिड, प्रोटीन, अमीनो अम्ल तथा न्यूक्लिक अम्ल का परिचय, उपलब्धता, वर्गीकरण, गुण तथा महत्व, आर.एन.ए. के प्रकार।	
Unit-V	(English)	**Enzyme**: Structure, classification and function. Active site, energy of activation, transition state hypothesis, lock and key hypothesis, induced fit hypothesis. Concept of Km- Michaels Menten equation. Various types of enzyme inhibition and identification using double reciprocal plot, Introduction to Allosteric Enzyme, Definition of holoenzyme, apoenzyme, coenzyme, cofactor, prosthetic group and their examples. Concept of ribozyme, multiple forms, isozymes and abzymes.	09
	(हिन्दी)	**विकरः** संरचना, वर्गीकरण एवं कार्य, सक्रिय स्थल, सक्रियण की ऊर्जा, संक्रमण अवस्था की परिकल्पना, ताला-कुंजी संकल्पना, प्रेरित-जोड़ संकल्पना, Km - मिकैलिस मेण्टन समीकरण की अवधारणा, एंजाइम अवरोधन (संदमन) के विभिन्न प्रकार तथा डबल रेसिप्रोकल प्लॉट द्वारा एंजाइम की पहचान। एलोस्टेरिक एंजाइम का परिचय। होलोएंजाइम, एपोएंजाइम, सह-एंजाइम, सह-कारक, प्रोस्थेटिक समूह की परिभाषा तथा इनके उदाहरण। राइबोजाइम, विभिन्न रूप, आइसोजाइम तथा एबजाइम की अवधारणा।	

SUGGESTED READINGS

1. Biophysics : Mohan P. Arora
2. Biology: Raven, Johnsen, Lassos Singer
3. Lehninger principles of Biochemistry (2005): Nelson & Cox.
4. Biochemistry: A. C. Deb
5. Biomolecule: Mohan P. Arora
6. Biophysics : Pattabh & Gautham
7. Molecular Biology of Cells (2002): Albert's et. al.

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2021-22

Theory

Session		2021-22
Class		**B.Sc. IInd Year**
Subject	(English)	Biotechnology
	(हिन्दी)	**जैवप्रोद्योगिकी**
Paper		**II**
Title of the Paper	(English)	**Bioinstrumentation, Biostatistics and Bioinformatics**
	(हिन्दी)	जैवयांत्रिकी, जैवसांख्यिकी एवं जैवसूचना विज्ञान
Medium of Instructions (Teaching)		English/**हिन्दी**/Both (**दोनों**)
Question Paper Language		English/**हिन्दी**/Both (**दोनों**)
Max. Marks		50

COURSE OUTCOME

CO1 Students understand principles and applications of basic instruments including computer;
CO2 They also acquire theoritical and applied knowledge of principles and applications of statistics ;
CO3 They do get familiarity with various biological databases and learn to Access them and their applications.

Unit		Syllabus	Periods
Unit-I	(English)	**Microscopy:** Light, Phase contrast, Fluorescence and Electron microscopy. **Centrifugation technique**: Principles, types and separation of biological molecules.	09
	(हिन्दी)	**सूक्ष्मदर्शिकीः** प्रकाश, फेज कंट्रास्ट, स्फूरदीप्ति तथा इलेक्ट्रॉन सूक्ष्मदर्शिकी। **अभिकेन्द्रीय तकनीकः** सिद्धान्त, प्रकार एवं जैविक अणुओं का पृथक्करण।	
Unit-II	(English)	**Chromatography and Electrophoresis** **Chromatography:** Principles and applications. **Electrophoresis:** Principle and applications. Agarose gel electrophoresis, Immuno electrophoresis. **Blotting:** Southern, Western and Northern Blotting.	09
	(हिन्दी)	**वर्णलेखनी तथा इलेक्ट्रोफोरेसिस –** **वर्णलेखनी –** सिध्दांत एवं अनुप्रयोग, **इलेक्ट्रोफोरेसिस** – सिध्दांत एवं अनुप्रयोग। एग्रोस इलेक्ट्रोफोरेसिस, इम्यूनो इलेक्ट्रोफोरेसिस। **ब्लॉटिंगः** सदर्न, वेस्टर्न एवं नादर्न ब्लॉटिंग।	

Unit-III	(English)	**Spectrophotometry -** Spectrophotometer (UV and Visible Light), Colorimeter. Radio and non-radio labeling, Autoradiography.	09
	(हिन्दी)	**स्पेक्ट्रोफोटोमिट्री –** स्पेक्ट्रोफोटोमीटर (पराबैंगनी एवं दृश्य प्रकाश), कॉलरीमीटर, रेडियो एवं अरेडियो नामांकन, ऑटोरेडियोग्राफी।	
Unit-IV	(English)	**Biostatistics:** Introduction, scope, application and use of statistic collection. Classification of data, summarization and presentation of data. **Measurement of Central Tendency:** Arithmetic mean, median, mode standard deviation. **Probability**: definition, Random variable and its distribution. Binomial probability distribution.	09
	(हिन्दी)	**जैवसांख्यिकी**: परिचय, कार्यक्षेत्र, अनुप्रयोग एवं संख्यिकी संग्रह का उपयोग। आंकड़ों का वर्गीकरण, आंकड़ों का संक्षिप्तीकरण एवं प्रस्तुतीकरण। **केंद्रीय प्रवृत्तियों की माप** : अंकगणित औसत/माध्य, मध्यिका, बहुलक, मानक विचलन। **प्रायिकताः** परिभाषा, यादृच्छिक चर एवं उसका बंटन। द्विपद प्रायिकता बंटन।	
Unit-V	(English)	**Computer:** General introduction (Characteristics, capabilities and generations). Hardware- organization of hardware (input and output devices, memory, control unit, arithmetic logic unit). Software: System software, application software. Languages- low level, high level, internet application. **Basic Bioinformatics**: Introduction to Internet, Search Engines (Google, Yahoo, Entrez etc) **Biological Databases**: Sequence databases (EMBL, GenBank, DDBJ – UNIPROT, PIR, TrEMBL), Protein family/domain databases (PROSITE, PRINTS, Pfam, BLOCK etc). Cluster databases- an Introduction. Specialized databases (KEGG etc), Database technologies (Flat-File), Structural databases (PDB)	09
	(हिन्दी)	**कम्प्यूटर**: सामान्य परिचय (गुण, क्षमताएं एवं कम्प्यूटर पीढ़ीयाँ)। हार्डवेयर- हार्डवेयर का संगठन (इनपूट एवं आउटपूट डिवाइस, मेमोरी, कंट्रोल यूनिट, अर्थमेटिक लॉजीक युनिट,) सॉफ्टवेयर- सिस्टम (सिस्टम सॉफ्टवेयर, एप्लीकेशन सॉफ्टवेयर, कम्प्यूटर भाषाएं - निम्न स्तरीय एवं उच्च स्तरीय), इंटरनेट एप्लीकेशन। **आधारभूत जैव सूचना विज्ञान**: इंटरनेट का परिचय, सर्च इंजन (Google, Yahoo, Entrez आदि) **जैविक डाटाबेस**: अनुक्रम डाटाबेस (EMBL, GenBank, DDBJ – UNIPROT, PIR, TrEMBL) प्रोटीन फेमिली/डोमेन डाटाबेस(PROSITE, PRINTS, Pfam, BLOCK etc). क्लस्टर डाटाबेस - परिचय, विशेष डाटाबेस(KEGG etc), डाटाबेस तकनीक (Flat-File), संरचनात्मक डाटाबेस (PDB)	

SUGGESTED BOOKS

1. A text book of Bioinformatics: Sharma, Munjal & Shankar.
2. Bioinformatics: CSV Muthy
3. Basic Bioinformatics: S. J. Ignacimuthu
4. Bioinformatics: Concepts, Skills and Application: S.C. Rastogi, N. Mendiratta & Parag Rastogi.
5. Practical Guide for basic Bioinformatics & Biostatistics: P. Tiwari & P. Pandey.
6. Biostatistics: B. Prasad
7. Statistical Methods: S.P. Gupta.
8. Fundamentals of Statistics: S. C. Gupta
9. Biostatistics by P.N. Arora
10. Lehninger Principles of Biochemistry: Nelson, D., and Cox, M
11. Fundamentals of Biochemistry: J. L. Jain
12. Biochemistry: Voet and Voet.
13. Textbook of Biochemistry: S.P. Singh
14. Biophysics: Pattabh & Gautham
15. Biochemistry: A.C. Deb
16. Biomolecules: Mohan P. Arora

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2021-22

Theory

Session		2021-22
Class		B. Sc. IIIrd Year
Subject	(English)	Biotechnology
	(हिन्दी)	**जैवप्रोद्योगिकी**
Paper		**I**
Title of the Paper	(English)	**Molecular Biology & Genetic engineering**
	(हिन्दी)	आण्विक जीवविज्ञान एवं अनुवांशिक अभियांत्रिकी
Medium of Instructions (Teaching)		English/**हिन्दी**/Both (**दोनों**)
Question Paper Language		English/**हिन्दी**/Both (**दोनों**)
Max. Marks		50

COURSE OUTCOME

CO1 The students learn to explain genome organization of prokaryotes and eukaryotes;
CO2 They understand the mechanisms by which genetic materials maintain them and perform genetical functions;
CO3 They acquire knowledge of principles of general and molecular genetics;
CO4 They understand the steps involved in recombinant DNA technology;

Unit		Syllabus	Periods
Unit-I	(English)	**DNA and RNA**: Chemical Structure, types and properties. Experimental proof of DNA as genetic material. **Genome**: Concept, Plant, Animal, Bacterial and Viral Genome. **DNA replication**: experimental proof of semi conservative replication method, Replicon- concept. Proteins and enzymes involved in replication in prokaryotes and eukaryotes. **Models of DNA replication**: unidirectional, bidirectional, types of DNA replication. Y shaped. Ø mode. Rolling circle Model.	09
	(हिन्दी)	**डी.एन.ए. और आर.एन.ए.:** रासायनिक संरचना, प्रकार एवं गुण, आनुवांशिक पदार्थ के रूप में डी.एन.ए. का प्रायोगिक प्रमाण। **जीनोम** – संकल्पना, पौधे, जन्तु, जीवाणु एवं विषाणु जीनोम। **डी.एन.ए. पुनरावृत्ति** : अर्धसंरक्षी पुनरावृत्ति विधि का प्रायोगिक प्रमाण, पुनरावृत्ति संकल्पना। प्रोकैरियोट्स और यूकेरियोट्स में पुनरावृत्ति में शामिल प्रोटीन तथा एंजाइम, **डी.एन.ए. पुनरावृत्ति के प्रारूप** – एकदिशीय, द्विदिशीय, डी.एन.ए. पुनरावृत्ति के प्रकार, **Y** आकार, **Ø** मोड, रोलिंग सर्किल प्रारूप।	
Unit-II	(English)	**Eukaryotic chromosomal organization**: Euchromatin, heterochromatin, chromatin structure. **Nucleosomes**: histone and non-histone proteins, histone modification.	10

		Introduction to epigenetic.	
	(हिन्दी)	**यूकेरियोटिक गुणसूत्र संगठनः** यूक्रोमैटिन, हेटरोक्रोमैटिन, क्रोमैटिन संरचना। **न्यूक्लियोसोमः** हिस्टोन व नॉन-हिस्टोन प्रोटीन, हिस्टोन रूपांतरण। **ऐपिजेनेटिक्स का परिचय।**	
Unit-III	(English)	**Origin of life**: Classical experiments and current concepts. Evolution of biological macromolecules. Evolution of early forms. **Mendelian genetics**: Mendel's law. Chromosomal basis of heredity, chromosomal analysis, allelic variation, dominance, linkage and crossing over.	10
	(हिन्दी)	**जीवन की उत्पत्ति** : पारम्परिक प्रयोग एवं वर्तमान संकल्पनाऐं, जैविक वृहद्अणुओं का उद्विकास, प्रारंभिक संरचना का उद्विकास। **मेन्डेलियन आनुवंशिकीः** मेंडल के नियम, आनुवंशिकता का गुणसूत्रीय आधार, गुणसूत्रीय विश्लेषण, एलील भिन्नता, प्रभाविता, लिंकेज एवं क्रॉसिंगओवर।	
Unit-IV	(English)	Introduction to Recombinant DNA technology, scope and importance, gene cloning. PCR, Introduction to restriction endonuclease. Vectors (for DNA transfer) and their types: Plasmids, Phagemids, Cosmids, BAC. Gene amplification.	08
	(हिन्दी)	पुनर्संयोजक डी.एन.ए. तकनीकी का परिचय, स्कोप एवं महत्व, जीन क्लोनिंग, पी.सी.आर., प्रतिबंध एंडोन्यूक्लाइज का परिचय, वेक्टर (डी.एन.ए. हस्तांतरण के लिये) और उनके प्रकारः प्लाज्मिड, फॉजमिड्स, कॉस्मिड्स, बीएसी, जीन प्रवर्धन।	
Unit-V	(English)	Plasmids: Types, properties and cloning vectors. Recombinant DNA techniques and cloning with Restriction endonuclease and recombinant DNA. Mutation: Types of mutation, point mutation (Base pair change, frame shift, deletion).Transcription, translation and gene expression in eukaryotes (yeast), alternate splicing.	10
	(हिन्दी)	प्लाज्मिडः प्रकार, गुण एवं क्लोनिंग वेक्टर। संयोजक डी.एन.ए. तकनीक एवं प्रतिबंध एंडोन्यूक्लियेज और पुनः संयोजक डी.एन.ए. के साथ क्लोनिंग। उत्पविर्तनः उत्परिवर्तन के प्रकार, बिन्दु उत्परिवर्तन (बेस जोड़ी परिवर्तन, फ्रेम शिफ्ट, विलोपन)। यूकेरियोट्स (यीस्ट) में प्रतिलेखन, अनुवादन एवं जीन अभिव्यक्ति, अलटरनेट स्प्लाइसिंग।	

SUGGESTED BOOKS

1. Cell and molecular Biology : P. K. Gupta
2. Cell & Molecular biology :S. C. Rastogy
3. Molecular Biology of Cells, (2202), Alberts's et. al.
4. Cell Biology: P. S. Verma & Agarwal

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2021-22

Theory

Session		2021-22
Class		**B.Sc. IIIrd Year**
Subject	(English)	Biotechnology
	(हिन्दी)	जैवप्रोद्योगिकी
Paper		**II**
Title of the Paper	(English)	**Applied Biotechnology**
	(हिन्दी)	व्यवहारिक जैवप्रौद्योगिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		50

COURSE OUTCOME

CO1 The students learn the techniques related to microbial, plants and animal biotechnologies;
CO2 They understand the biotechnological applications of microbial, plant and animal technologies;
CO3 They get insight in Primary and Secondary organs of Immune system and application of immunological principles.

Unit		Syllabus	Periods
Unit-I	(English)	**Microbial Biotechnology-**Food Microbiology: Microbial contamination & spoilage, food preservation. Industrial production of Ethyl alcohol, Penicillin, Cynocobalamin, Glutamic acid, Citric acid, Amylase and Protease.	09
	(हिन्दी)	माइक्रोबियल बायोटेक्नोलॉजी – फूड माइक्रोबायोलॉजी – माइक्रोबियल संदूषण और स्पॉयलेज, खाद्य संरक्षण। औद्योगिक उत्पादन इथाइल अल्कोहल, पेनिसिलिन, सिनोकोबलामिन, ग्लूटामिक एसीड, साइट्रिक एसीड, एमाइलेज, प्रोटीएज।	
Unit-II	(English)	**Plant Biotechnology:** Introduction to plant tissue culture, Nutritional requirements, In vitro culture, Single cell culture, Anther culture, Ovule culture, Somatic embryogenesis, Organogenesis, Protoplast culture, Somatic hybridization. Genetic manipulation of plants using *Agrobacterium tumefaciens.*	09
	(हिन्दी)	**पादप जैवप्रोद्योगिकी–**पादप ऊतक संवर्धन का परिचय, पोषण संबंधी आवश्यकताऐं, इनविट्रो संवर्धन, एकल कोशिका संवर्धन, ऐंथर संवर्धन, ओव्यूल संवर्धन, दैहिक भ्रूणजनन, ऑर्ग्रेनोजेनेसिस, प्रोटोप्लास्ट संवर्धन, दैहिक संकरण। एग्रोबैक्टीरियम टूमेफेशियन्स का उपयोग कर पौधों की आनुवंशिक हेरफेर।	
	(English)	**Immunology and Animal Biotechnology:**	09

III		Immunity: Innate and acquired, host defense mechanism. Infection and its types. Organs and cells of Immune system. Vaccines and its types. Antigens- properties, types and adjuvant. Immunoglobulin's- structure, types and functions. Generation of antibodies, primary and secondary response, agglutination and precipitation reactions. History, equipment and materials for animal cell culture technology. Physical requirement for animal cell culture and their growth curve in culture. **Commonly used cell lines**- their organization and characteristics, differentiation of cells. Organ culture- techniques, advantage and applications. **Applications of animal biotechnology**- methods of transfection and cell fusion of animal cells, selectable markers, HAT selection, transgenic animals. Stem cell culture, transplantation of cultured cells. Bioreactors for large scale production of animal cells.	
	(हिन्दी)	**इम्यूनोलॉजी एवं पशु जैवप्रौद्योगिकी**– प्रतिरक्षा– इन्नेट एवं एक्वायर्ड प्रतिरक्षाऐं, होस्ट डिफेंस मैकेनिज्म। संक्रमण एवं इसके प्रकार, प्रतिरक्षा तंत्र की कोशिकाऐं एवं अंग। टीके एवं इसके प्रकार। एंटीजन– गुण, प्रकार एवं उनके सहायक। इम्यूनोग्लोबुलिन– संरचनाऐं, प्रकार एवं कार्य। एंटीबॉडी की उत्पत्ति, प्राथमिक एवं द्वितीयक प्रतिक्रियाऐं, एकत्रीकरण एवं अवक्षेपण प्रतिक्रियाऐं। प्राणी कोशिका संवर्धन तकनीक– इतिहास, उपकरण एवं सामग्री। प्राणी कोशिका के लिये भौतिक आवश्यकताऐं एवं संवर्धन में उनके वृध्दि वक्र। **आमतौर पर उपयोग की जाने वाली सेल लाइन्स**, उनके संगठन और विशेषताऐं, कोशिकाओं का विभेदन। ऑर्गन संवर्धन– तकनीक, लाभ और अनुप्रयोग। **पशु जैव प्रौद्योगिकी के अनुप्रयोग** –पशु कोशिकाओं के चयन और कोशिका संलयन के तरीके, चयनकर्ता मार्कर, HAT चयन, ट्रांसजेनिक पशु। स्टेम कोशिका संवर्धन। प्राणी कोशिका संवर्धन का प्रत्यारोपण, पशु कोशिका के बड़े पैमाने पर उत्पादन के बायोरिएक्टर।	
Unit-IV	(English)	**Fermentation Technology:** Fermentation Technology: Primary and secondary screening, strain improvement, inoculum development, industrial sterilization process, scale-up and harvest and recovery. Types of fermentation- batch, continuous, fed batch process. Submerged and solid State fermentation process, basic design of a fermentor and factors affecting fermentor design. Types of fermentors- fluidized, packed bed, air lift, tray and tower fermentors.	09
	(हिन्दी)	**किण्वन प्रौद्योगिकी**– किण्वन प्रौद्योगिकी, प्राथमिक एवं द्वितीयक स्ट्रैन में सुधार। इनोकुलम विकास, औद्योगिक बंध्याकरण प्रक्रिया, स्केल–अप और हार्वेस्ट और रिकवरी। किण्वन के प्रकार– बैच, निरंतर, फेड बैच प्रक्रिया, जलमग्न और ठोस अवस्था किण्वन प्रक्रिया, किण्वक की मूल डिजाइन और किण्वक डिजाइन को प्रभावित करने वाले कारक। किण्वक के प्रकार– द्रवित, पैक्ड बेड, एयर लिफ्ट किण्वक, ट्रे किण्वन एवं टॉवर किण्वक।	

Unit-V	(English)	**Environment Biotechnology:** Environment: Basic concept, significance, public awareness, environmental pollution, assessment of water quality. Treatment of waste water- primary, secondary and tertiary treatment. Solid waste management: Composting, vermi-composting, methane production. **Biopesticides**– bacterial and fungal. Genetically modified crops. **Biofertilizers**– nitrogen fixers, PSB, mycorrhiza and VAM. Microbial leaching, microbial enhanced oil recovery. Bioremediation and biodeterioration. **Modern fuels**– Methanogenic bacteria and biogas, microbial hydrogen production	09
	(हिन्दी)	**पर्यावरण जैव प्रौद्योगिकी –** पर्यावरणः बुनियादी अवधारणा, महत्व, सार्वजनिक जागरूकता, पर्यावरण प्रदूषण, पानी की गुणवत्ता का आकलन, अपशिष्ट जल का उपचार – प्राथमिक, द्वितीयक और तृतीयक उपचार। ठोस अपशिष्ट प्रबंधन (खाद बनाने की प्रक्रिया, वर्मी खाद बनाने की प्रक्रिया, मीथेन उत्पादन)। **बायोपेस्टीसाइड्स**– बैक्टीरियल और फंगल, आनुवंशिक रूप से संशोधित फसलें, **जैवउर्वरक**– नाइट्रोजन फिक्सर, पीएसबी, माइकोराइजा और वीएएम, माइक्रोबियल लीचिंग, माइक्रोबियल एन्हांस्ड ऑइल रिकवरी। **आधुनिक ईंधन** – मीथेनोजैनिक जीवाणु एवं बायोगैस, माइक्रोबियल हाइड्रोजन उत्पादन।	

SUGGESTED BOOKS

1. Immunology: Tizard
2. Biotechnology An Introduction : Barum
3. Principles of Immunology: Shastri
4. Problems of genetics, Molecular genetics & evolutionary genetics: Pranobh K. Banerjee
5. Fundamentals of Microbiology & Immunology : Banerjee& Banerjee
6. Biotechnology : Mohan P.Arora
7. Immunology : Rao
8. Biotechnology & Genomics : P.K.Gupta
9. Biotechnology : Satyanarayan
10. Plant tissue culture: Bhojwani
11. Introduction to plant tissue culture: Razadan
12. Introduction to Biotech: Chawla
13. Animal Biotechnology: Shrivastava, Singh& Yadav.
14. Immunology: Kubey, J.
15. Molecular Biotechnology: Glick & Pasternak.
16. Plant tissue culture: Evance, D.R.
17. Food, Microbiology: Frazier
18. Biotechnology: K. Trahan

Practicals

B.Sc. II Year Laboratory Exercises

List of Practical's

1. Principles and working knowledge of instruments like Colorimeter, pH meter, Centrifuge, Spectrophotometer, Microscope etc.
2. Qualitative analysis of Carbohydrates, Proteins and Lipids.
3. Qualitative estimation of Protein by Folin-Lowry method.
4. Qualitative estimation of sugar by Nelson Smogyi's method.
5. Determination of enzyme activity by amylase.
6. Study the effect of temperature on enzyme activity.
7. Study the effect of pH on enzyme activity.
8. Separation of amino acids by TLC
9. Separation of leaf pigments by Paper chromatography.
10. Estimation of hemoglobin.
11. RBC counting by haematocytometer.
12. WBC counting by Differential/ or total cell count.
13. Measurement of bleeding and clotting time.
14. Measurement of Hemin Crystals.
15. Estimation of beta carotene in carrots.
16. Estimation of ascorbic acid in lemon juice.
17. Determination of iodine number of fat sample.
18. Determination of phosphorus content in plant material (Colorimetric method).
19. Computer Input and output devices.
20. Prepare a Mark sheet of your class Subjects.
21. Design your class timetable.
22. Prepare a bar chart, pie chart for analysis of Election Result.
23. Exercise based on power point presentation.
24. Design a presentation illustrating insertion of pictures, word art & clip art.
25. Use MS Word to insert a table into document.
26. Problem based on Mean, Median, Mode.
27. Hardy Weinberg Law applied on Population Genetics.
28. Problem based on Probability
29. Exercise based on standard Deviation.
30. Biological data resources and data retrieval.
31. Introduction to NCBI.
32. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.
33. Analyzing Protein Sequences.
34. Analyzing DNA Sequences

Scheme of practical examination based on paper I & II

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

B. Sc. Biotechnology II year

Time: 4 hrs **Max.Marks-50**

S.No.	Exercise	Marks
1	Major practical	10
2	Major practical	10
3	Minor practical	05
4	Minor practical	05
5	Spotting (1 to 5)	10
6	Viva	05
7	Sessional	05
Total Marks		**50**

(As Recommended by the Central Board of Studies and approved by Governor of M.P.)

2021-22

Practicals

B.Sc. III Year Laboratory Exercises

List of Practical's

1. Chromosomal DNA isolation from plant cells
2. Chromosomal DNA isolation from animal cells
3. Genomic DNA isolation from Micro-Organisms.
4. Analysis of isolated DNA by Agarose gel electrophoresis.
5. Spectrophotometric analysis of DNA & DNA melting
6. UV as a physical mutagen
7. Gradient plate technique
8. Estimation of DNA using diphenylamine method
9. Estimation of RNA using Orcinol method.
10. Isolation of RNA from yeast.
11. Isolation of plasmid DNA from bacteria.
12. Effect of UV radiation on microbial cell.
13. Demonstration of repair mechanism in microbes.
14. Bacteriophage and determination of latent period in infection
15. Isolation of total RNA from plant tissue by SDS phenol method.
16. Elution of DNA from agarose gel band
17. Transformation in E. coli cell.
18. Growth of plant tissue into undifferentiated mass of callus.
19. Preparation of animal cell culture media
20. Separation and culture of lymphocyte from blood
21. Demonstration of Fermentor
22. Preparation of wine
23. Extraction of citric acid from *Aspergillus*
24. Production of ethanol by yeast
25. Demonstration of PCR
26. Immobilization of Microbial Cell
27. Extraction and Preparation of lactic acid
28. Extraction and Preparation of citric acid
29. Demonstration of Radial immunodiffusion ana*lysis*
30. Isolation of microorganism from polluted site/industrial waste
31. Blood group analysis
32. Differential count of WBC
33. To examine flocculation reaction using VDRL test
34. To observe the agglutination reaction using WIDAL test
35. Determine the concentration of unknown antigen using Radial Immunodiffusion technique.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Scheme of practical examination based on paper I & II

(As Recommended by the Central Board of Studies and approved by Governor of M.P.)

2021-22

B. Sc. Biotechnology III year

Time: 4 hrs **Max.Marks-50**

S.No.	Exercise	Marks
1	Major practical	10
2	Major practical	10
3	Minor practical	05
4	Minor practical	05
5	Spotting (1 to 5)	10
6	Viva	05
7	Sessional	05
Total Marks		**50**

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE, SHIVAJI NAGAR, BHOPAL

(Accredited 'A' Grade by NAAC)

Syllabus of Organic Farming

2021-22

(As Recommended by the Central Board of Studies and approved by Governor of M.P.)

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College, Shivaji Nagar, Bhopal – 462016

Syllabus

2021-2022

Index

SUBJECT: BOTANY (Vocational Course)

Details			Page No.
1.	Vocational course (Organic Farming)	B.Sc.I Year	3-8
Date of submission in Autonomous Examination cell: ***Signature H.O.D.***			

Signature with date

Member Board of Studies:

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Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

O;kolkf;d iz'ui= ds ikB~;Øe

Part A- Introduction **Hkkx v & ifjp;**			
Program: Certificate dk;ZØe% izek.k i=	Class : B.Sc. I st year d{kk % ch-,l-lh- izFke	Year: 2021 o"kZ% 2021	Session: 2021-22 l=% 2021&22

Subject: Botany **fo"k;% ouLifr'kkL=**		
1	**Course Code**	V1-HOR-ORGT
	ikB~;Øe dk dksM	V1-HOR-ORGT
2	**Course Title**	Organic Farming
	ikB~;Øe dk 'kh"kZd	tSfod [ksrh
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Vocational Course
	ikB~;Øe dk izdkj% ¼dksj dkslZ@bysfDVo@tsusfjd bysfDVo@cksds'kuy@-----½	O;kolkf;d
4	**Pre-requisite (if any)**	Open for All
	iwokZis{kk	bl dkslZ dk v/;;u djus ds fy;s Nk= dks fdlh Hkh fo"k; esa 12 oh d{kk ikl gksuk pkfg,A
5	**Course Learning Outcomes (CLO)**	After studying this course the student will be able to: • Prepare media for protected cultivation. • Demonstrate irrigation and fustigation, green house operations, irrigation and fustigantion, care and maintenance of protected structure. • Demonstrate special horticultural practices in protected cultivation

		• Identify and control of insect-pest and diseases, harvest and post-harvest practices.
	ikB~;Øe v/;;u dh ifjyfC/k;ka	bl dkslZ dk v/;;u djus ds ckn Nk= fuEu dj ldus esa l{ke gksxk% • lajf{kr [ksrh ds fy;s ehfM;k rS;kj djukA • flapkbZ vkSj QLVhxs'ku] xzhu gkml lapkyu] flapkbZ ,oa ¶;wLVhxs'ku] lajf{kr lajpuk dh ns[kHkky vkSj j[kj[kkoA • lajf{kr [ksrh esa fo'ks"k ckxokuh izfØ;kvksa dks le>ukA • dhVuk'kd thoksa vkSj chekfj;ksa dh igpku vkSj fu;a=.k Qly vkSj dVkbZ ds ckn dh izfØ;kvksa dks le>ukA
6	**Expected Job Role/career opportunities**	Job opportunities in government sectors well as private sector and self employment.
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7	**Course Value**	02 Credit Theory + 02 Credit Practical
	ØsfMV eku	02 ØsfMV lS/nkafrd + 02 ØsfMV izk;ksfxd

Part B- Content of the course

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Total No. of Lectures + Practical (in hours per week): L-1 Hr / P-1 Lab Hr

Total No. of Lectures/ Practical: L- 30 Hrs/P-30 Hrs.

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O;k[;ku@izSfDVdy dh dqy la[;k % L - 30 hrs/P-30 hrs

Module	Topic	No. of Hours
ekWM~;wy	**fo"k;**	**?kaVs**
I	Introduction and Principles, Developing Organic farm, conversion of soil	5

	to organic soil cultivation and Tillage, Creating good growing conditions, soil compaction, Types of soil cultivation.	
I	ifjp; vkSj fl/nkar] tSfod [ksr dk fodkl] feV~Vh dks tSfod feV~Vh dh [ksrh vkSj tqrkbZ esa cnyuk] vPNh c<+rh ifjfLFkfr;ksa dk fuekZ.k] feV~Vh dk la?kuu] feV~Vh dh [ksrh ds izdkjA	5
II	Crop planning and management, Crop rotation, intercropping, cover crops, crop-animal association. Mulching: Definition, Uses, Selection of mulch materials, source of mulching materials, Application of mulch.	8
II	Qly ;kstuk vkSj izca/ku] Qly pØ] varj Qly] doj Qlysa] Qly&i'kq la?kA efYpax% ifjHkk"kk] mi;ksx] eYp lkexzh dk p;u] efYPkax lkexzh dk L=ksr] eYp dk vuqiz;ksxA	8
III	Organically manage the field, Live fencing, Water and nutrient management, Weed management, Pest and disease management. Plant propagation, Criteria for seed evaluation, characterization and multiplication, Importance of traditional varieties, Seed conservation.	8
III	tSfod :i ls [ksr dk izca/ku djsa] ykbo ckM yxkuk] ty vkSj iks"kd rRo izca/ku] [kjirokj izca/ku] dhV vkSj jksx izca/kuA ikS/k izlkj] cht ewY;kadu ds fy;s ekunaM] y{k.k o.kZu vkSj xq.ku] ikjaifjd fdLeksa dk egRo] cht laj{k.kA	8
IV	Other form of organic management, Biodynamic agriculture, Rishi Krishi, natural farming, panchgavya krishi, Natueco farming, Homa farming.	7
IV	tSfod izca/ku ds vU; :i] ck;ksMk;ukfed d`f"k] _f"k d`f"k] izkd`frd [ksrh] iapxO; d`fa"k] ukVqdks [ksrh] gksek [ksrhA	7
	Practical	
	1. Soil sampling and determination of soil pH.	30

	2. Determination of soil organic carbon content. 3. Preparation of nusery and seed beds. 4. Seed treatment with fungicides and Bio-fertilizers. 5. Identification of different types of chemical fertilizers, composts, bio- fertilizers. 6. Calculation of fertilizer requirement of crops (for wheat, rice and maize) based on their nutrient needs. 7. Preparation of FYM and Compost. 8. Uses of sprayers and dusters for pest control and nutrient spray. 9. Determination of moisture content of crop seeds (wheat, rice, maize and mustard). 10. Visit to a crop field and compare healthy plant with a diseased and insect affected plant. 11. Identification of different types of Insecticides, Fungicides and Herbicides.	
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	1. e`nk uewukdj.k vkSj e`nk ih,p dk fu/kkZj.kA 2. e`nk dkcZfud dkcZu lkexzh dk fu/kkZj.kA 3. ulZjh vkSj cht D;kjh rS;kj djukA 4. doduk'kh vkSj tSo&moZjd ds lkFk cht mipkjA 5. fofHkUu izdkj ds jklk;fud moZjdksa] [kknksa] tSo moZjdksa dh igpkuA 6. Qlyksa ¼xsagw] pkoy vkSj eDdk ds fy;s½ dh iks"kd vko';drkvksa ds vk/kkj ij moZjd vko';drk dh x.kukA 7. ,QokbZ,e vkSj dEiksLV rS;kj djukA 8. dhV fu;a=.k vkSj iks"kd rRo Lizs ds fy;s Lizs;j vkSj MLVj dk mi;ksxA 9. Qly ds cht ¼xsagw] pkoy] eDdk vkSj ljlksa½esa	30

	ueh dh ek=k dk fu/kkZj.kA 10. fdlh Qly ds [ksr dk nkSjk djsa vkSj LoLFk ikS/ks dh rqyuk jksxxzLr vkSj dhV izHkkfor ikS/ks ls djsaA 11. fofHkUu izdkj ds dhVuk'kdksa] doduk'kh vkSj 'kkduk'kh dh igpkuA	

Project/Field trip: Excursion of an Organic Farm/ Presentation of a project related to any topic of Organic Farming

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Part C- Learning Resources

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Text Books, Reference Books, Other resources

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Suggested Readings:

- Principles of Organic Farming- by S.R. Reddy, Kalyani Publishers, New Delhi.
- Organic Farming (Theory and Practice) - by S.P. Palaniappan and Annadurai, Scientific Publishers, New Delhi.

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- Principles of Organic Farming- by S.R. Reddy, Kalyani Publishers, New Delhi.
- Organic Farming (Theory and Practice) - by S.P. Palaniappan and Annadurai, Scientific Publishers, New Delhi.

Suggested digital platforms web links

- www.nptel.ac.in>organic farming>126/105/126105014
- http://www.agmoocs.in/organic farming

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- www.nptel.ac.in>organic farming>126/105/126105014
- http://www.agmoocs.in/organic farming

Suggested equivalent online courses:

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Part D- Assessment and Evaluation (For Theory)

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Maximum Marks: 100 **Min. Passing Marks: 35**

Internal Assessment: Continuous Comprehensive Evaluation(CCE): 30	Class Test Assignment/ Presentation	20 10 Total = 30
External Assessment: Annual Exam Section: 75 Time: 02.00 Hours	**Section (A):** Objective Type Question (**Section (B):** Short Questions (200 Words each) **Section (C):** Long Questions (500 Words each)	05X02= 10 05 x 06 = 30 03 x 10 = 30 Total = 70

Any remarks/suggestions:

vf/kdre vad% 100 **U;wure mRrh.kZ vad% 35**

vkarfjd ewY;kadu% lrr~ O;kid ewY;kadu(CCE) **% 30**	Dykl VsLV vlkbuesaV@ izLrqrhdj.k	20 10 dqy vad % 30
vkdyu% okf"kZd ijh{kk % 70 le;& 02-00 ?kaVs	**vuqHkkx ¼v½%** oSdfYid iz'u **vuqHkkx ¼c½%** y?kq iz'u ¼izR;sd 200 'kCn½ **vuqHkkx ¼l½%** nh?kZ mRrjh; iz'u ¼izR;sd 500 'kCn½	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 dqy vad = 70

Part D- Assessment and Evaluation (For Practical)

Hkkx n & vuq'kaflr ewY;kadu fof/k;k¡ ¼izk;ksfxd gsrq½

Maximum Marks: 100 **Min. Passing Marks: 35**

1. Project/ Field Trip - 25

2. Assignment/ Presentation - 25

3. External Assessment - 50

vf/kdre vad% 100 **U;wure mRrh.kZ vad% 35**

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Any remarks/suggestions:

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SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE, SHIVAJI NAGAR, BHOPAL

(Accredited 'A' Grade by NAAC)

Certificate Course
On
Cultivation, Processing and Marketing of Medicinal Plants

Session 2021-22

(As Approved by Higher Education Department M.P. & Janbhagidari Samiti)

6 Months Certificate Course

Name of Course : **Cultivation, Processing and Marketing of Medicinal Plants**

Duration in which course will be completed : **Six month**

Objective of proposed course:

- Medicinal plants are known worldwide for their medicinal importance. Nearly 25% of the prescribed drugs are prepared from the medicinal plants. India is rich in these plants, and due to the suitable climatic conditions of the country, a number of described species of such plants can be grown and cultivated. Increased awareness about the commercial potential of this useful group of plants has encouraged innovative and progressive farmers and many entrepreneurs to take up the cultivation of aromatic plants commercially. Hence it would be beneficial to explore, cultivate and propagate these plants.
- **Study of Biodiversity status of locally available some important medicinal plants.**
- This certificate course will serve as the source of self-employment. The students can do the cultivation in small groups or individually.

Important objectives of the certificate training course are mentioned below-

1. **To develop trained manpower to support local demand in the field as respectful and recognized professional.**
2. **To enhance income generation, marketing and employment possibilities.**
3. **To enhance the soil fertility of the state by organic farming of medicinal plants.**
4. **To develop entrepreneurial skills in the students so that they can set-up their own enterprise and knowledge in this field.**
5. **To develop overall personality of an individual through inclusion of courses like Communication skills, Entrepreneurship development, Personality development, Environmental awareness, Management and Marketing Skills.**
6. **To attract entrepreneurs for farming of medicinal plants.**

Level of certifications	Minimum Duration	Maximum Duration
Short term course	6 months	1 year

Course out line- Theory

Module I **Credit-0.5**

Introduction ,Selection of Medicinal Plants based on their medicinal Properties—*Withania, Raulfia, Andrographis, Azadirecta, Aloevera, Chlorophytum, Aspargus, Emblica officinale, Oscimum sanctum.* Morphological description.

Module II **Credit-0.5**

Role of medicinal plants in Homoeopathy and Ayurveda in selected disease—heart disease, diabetes, Respiratory disorder.

Module III **Credit-0.5**

Soils – different types of soils, cultivation techniques of medicinal plants, Rodents and pests -harmful effects and their control.

Module IV **Credit-0.5**

Manures and fertilizers, organic and synthetic fertilizers, Processing of medicinal plants Isolation and Extraction by Sohxlate method.

Module V **Credit-0.5**

Packaging and Marketing management of medicinal plants and plant products.

Course out line- Practical

Module I : Study of selected medicinal plants**.** **Credit-1**

Module II : Short duration hands on training programme **Credit-1**

Module III: Processing of few medicinal plants. **Credit-1**

Module IV:. Cultivation technique and marketing of few medicinal plants & field visit. **Credit-1**

Module V : Herbarium preparation **Credit-1**

Tutorial : **Credit-4.5**

Field work: **Credit-8**

……..

Total Credit - 20

(20 Credit as per UGC norms and 1 Credit = 15hrs.)

Total no. of teaching hours per week (hours = Teacher Lerner Interaction)

Teaching Scheme(hrs. per week)			Examination Scheme(marks)			Total Marks
Lecture	Tutorial	Practical/field work	Theory	Practical/Viva-voce	Team work, field work & Internal assessment	
2	4	4	50	100	50	200

Six month certificate course

S no.	Paper title	Type of paper	Credit hours (1 Credit=15hrs.)	Max. Marks	Min. Marks
1	Cultivation, Processing and Marketing of Medicinal Plants	Theory	2.5	35	15
2		Practical	5	100	40
3		Tutorial /Presentation =CCE	4.5	15	6
4		Field work/training	8	50	20
			Total	200	

Eligibility:
UG/PG student of any discipline.

Course Detail:

Course is offered in 20 teaching weeks. Each week has 10 working hours, spread over 5-6 days remaining 4 weeks are to be utilized for conducting theory examination as well as practical, viva, and presentation.

Course to be designed variously under Lectures/Tutorials/Laboratory/Field work /Seminar/Practical training/Assignments/Team paper of report writing etc. to meet effective teaching and learning needs.

Examinations:
There shall be examinations at the end of the course.
Course will be started from 1st Oct.2021 and exam conducted in the month of April.

Final Examination-

1. Theory : Question paper pattern

Part A -	**05 Objective type Questions**	**5×1= 05 Marks**
	One question from each Module	
Part B -	**05 Short answer type Questions**	**5×4= 20 Marks**
	One question from each Module with internal choice	
Part -C	**02 Long answer type Questions**	**2×5= 10 Marks**
	Questions from Theory Module with internal choice	

……..

Total Theory = 35 Marks

2.CCE	**CCE I Assignment and Presentation**	**- 05 Marks**
	CCE II written test	**- 10 Marks**

……..

Total CCE = 15 Marks

3.Practical Examination Scheme

1. **Study of Medicinal Plants**	**20**
2. **Processing technique of Medicinal Plants**	**10**
3. **Cultivation technique of Medicinal Plants**	**10**
4. **Herbarium**	**20**
5. **Field report and presentation**	**20**
6. **Viva-voce**	**20**

…….

Total 100 Marks

4.Team work :

Field work and report writing

Total 50 Marks

……

Grand total 200 Marks

Grade earned by the candidate in the course will be as given below:-

Percentage of Marks	Letter Grade	Grade Point	Performance
90-100	O	10	Outstanding
80-89	A++	9	Excellent
70-79	A+	8	Very Good
60-69	B++	7	Good
56-59	B+	6	Above Average
50-55	C+	5	Average
40-49	P	4	Pass
0-39	F	0	Fail

(Dr. Shobha Shrivastava)
HOD, Botany

Signature
Members of Board of Studies of Botany

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE, SHIVAJI NAGAR, BHOPAL

(Accredited 'A' Grade by NAAC)

Syllabus of Botany

2021-22

(As Recommended by the Central Board of Studies and approved by Governor of M.P.)

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College, Shivaji Nagar, Bhopal – 462016

Syllabus
2021-2022

Index
SUBJECT: BOTANY

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	„ „	**Semester III**	…27-34
	„ „	**Semester IV**	…35-44
	Practical Scheme	**Semester I**	…47
	„ „	**Semester II**	…48
	„ „	**Semester III**	…49
	„ „	**Semester IV**	…50
Date of submission in Autonomous Examination cell:			

Signature
H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College, Shivaji Nagar, Bhopal – 462016

Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.)

2021-22

Course: Botany						**Course Code:C043**
M.Sc. (Botany) Semester Wise Syllabus of Botany						
Theory Papers/ practical	**Title of paper**	**Compulsory/ Optional**	**CCE**		**Theory Marks**	**Total Marks**
			CCE I	**CCE II**		
M.Sc. I Semester						
PG 101	Biology& Diversity of Virus,Bacteria & Fungi	Compulsory	10	20	70	100
PG 102	Biology and Diversity of Algae	Compulsory	10	20	70	100
PG 103	Biology & Diversity of Bryophyta and Pteridophyta	Compulsory	10	20	70	100
PG 104	Biology and Diversity of Gymnosperms	Compulsory	10	20	70	100
PG 105	Practical I – based on Course PG 101 & 102	Compulsory				100
PG 106	Practical II – based on Course PG 103 & 104	Compulsory				100
	Project work related to course Paper(JOPW)	Compulsory				50
Grand Total						**600+50**
M.Sc. II Semester						
PG 201	Cell Biology and Genetics	Compulsory	10	20	70	100
PG 202	Plant Development & Reproduction	Compulsory	10	20	70	100
PG 203	Plant Physiology-I	Compulsory	10	20	70	100
PG 204	Plant Ecology-I	Compulsory	10	20	70	100
PG 205	Practical I – based on Course PG 201 & 202	Compulsory				100
PG 206	Practical II – based on Course PG 203 & 204	Compulsory				100
	Project work related to course Paper(JOPW)	Compulsory				50
Grand Total						**600+50**

Theory Papers/ practical	Title of paper	Compulsory/ Optional	CCE		Theory Marks	Total Marks
			CCE I	CCE II		
M.Sc. III Semester						
PG 301	Systematic of Angiosperms	Compulsory	10	20	70	100
PG 302	Molecular Biology and Plant Breeding	Compulsory	10	20	70	100
PG 303	Plant Physiology, Biochemistry and Metabolism	Compulsory	10	20	70	100
PG 304	Plant Ecology-II (Conservation & Utilization of Plant Resources)	Compulsory	10	20	70	100
PG 305	Practical I – based on Course PG 301 & 302	Compulsory				100
PG 306	Practical II – based on Course PG 303 & 304	Compulsory				100
	Project work related to course Paper(JOPW)	Compulsory				50
Grand Total						**600+50**
M.Sc. IV Semester						
PG 401	Biotechnology and Tissue Culture	Compulsory	10	20	70	100
PG 402	Applied Botany & Instrumentation	Compulsory	10	20	70	100
PG 403	Environmental Science	Elective Paper-I*	10	20	70	100
PG 404	Ethenobotany	Elective Paper-II**	10	20	70	100
PG 405	Practical I – based on Course PG 401 & 402	Compulsory				100
PG 406	Practical II – based on Course PG 403 & 404	Compulsory				100
	Internship Training (JOPW)	Compulsory				100
Grand Total						**600+100**

The students may opt any one of the following Elective papers operative in the University/ College.

List of suggested Elective papers I (PG 403)

1. Environmental science *****
2. Limnology
3. Industrial microbiology
4. Taxonomy of Angiosperms
5. Applied Mycology
6. Forest Biology, Forest vegetation of India and Management of Forest Resources
7. Plants and Society

List of suggested Elective papers II (PG 404)

1. Ethnobotany **
2. Plant protection
3. Bioinformatics and computer applications and Biostatistics
4. Molecular biology and biotechnology
5. Pollution Ecology

Note: 1. Elective paper I & II offered are based on the choice of the students.
2. Local excursion is compulsory for all students of Previous and Final year.

Signature with date

Member Board of Studies:

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M.Sc. (Botany) Program Specific Outcomes

- Students will be able to conduct experiments, analyze and interpret data for investigating problems in the field of Botany.
- Student of Botany can pursue higher studies (M. Phil. Ph. D) to attain research positions.
- Students can get jobs in various fields of Botany, like Ecologists/Park ranger/Forester/Nursery Manager/Taxonomist/Horticulturist/Plant Explorer/Geneticist/Plant biochemist/Molecular biologist/ Pharmacologist/ Conservationist and Entrepreneur (Extraction of valuable bioactive substances from plants and their parts/ Industries/Marketing of herbs/ Environment consultant / Training centers/ Processing of valuable plant parts/ Floriculture / Florist/ Mushroom Culture /Landscaping / Marketing of plant raw materials/ Herbal cosmetic industry etc).
- Besides industrial sector, there are ample opportunities in Academics, like in School Education Department and Higher Education Department.
- Students will be able to understand the wide potential of the subject Botany, and its implementation in sustainable development.

COURSE OUTCOMES

SEMESTER-1

Paper I (PG-101) : Biology & Diversity of Viruses, Bacteria and Fungi	The objective of this course is to provide exposure to the students on general characters, classification, and reproduction of various micro-organisms. ➢ Students will be able to evaluate the economic importance of Viruses, Actinomycetes, Bacteria and Fungi. ➢ Students will be able identify and apply the wide area of plant pathology related to these members, and the role of microorganisms in various fields of science.
Paper II (PG-102) : Biology & Diversity of Algae	The objective of this course is to give students an idea on diverse group of Algal members. ➢ Students will be able to explain the systematic, morphology, reproduction, and structure of selected members of algae. ➢ Students will be able to explain the life cycle pattern of algal members. ➢ Students will be able to explain different useful and harmful activities and their ecological significance.
Paper III(PG-103) Biology & Diversity of Bryophyta& Pteridophyta	The objective of this course is to equip the students about the morphological diversity and biology of Bryophyte & Pteridophyte, ➢ Students will be able to explain the general characteristics, structural variation, classification & reproduction of Bryophytes and Pteridophytes. ➢ Students will be able to outline the role of Pteridophytes in the origin of seed habit. ➢ Students will be able to analyze significance of Bryophytes as pioneer plants on land and their role in the origin of higher plants. ➢ Students will be able to understand the evolutionary trends in plants species on the Earth.

	➢ Students can understand the ecological importance of Bryophyte & Pteridophyte. ➢ Students will be able to explain the economic & medicinal value of Bryophyte & Pteridophyte.
Paper IV (PG-104) Biology and Diversity of Gymnosperms	The objective of this course is to enable students to figure out the prominent role of diverse gymnosperms in the socio-economic life of people and their role in understanding the evolutionary trends. ➢ Students will be able to outline the general characters, distribution and classification of Gymnosperms. ➢ Students can analyze the Indian contribution to Gymnosperms. ➢ Students can identify prescribed gymnosperms of the syllabus and fossil gymnosperms.
SEMESTER-2	
Paper I (PG-201) **Cell Biology and Genetics**	The objective of this course is to provide exposure to the students on plant cell, functions and vital processes of various cellular organelles, cell division and inheritance. ➢ Students will be able to explain the structural organization of plant cell, various cellular compartments and cellular organelles. ➢ Students will be able to apply the knowledge of classical genetics at organism and cellular levels.
Paper II (PG-202) **Plant Development & Reproduction**	The objective of this course is to equip the students with the knowledge in the field of plant development and reproduction spanning from the induction of flowering to fruit development. ➢ Students can outline the scientific knowledge related to organization of the higher plant body at shoot and root level. ➢ Students can understand the reproductive phenomenon in angiospermic plant.
Paper III (PG-203): plant physiology-I	Upon completion of this course, the students will be able to gain an insight into the various physiological processes in plants. ➢ Students will be able to understand the principles of thermodynamics. They will be able to explain the different mechanisms related to plant water relation, absorption, transpiration and mineral nutrition. ➢ Students will be able to assess the importance of plant growth regulators and elicitors. ➢ Students will define flowering process and stress physiology.
Paper IV (PG-204) : Plant Ecology –I	The course covers plant ecology on advanced level. The course deals with plants and their interaction with the remaining ecosystem. ➢ Students will be able to demonstrate knowledge about ecosystem components, population and community ecology. ➢ Students can recognize the major biomes and vegetation types in diverse ecosystems. ➢ They would be able to interpret the field and work with practical and theoretical problems and solving them with respect to different ecosystems.

SEMESTER-III	
Paper I (PG-301): Systematic	➢ Students can identify the flora of any region of India. ➢ Students can utilize the knowledge about plant species in various fields of life. ➢ Students will be able to explain the evolutionary trends in plant species. ➢ They will be equipped with the knowledge about biodiversity of Angiospermic flora and groomed in the field of entrepreneurship.
Paper II (PG-302): Molecular biology and plant breeding	The objective of this course is to elevate the students at a level where they can explain structure, synthesis and packaging of the hereditary material. ➢ Students can identify and use the tools and techniques of molecular biology in genetics as well as in plant breeding. ➢ They can explain modern methods of plant breeding and compare them with the traditional ones.
Paper III (PG-303): Plant Physiology, Biochemistry	The objective of this course is to focus on physiological and metabolic process of plant. After completing of the course students will be able to- ➢ Discuss enzymology, practical applications and its biological significance. ➢ Explain the principles of photosynthesis, photochemistry and respiration. ➢ Describe the bio-molecules, chemistry of carbohydrates, lipids, fatty acids with respect to their structure, classification and function. ➢ Explain the fixation of nitrogen and metabolism of sulphur.
Paper IV (PG-304): Plant Ecology- II (Conservation and Utilization of Plant Resources	The objective of this course is to take students at the advance level of ecology, It deals with the conservation and utilization of plant resources and interaction between plants and the remaining ecosystem. On completion of this course students will be able to- ➢ Discuss about the plant biodiversity, its concepts and status. ➢ Explain sustainable development and utilization of plant resource. ➢ Apply the principles of conservation and critically understand different methods of conservation. ➢ Critically analyze the consequences of climate change and pollutants. ➢ Gain background knowledge and understanding of Remote Sensing and its applications.
SEMESTER-IV	
Paper I (PG-401): Biotechnology	The objective of this course is to provide knowledge about the application of various principles of plant propagation, regeneration and genetic engineering. ➢ Enable students to apply techniques of plant tissue culture. ➢ Students can use its applied aspect in the field of conservation of RET plant species and micro propagation of plants for the extraction of secondary metabolites. ➢ The students can identify scope and application of biotechnology in different fields.

Paper II **(PG-402): Applied Botany**	This course deals with the varied aspects of applied Botany with the aim to groom the students to be an entrepreneur in this field. ➢ Students will be able to apply the skills in the field of herbal cosmetics and beverages, and herbal dyes for use in textile industry. ➢ Students will be able to apply the skills in the extraction of essential oils in Aromatherapy. ➢ Students will be able to apply the techniques of organic farming and biofertilizers. ➢ Students will be able to develop the skills to use computer and to apply this knowledge in biological science. ➢ Students will be able to discuss the basics of computer operations, and explain the knowledge about software and hardware. ➢ Students will be able to describe the principles used in microscopy, spectroscopy, electrophoresis and colorimetry. ➢ Students will be able to apply the knowledge of instrumentation in analytical work.
Paper III **(PG-403): Environmental Science**	Objective of this course is to create awareness among the students about the environment. By the end of the course, the students- ➢ Will have a better appreciation for the environment and become responsible citizens. ➢ Can explain the role of climate change and will be able to address the environmental issues. ➢ Will be able to analyze case studies representation of toxicology, ➢ Will be able to discuss different environment laws, environmental education and related organizations.
Paper IV **(PG-404): Ethnobotany**	This course deals with the varied aspects of ethnic values and traditions related to plant world. ➢ Students will be able to explain the ethnomedicinal use of plants endemic to various regions of India. ➢ They will be able to know the various ethnic society and their phytodiversity and related cultural practices. ➢ The students will be the ambassador for the conservation of traditions related to nature.

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**I**
Subject	**Botany**
Paper	PG - 101
	Paper-I
Title of the Paper	**Biology & Diversity of Viruses, Bacteria and Fungi**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	**Syllabus**	**Period**
Unit-I	Virus: characteristics, classification and ultrastructure, Isolation and Purification of viruses; chemical nature, replication, transmission of viruses, economic importance of viruses.	9
Unit-II	General characteristics, ultrastructure, nutrition and reproduction, biology and economic importance of Archaebacteria and Eubacteria. General characteristics of Cyanobacteria, Actinomycetes Mycoplasma, Rickettsiae, Chlamydiae.	9
Unit-III	General characteristics, classification of Fungi, substrate relationship in Fungi, reproduction, heterothallism, parasexuality, economic importance of Fungi (Fungi in industries, medicine, as food**,** symptoms & signs of fungal diseases in Plants, and Humans- Dermatophytes), Fungus as biocontrol agent, mycorrhiza.	9
Unit-IV	General characteristics of Mastigomycotina- *Synchytrium, Saprolegnia, Pythium, Phytophthora, Peronospora, Sclerospora.* General characteristics of Zygomycotina – *Rhizopus, Pilobolus*. General characteristics of Ascomycotina- Yeast, *Taphrina, Penicillium, Erysiphe, Phyllactinia, Uncinula, Chaetomium, Peziza, Morchella*.	9
Unit-V	General characteristics of Basidiomycotina- *Puccinia, Melampsora, Ustilago, Agaricus, Geastrum.* General characteristics of Deuteromycotina- *Alternaria, Curvularia Cercospora, Colletotrichum*	9

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of reproductive members of fungi and cynobacteria : *Peronospora, Albugo, Mucor, Pilobolus,* Yeast, *Chaetomium, Morchella, Agaricus, Melampsora curvularia, Polyporus, Phoma, Penicillium, Fusarium, Rhizopus, Asprgillus, Colletotrichum, Nostoc, Anabaena, Gleotrichia, Rivularia, Microcystis, Oscillatoria, Lyngbya.***
2. **Symptomatology of some diseased specimens: White rust, Downy mildew, Powdery mildew, Rust, Smut, Ergot, Groundnut leaf spot , Red rot of sugarcane, Wilts, Paddy Blast, Citrus canker, Bacterial blight of paddy, Angular leaf spot of cotton, Tobacco mosaic, Little leaf of brinjal, Mango malformation, Leaf curl of papaya.**
3. **Gram staining of Bacteria.**
4. **Sterilization methods, preparation of media and stains.**
5. **Isolation of microbes from soil, water and air.**

SUGGESTED READINGS

- Alexopoulus, C.J., Mims, C.W. and Blackwel, M. 1996. Introductory Mycology, Wiley & Sons Inc.
- Clifton, A.1958. Introduction to Bacteria, Mcgraw Hills Book Co., New Delhi.
- Madigan, M. T. Martinko, J. M. and Parker Jack, 1997. Brock Biology of Microorganisms (8th edition), Prentice Hall, USA.
- Mandahar, C. L. 1978. Introduction to Plant Viruses, Chand & Co.Ltd., Delhi.
- Mehrotra, R.S. and Aneja, R.S. 1998. An Introduction to Mycology, New Age Intermediate Press.
- Rangaswamy, G. and Mahadevan, A. 1999. Diseases of Crop Plants in India (4th edition), Prentice Hall of India Ltd., New Delhi.
- Webster, J. 1985. Introduction to Fungi, Cambridge University Press.
- Dubey, R.C. and Maheshwari, D. K. 2005. A Text Book of Microbiology, S. Chand Publisher, New Delhi.

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**I**
Subject	**Botany**
Paper	PG – 102
	Paper-II
Title of the Paper	**Biology & Diversity of Algae**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General characteristics of Algae, classification of Algae, diversified habitats, thallus organization, cell ultra structure, reproduction, pigments, reserve foods, types of flagella, and economic importance of Algae.	9
Unit-II	General characteristics of Chlorophyta and Charophyta- *Chlamydomonas, Pandorina, Eudorina, Chlorella, Hydrodictyon, Pediastrum, Ulothrix, Cladophora, Draparnaldiopsis, Spirogyra, Zygnema, Bryopsis* and *Nitella*	9
Unit-III	General characteristics of Xanthophyta- *Botrydium, Vaucheria*. General characteristics of Bacillariophyta- Diatoms (*Pennularia*). General characteristics of Euglenophyta- *Euglena*.	9
Unit-IV	General characteristics of Phaeophyta- *Ectocarpus, Dictyota, Laminaria, Fucus, Sargassum*	9
Unit-V	General characteristics of Rhodophyta- *Porphyra, Batrachospermum, Gelidium, Cryptonemia, Rhodymenia, Polysiphonia*.	9

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of representative members of Algae**
2. **Algae :-** ***Volvox, Pandorina, Chara, Nitella, Oedogoneum, Spirogyra, Zygnema, Coleochaete, Chaetophora, Hydrodictyon, Ulva, Pithophora , Stigloclonium , Draparnaldiopsis , Clostridium , Cosmarium , Valonia , Vaucharia , Botydium, Dictyota , Padina , Laminaria , Saragassum, Fucus , Cutleria , Porphyra , Batrachospermum , Gracillaria, Polysiphonia***
3. **Study of algae as biofertilizers, algal bloom.**
4. **Study the role of algae in eutrophication.**
5. **Culture technique of Algae**

SUGGESTED READINGS

- Smith, G. M., Cryptogamic Botany Vol I (1st edition), TataMcGraw Hill Publishing Company Ltd., Bombay.
- Kumar, H. D. 1988. Introduction to Phycology, Affiliated East-West Press Ltd.
- Prescott, G.W.1969. The Algae: A review, Butler &Tanner Ltd., London.
- Chapman, V.J. and Chapman, D.J. 1973. The Algae, Palgrave Macmillan.
- Sharma O.P., The Algae
- Gangulee, H.C. and Car, A.K. 1989. College Botany Vol. I and II, Books & allied P. Ltd., Calcutta.
- Fritsch, F.E. 1965. The Structure and Reproduction of the Algae Vol I, The Syndics of Cambridge University Press.

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2021-22

Theory

session	**2021-22**
Class	M.Sc.
Semester	**I**
Subject	**Botany**
Paper	PG – 103
	Paper-III
Title of the Paper	**Biology & Diversity of Bryophyta& Pteridophyta**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General characteristics, classification, morphology, reproduction and life history, distribution, origin, evolution & affinities, ecology and economic importance of Bryophytes. Contribution of Bryophyta in India	9
Unit-II	General characteristics of Hepaticopsida- *Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Sphaerocarpus, Pellia, Porella*. General characteristics of Anthocerotopsida- *Anthoceros, Notothylas.* General characteristics of *Bryopsida- Sphagnum, Polytrichum*.	9
Unit-III	General characteristics of Pteridophyta- classification, origin, telome theory, stelar organization, homospory, heterospory and seed habits, reproduction, Indian contribution to Pteridophyta, Paleobotany and Geological time- scale, types of fossils.	9
Unit-IV	General characteristics of Psilophyta- *Rhynia, Horneophyton, Zosterophyllum, Psilophyton, Asteroxylon, Psilotum, Tmesipteris*. General characteristics of Lycophyta- *Lycopodium, Protolepidodendron, Lepidodendron, Isoetes, Selaginella.*	9
Unit-V	General characteristics of Sphenophyta- *Equisetum, Hyenia, Calamites, Paleostachys, Calamostachys, Sphenophyllum.* General characteristics of Pterophyta- *Ophioglassum, Osmunda, Gleichenia, Pteris, Lygodium, Marsilia, Salvinia, Azolla*.	9

SUGGESTED READINGS

- Smith, G. M. Cryptogamic Botany Vol III (2nd edition), TataMcGraw Hill Publishing Company Ltd., Bombay, New Delhi.
- Brower, 1926. Primitive Land Plants, Cambridge at the University Press.
- Kashyap, 1972. LivelWorts of Western Himalayas and Punjab, Researchco Publication.
- Puri, P. 1980. Bryophyta -Morphology Growth & Differentiation, Atma Ram and Sons, Delhi.
- Chopra and Kumara, 1988. Biology of Bryophyta, Wiley Eastern Ltd.
- RamUdar, 1970. An Introduction to Bryophyta, Shashidhar Malviya Prakashan.
- Watson, 1968. Structure and life of Bryophyta, Hutchinson & Co. Ltd.
- Campbell, 1939. The evolution of land plants, Stanford University.
- Sporne, K.R. 1991. The Morphology of Pteridophyta.
- Parihar, N.S. 1996. Biology and Morphology of Pteridophytes, Central Book Depot, Allahabad.
- Arnold, C. A. An Introduction to Paleobotany, Tata Mc Graw Hill Publishing Co., New Delhi.
- Stewart, W. N. and Rathwel, L.G.W. 1993. Paleobotany and the Evolution of Plants, Cambridge University Press.
- Eames, A. J. Morphology of Vascular Plants-Lower Groups, Tata Mc Graw Hill Publishing Co., New Delhi
- Rashid, A. 1999. An introduction to Pteridophytes, Vikas Publishing House Pvt. Ltd.
- Gangulee and Kar, College Botany Vol II

SUGGESTED LABORATORY EXERCISES

1. **Morphological & Anatomical study of representative members of the Bryophyta:** *Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Pellia, Porella, Anthoceros, Notothylas, Sphagnum, and Polytrichum*.
2. **Morphological & Anatomical study of representative members of the Pteridophyta** :- *Psilotum , Isoetes , Lycopodium , Sellagena , Ophioglossum , Osmunda , Lyathia , Marsilea , Salvinia , Azolla , Gleichenia, Dryopteris, Alsophilla*, Study of fossil members.

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**I**
Subject	**Botany**
Paper	PG – 104
	Paper-IV
Title of the Paper	**Biology & Diversity of Gymnosperms**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General characteristics and classification of Gymnosperms, distribution of Gymnosperms in India, economic importance, evolutionary tendencies in Gymnosperms. Indian contribution to Gymnosperms – Dr. Birbal Sahni, Dr. P. Maheshwari & Dr. M.S. Swaminathan.	9
Unit-II	General characteristics of fossil Gymnosperms (Pteridospermales) - *Lyginopteris, Medullosa, Glossopteris, Pentoxylon, Caytonia.*	9
Unit-III	General characteristics of Cycadeoidales, Cycadales, Bennettitales- *Williamsonia*, Cycadeoidea- *Cycas, Zamia, Nilssonia*.	9
Unit-IV	General characteristics of Ginkgoales, Cordaitales & Coniferales- *Ginkgo biloba, Cordaites, Cedrus, Pinus, Araucaria, Cryptomeria, Thuja, Cupressus Podocarpus, Taxus*.	9
Unit-V	General characteristics of Ephedrales- *Ephedra*. General characteristics of Welwitschiales- *Welwitschia*. General characteristics of Gnetales- *Gnetum.*	9

SUGGESTED LABORATORY EXERCISES

1. Monographic study of following :- *Cycas* , *Ginkgo* , *Cedrus* , *Abies* , *Picea* , *Cupressus* , *Araucaria* , *Cryptomeria* , *Taxodium* , *Podocarpus* , *Agathis* , *Taxus* , *Ephedra* and *Gnetum*.
2. Study of important fossil gymnosperm from prepared slides and specimens.

SUGGESTED READINGS

- Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms, New Age International Pvt. Ltd., New Delhi.
- Singh, H. 1978. Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X, Gebruder Bortraeger, Berlin.
- Spome, K .R. 1991. The Morphology of Gymnosperms, Hutchinson Univ. Library, London.
- Foster, A. S. and Gifford, E. M. Comparative morphology of vascular plants, Vakils, Feffer and Simons Private Ltd., Bombay.
- Chamberlain, Gymnosperms -Structure & Evolution, CBS Publishers & Distributors, Delhi.
- Shukla, A. C. and Mishra, S. P. Essentials of Paleobotany, Vikas Publishing House Pvt. Ltd., Delhi-Bombay Bangalore-Calcutta-Kanpur.

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Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**II**
Subject	**Botany**
Paper	PG – 201
	Paper-I
Title of the Paper	**Cell Biology and Genetics**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	**Syllabus**	**Period**
Unit-I	Structure and organization of plant cell, structure and functions of Cell wall, Plasma membrane, Ion carriers, Channels and Pumps, Receptors, Plasmodesmata, Sites for ATPases.	9
Unit-II	Structure and function of Cell organelles: Chloroplast, Mitochondria, Vacuole, Endoplasmic Reticulum, Lysosomes, Ribosome, Golgi body.	9
Unit-III	Structure and functions of Nucleus, Nucleosome, Chromosome structure and packaging of DNA, Euchromatin and Heterochromatin, karyotype , banding patterns, specialized types of Chromosomes.	9
Unit-IV	Cell division, Cell cycle, Programmed cell death, Structural changes in Chromosomes (Duplication, Deficiency, Inversion and Translocation), Numerical changes in chromosomes (Aneuploids and Euploids, Haploids)	9
Unit-V	Mendel's Laws, Genetics of Mitochondria and Chloroplast, Polygenic inheritance, Crossing over and Linkage, Transposable elements.	9

SUGGESTED LABORATORY EXERCISES

1. Isolation of plant DNA and its quantitaion by a spectrophotometric method.
2. Isolation of RNA and quantitaion by a spectrophotometric method.
3. Demonstration of SEM and TEM.
4. Isolation of Mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDH).
5. Isolation of chloroplasts and SDS-PAGE. Profile of proteins to demarcate the two submits of Rubisco.
6. Demonstration of Mitosis.
7. To determine Mitotic Index in onion root tip cells.
8. Demonstration of Meiosis (normal) in Tradeshcantia.
9. Demonstration of abnormal meiosis.
10. Demonstration of special types of chromosomes.
11. Preparation of karyotype and Idiogram.
12. Calculation of Nucleo Cytoplasmic Index of onion/garlic root tip with the help of micrometric method.

Subscribed review Journals:-

1. **Annual Review of plant physiology and Molecular Biology.**
2. **Current Advances in Plant Sciences.**
3. **Nature Reviews: Molecular and Cell Biology.**

SUGGESTED READINGS

- Lewin, B. 1999. Genes VII, Oxford University Press, New York.
- Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell, Garland Publishing Inc., New York.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, U.S.A.
- Rost, T. et. al. 1998. PIant Biology, Wadsworth Publishing Co., California, U.S.A.
- Krishanmurthy, K. V. 2000. Methods in Cell Wall Cyto chemistry, CRC Press, Boca Raton, Florida, U.S.A.
- Buchanan, B.B., Groissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, U.S.A.
- De, D.N. 2000. Plant Cell Vacuoles: An Introduction, CSIRO Publication, Australia.

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**II**
Subject	**Botany**
Paper	PG – 202
	Paper-II
Title of the Paper	**Plant Development & Reproduction**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Organization of the higher plant body- Shoot and Reproductive meristem, Tissue system, Shoot apical meristem (SAM), Root apical meristem, Lateral meristem. Control of tissue differentiation especially xylem and phloem, Lateral root and root hair.	9
Unit-II	Development of Shoot, Secondary growth in stem, primary and secondary anomaolus structure of stem. Origin, development, differentiation, arrangement, diversity, venation, modification and anatomy of leaves.	9
Unit-III	Flower development, floral organ differentiation, homeotic mutants in *Arabidiopsis* and *Antirrhinum*, Androecium, Microsporangium, Microsporogenesis, role of tapetum, Male gametophytes and their development, Pollen storage, Pollen allergy and Pollen enbryos, Male sterility.	9
Unit-IV	Gynoecium- structure of Megasporangium, Ovule development, Types and development, Megasporogenesis, organization of Embryo sacs, Pollination- mechanisms and vectors, Self incompatibility.	9
Unit-V	Double fertilization- Endosperm development, embryogenesis, storage proteins of endosperms and embryo. Fruit growth- biochemistry and molecular biology of fruit maturation. Seeds growth and their dispersal, Polyembryony, apogamy and apomixis.	9

SUGGESTED LABORATORY / FIELD EXERCISES

1. Effect of gravity, unilateral light and plant growth regulators (PGRs) on the growth of young seedlings.
2. Role of dark and light on the expansion of cotyledons and epicotylar hook opening in pea.
3. Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double strained permanent slides of suitable plant such as Coleus , Tobacco.
4. Study of shoot apices in a monocotyledon in both TS and LS to show the origin and arrangement of leaf Primordia.
5. Study of phyllotaxy of various plant species.
6. Anatomy of leaf available locally.
7. Study of trichomes, glands in few species Osimum , Azadirecta Indica , Plumbago , Eucalyptus etc.
8. Study of morphology pollengrains of different species.
9. Study of pollen germinations and test for pollen viability using strains
10. Study of microsporogenesis and gametogenesis in section of Anthers.
11. Pollen storage, pollen pistil interaction, self incompatibility In- vitro pollination.
12. Study of monosporic, bisporic and tetra sporic type of embryosac.
13. Emasculation , bagging and hand pollination to study pollen germination seed set and fruit development using self compatible and obligate outcrossing systems.
14. Suitable seeds and polyembryony in Citrus, Jamun, etc by dissection.

SUGGESTED READINGS

- Bhojwani, S.S.and Bhatnagar, S.P.2000. The Embryology of Angiosperms 4th revised and enlarged edition, Vikas Publishing House, New Delhi.
- Burgess, J.1985. An introduction to Plant Cell Development, Cambridge University Press, Cambridge.
- Faegri, K.and Van Der Pijl, L. 1979. The Principles of Pollination Ecology 3rd edition, Pergamon Press, Oxford.
- Fahn, A. 1982. Plant Anatomy 3rd edition, Pergamon Press, Oxford.
- Fosket, D .E.1994. Plant Growth and Development- A Molecular Approach, Academic Press, San Diego.
- Howell, S.H.1998. Molecular Genetics of Plant Development, Cambridge University Press, Cambridge.
- Leins, P., Tucker, S.C.and Endress, P .K.1988. Aspects of Floral Development, J. Cramer, Germany.
- Lyndon, R.F.1990. Plant Development the Cellular Basis, Unin Hyman, London.
- Murphy, T. M. and Thompson, W. E. 1988. Molecular Plant Development, Prentice Hall, New Jersey.
- Proctor, M. and Yeo, P.1973.The Pollination of Flowers, William Collins Sons, London.
- Raghvan, V. 1997. Molecular Embryology of Flowering Plants, Cambridge University Press, Cambridge.
- RaghVan, V. 1999. Development Biology of Flowering Plants, Springer-verlag.
- Atwell, B. J., Kriedermann, P.E. and Jurnbull, C.G.N. (eds) 1999. Plants in Action- Adaptation in Nature, Perfonnance in Cultivation, MacMillan Education, Sydney, Australia.
- Esau Katherine, 2006. Anatomy of Seed Plants, Wiley India Pvt. Ltd., New Delhi.
- Paula J. Rudall, 2007. Anatomy of flowering plants, Cambridge University Press.
- Maheshwari P. Embryology of Angiosperm.
- Cutler David F., Botha Ted, Dennis Wm., Stevenson, 2008. Plant Anatomy: An Applied Approach, Wiley–Blackwell Publishing.

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Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**II**
Subject	**Botany**
Paper	PG - 203
	Paper-III
Title of the Paper	**Plant Physiology-I**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	**Syllabus**	**Period**
Unit-I	Principles of thermodynamics, Free energy and Redox potential, Plant water relation, Mechanism of water absorption, Water transport through xylem, Transpiration, Root-Microbe interactions in facilitating nutrient uptake, Mineral Nutrition, Membrane transport protein.	9
Unit-II	Phloem transport, Signal transduction, Receptors and G-proteins, Phospholipids signaling, role of cyclic nucleotide, Calcium-Calmodulin cascade.	9
Unit-III	Plant growth regulators and elicitors- physiological effects and mechanism of action of Auxins, Gibberellins, Cytokinins, Ethylene, Abscisic Acid, Bracinosteroids, Polyamines, Jasmonic Acid, and Salicylic Acid. Hormone receptors.	9
Unit-IV	Flowering process- Floral induction and development, Photoperiodism and its significance, Phytochrome and Cryptochrome, their photochemical and biochemical properties, Molecular mechanism of action of photomorphogenic receptors, Vernalization, Endogenous Clock and its regulation, Movement.	9
Unit-V	Stress physiology- Plant response to biotic and abiotic stress, water deficit and Drought resistance, Salinity stress and resistance, Concept of Freezing, Heat stress and Oxidative stress.	9

SUGGESTED LABORATORY EXERCISES

1. Radioisotope methodology, Autoradiography, Instrumentation (GM Counter & Scintillation Counter) and principles involved.
2. Principle of Colorimetry, Spectrophotometry and Florimetry.
3. Study of physiological stress in terms of water, light and tempreture.
4. Determine the rate of transpiration by Gravimetric Method.
5. Determine rate of transpiration by Ganong's potometer.
6. Demonstration of the effect of light intensity and wind velocity on the rate of transpiration by Ganong's potometer.
7. To Study the comparision between stomatal and cuticular transpiration by Cobalt Chloride Method and Four Leaf Method.
8. To Study the comparision between evaporation and transpiration and find out T/E ratio.
9. Bioassay of plant hormones- Auxins, Ethylene, GA, ABA and Cytokinin.
10. To study the effect of auxins (IAA/IBA/BAP/NAA) on plant tissue culture.
11. To study the effect of auxins (IAA/IBA/BAP/NAA) on seed germination.
12. To determine stomatal index (SI) and stomatal frequency.
13. To demonstrate the presence of Phosphate in plant tissue.
14. To study the effect of Auxin on Shoot /root growth.
15. To study the effect of Cytokinin Shoot /root growth.
16. Study of Hydroponic.
17. To compare the rate of transpiration in an ABA treated leaf and normal leaf.

SUGGESTED READINGS

- Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley & Sons Inc., New York, U.S.A.
- Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones second edition, Springer -Verlag, New York. U.S.A.
- Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, U.S.A.
- Salisbury, F.B. and Ross, C.W. 1991. Plant Physiology IV edition, Wdsworth Publishing co., California, U.S.A.
- Taizl and Zeiger, E.1998. Plant Physiology II Edition, Sinauer Associates Inc. Publisher MS.
- Dennis, D.T., Terpin, D.H., Lefevere, D.D. and Layzell, D.V. 1997. Plant Metabolism II Ed. Longman, England.
- Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and molecular Biology of plants, American Society of Plants Physiologist, Maryland, U.S.A.

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Post Graduate SEMESTER PATTERN Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**II**
Subject	**Botany**
Paper	PG – 204
	Paper-IV
Title of the Paper	**Plant Ecology-I**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Introduction, division of plant Ecology, Ecosystem component- biotic and abiotic factors (light, temperature, water, soil), soil organic matter, Population Ecology, Inter and intra specific competition and self regulation. **Biostatistic**s- mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample (t-test and chi square test)	9
Unit-II	Community organization- Concepts of community and continuum, analysis of community (analytical and synthetic characters), Community coefficients, Association (negative and positive associations), Concept of ecological niche, allopatric and sympatric speciation, Ecads and Ecotypes.	9
Unit-III	Ecosystem development and stability- Temporal changes (cyclic and non cyclic), Succession processes & types, Mechanism of succession, facilitation, tolerance and inhibition models, Concept of climax, persistence, Ecological stability concept (resilience and resistance), Ecological perturbation- natural and anthropogenic and their impact on plants and ecosystem, Ecosystem restoration.	9
Unit-IV	Fate of energy and matter in Ecosystems- Trophic organization (ecological pyramids) and structure, Food chains & Food webs, Ecological energetic- Energy flow pathways, Ecological efficiencies, consumption, assimilation and production at trophic level, Primary production measurement methods, Limiting factors, litter fall and decomposition, Recycling pathways, relation between energy flow and nutrient cycling ,Global Biogeochemical cycle of C,N,P,S.	9
Unit-V	Major Biomes of the World, Major vegetation types- Tropical rain forests, Temperate forests, Seasonal forests, Boreal forest, Grasslands, Deserts, Aquatic ecosystems and Wetlands.	9

SUGGESTED LABORATORY EXERCISES

1. To determine minimum size and number of quadrat required for study of vegetation by species area curve method.
2. To determine percentage frequency and frequency classes of various species by quadrate and line transect method using Raunkiaer's Law.
3. To study density and abundance of species.
4. To calculate relative frequency , relative density and relative dominance (or basal area) and determine importance value Index (IVI) of the species.
5. To determine diversity Index or community coefficient for two different vegetation / protected and unprotected grassland.
6. To determine gross and net phytoplankton productivity by light and dark bottle method.
7. To calculate Basal area of tree species found locally.
8. To find out reproductive capacity of the seeds.
9. To study the foliar injuries of plants which are exposed by SO_2.
10. To determine dust deposition on leaves of polluted and non polluted area.
11. To estimate the dissolved oxygen (DO) content in entrophic and oligotrophic water sample by azide modification of Winkler's method.
12. Physical and Chemical analysis of soil.
13. To study water holding capacity, porocity, bulk density of soil.
14. Ecological adaptations: Hydrophyte, Xerophyte, Epiphyte, Parasite etc.
15. To study- Hygrometer , Minimum Maximum Thermometer ,sling Psychrometer , Saci disc , pH meter , Spectrophotometer, Soxhlet apparatus , Kjehldal's apparatus.
16. Biostatistics**:** mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test).
17. To study various Biotic and abiotic components of pond and forest ecosystem.
18. Mapping of Biomes on world map**.**

SUGGESTED READINGS

- Smith, R.L. 1996. Ecology and Field Biology, Harper Collins, New York.
- Muller Dombois, D. and Ellenberg, H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- Begon, M., Harper, J.L. and Townsend, C.R. 1996. Ecolog,. Blackwell Science, Cambridge.
- Ludwig, J. and Reynolds, J.F. 1988. Statistical Ecology, John Wiley & Sons.
- Odum, E.P. 1971. Fundamentals of Ecology, Saunders, Philadelphia.
- Odum, E.P. 1983. Basic Ecology, Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology, Cummings Publication Company, California.
- Kormondy, E.J. 1996. Concepts of Ecology, Prentice Hall of India Pvt. Ltd., New Delhi.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology- Principles and Applications, Cambridge University Press, Cambridge, U.K.
- Moldan, B. and Billharz, S. 1997. Sustainability Indicators, John Wiley & Sons, New York.
- Treshow, M. 1985. Air Pollution and Plant Life,Wiley Interscience.
- Heywood, V.H. and Watson, R.T. 1995. Global Biodiversity Assessment,Cambridge University Press.
- Mason, C.F. 1991. Biology of Freshwater Pollution, Longman Scientific and Technical.
- Hill, M.K. 1997. Understanding Environmental Pollution, Cambridge University Press.
- Brady, N.C. 1990. The Nature and Properties of Soils, MacMillan.

M. Sc. Botany (Semester System)

List of suggested Project work/Dissertation work

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Inventroization of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**III**
Subject	**Botany**
Paper	PG - 301
	Paper-I
Title of the Paper	**Systematic of Angiosperms**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Morphology of flower, floral induction and development, morphology of stamens and carpals, carpels evolution, morphology of inferior ovary, placentation- their origin and types.	9
Unit-II	The species concept Taxonomic hierarchy, International Code of Botanical Nomenclature, Taxonomic evidences (morphology, anatomy, palynology, embryology, cytology, phytochemistary). Taxonomic tools(Herbarium, Botanical garden, Taxonomic keys, Taxonomic literature, floras.) Histological, biochemical, cytological phytochemical, serological, and molecular technique.	9
Unit-III	Systems of Angiosperm classification- origin of Angiosperms Phenetic versus phylogenetic system, Cladistics in taxonomy, relative merits and demerits of major system of classification, Plant exploration , invasions and introduction and, World centers of primary and secondary diversity of domesticated plants.	9
Unit-IV	Families of Dicotyledons- Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae.	9
Unit-V	Families of Monocotyledons- Orchidaceae, Iridaceae, Amaryllidaceae , Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales, Santanales, Centrospermales, and Hellobiales.	9

SUGGESTED LABORATORY EXERCISES

1. Study of stamens and carpals in various species.
2. Different kinds of placentations
3. Description of various species of a genus, location of Key characters and preparation of Key at generic level.
4. Location of key characters and use of keys at family level.
5. Training for herbarium preparation.
6. Preparation of Herbarium sheet of such plants, wild cultivated medicinal as are available locally.
7. Locally available Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae
8. Locally available Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales Santanales, Centrospermales, and Hellobiales.

SUGGESTED READING

1. Heywood, V.H. and Moore, D.M. 1984. Corrent concept in Plant Taxonomy, Academic Press.
2. Banson, L.B.1957. Plant Classification, Health & Co., Boston.
3. Davis, P.R. and Heywood, V.H. 1973. Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. Co., New York, U.S.A.
4. Eames, A.L. 1961. Morphology of Angiosperms, McGraw Hill, New York.
5. Lawerence, G.H.M. 1951. Taxonomy of Vascular Plants, Macmillan, New York.
6. Naik, V.N.1984. Taxonomy of Angiosperms, Tata McGraw Pub Co. Ltd, New Delhi.
7. Plant Taxonomy of Angiosperms by A.B. Rendle Vol I and II.
8. Plant Taxonomy by Tod F., Stussey.
9. Plant Taxonomy and Biosystematics by Clive A. Stace.
10. Systematic Botany by S.C. Dutta.
11. An Introduction to plant Taxonomy by Charles Jeffrey.
12. Plant Taxonomy by O.P. Sharma.
13. Taxonomy of Angiosperm by A.V.S.S Sambhavmuthi.
14. Taxonomy of Angiosperms by N.S. Subhramaniyam.

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**III**
Subject	**Botany**
Paper	PG-302
	Paper II
Title of the Paper	**Molecular Biology and Plant Breeding**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Unit	Syllabus	Period
Unit-I	Nuclear DNA content, DNA structure and forms, DNA replication, mutation, C value paradox, Cot curve, and its significance, damage and repair, Restriction Mapping, Multigene families and their evolution.	9
Unit-II	Gene structure and expression, Gene fine structure, cis and trans test of recombination, introns and exons, their significance, Genetics of Bacteria and Virus (genetic transformation, conjugation, transduction, recombination in Phage), Regulation of gene expression in Prokaryotes and Eukaryotes.	10
Unit-III	RNA synthesis and processing- adding, splicing, polyadenilation, structure and function of different types of RNA, RNA transport.	9
Unit-IV	Genetic code, Protein synthesis– Ribosome structure and site of protein synthesis, initiation complex, factors, elongation, and termination. Post translation modification of protein, protein sorting. Targeting of protein to organelles.	9
Unit-V	Plant breeding- In situ Hybridization- concept and techniques. Genetic basis of inbreeding and heterosis, exploitation of hybrid vigor, Cancer- oncogene, Apoptosis, Innate immune and adaptive immune systems	8

SUGGESTED LABORATORY EXERCISES

1. Isolation of genomic DNA from plant tissue using CTAB (Cetyltrimethyl ammonium bromide) or any animal tissue.
2. Isolation of DNA & its quantitation by a spectrophometric method.
3. Restriction digestion of plant DNA, its seperation by Agarose gel electrophoresis and visualization by ethidium bromide staining.
4. Isolation of RNA and quantitation by a spectrophotometric method.
5. Separation of RNA by Agarose gel electrophoresis and visualization by Et. Br. staining.
6. Immunological techniques : Ouchterlony method, ELISA & Western blotting.
7. Isolation of chloroplats and SDS-PAGE. profile of proteins to demarcate the two subunits of Rubisco.
8. Emasculation technique.

Other experiments based on theory paper

Suggested Readings:

- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J. D. 1989. Molecular Biology of the Cell (2nd edition), Garland Publishing Inc., New York, U. S. A.
- Karp, G. 1999. Cells and Molecular Biology: Concepts and Experiments, John Wiley & Sons Inc., U. S.A.
- Malacinski, G. M. and Freifelder, D. 1998. Essentials of Molecular Biology (3rd edition), Jones and Barlett Publishers, Inc. London.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, WadsworthPublishing Co., California, USA.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J. D. 1999. Molecular Biology of the Cell, Garland Publishing Inc., New York.
- Rost, T. et al. 1998. Plant Biology, Wadsworth Publishing Co.,California, U.S.A.
- Krishanmurthy, K. V. 2000. Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A.
- Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, U.S.A.
- De, D.N. 2000. Plant Cell Vacuoles: An Introduction, CSIRO Publication, Collingwood, Australia.
- Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition), Harper Collins College Publishers, New York, U.S.A.
- Lodish, H. Bert, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology, W.H.Freeman and Co., NewYork, U.S.A.
- Twyman, R. M. 2003. Advanced Molecular Biology, Viva Books Private Ltd., New Delhi.
- Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley & Sons Inc., New York, U.S.A.
- Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition), Springer - Verlag, New York. U.S.A.
- Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, U.S.A.
- Salisbury, F.B. and Ross, C.W. 1991. Plant Physiology IV edition, Wdsworth Publishing co.,California, U.S.A.
- Taizl and Zeiger, E. 1998. Plant Physiology II Edition, Sinauer Associates Inc. Publisher MS.
- Dennis, D.T., Terpin, D.H., Lefevere, D.D. and Layzell, D.V. 1997. Plant Metabolism II Ed, Longman England.
- Buchanan, B.B.,Gruissem, W. and Jones, R.L. 2000. Biochemistry and molecular Biology of plants, American Society of Plants Physiologist, Maryland, U.S.A.

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Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**III**
Subject	**Botany**
Paper	PG-303
	Paper III
Title of the Paper	**Plant Physiology, Biochemistry and Metabolism**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Unit	Syllabus	Period
Unit-I	Fundamentals of Enzymology- general aspects, Allosteric mechanism, regulatory and catalytic sites, Isoenzyme, kinetics of enzymatic catalysis, Michaelis-Menten equation and its significance, mechanism of enzyme action.	9
Unit-II	Photochemistry and Photosynthesis- general concept and historical background, evolution of photosynthetic apparatus, Photosynthetic pigment and light harvesting complexes, Photo-oxidation of water, mechanism of electron and proton transport, Carbon assimilation, Calvin cycle, Photorespiration and its significance, C-4 cycle, CAM pathway, physiological and ecological consideration.	9
Unit-III	Respiration- overview of plant respiration, Glycolysis, TCA cycle, Electron Transport- structure, function & synthesis of ATP, Oxidative Pentose Phosphate Pathway.	9
Unit-IV	Structure, classification and function of Carbohydrates, Biosynthesis of Sucrose and Starch. Structure and function of Lipids, Fatty acid biosynthesis, Synthesis of Membrane Lipids, structural Lipids and storage Lipids and their catabolism. Glyoxilate cycle and alternative oxidases system.	9
Unit-V	Nitrogen fixation (chemical and biological), Nodule formation, mechanism of nitrate uptake and reduction, Ammonium assimilation, Sulphate uptake, transport and assimilation, Sulphur metabolism. Vitamins (structure and role).	9

Suggested Laboratory Exercise based on P.G 301:

1. Principles of Colorimetry and Spectrophotometry.
2. Determine the rate of respiration in germinating seeds/young buds by Ganong's respirometer.
3. Determine rate of respiration in terms of oxygen utilized by plant material by volume method/ weight method.
4. Determine effect of light intensity / wave length on rate of Photosynthesis.
5. Determine effect of CO_2 concentration on rate of Photosynthesis
6. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophyll and carotenoid by Spectrophotometer.
7. To seperate chloroplast pigments by strip paper chromatography/circular paper chromatography.
8. To determine the chlorophyll-a / chlorophyll b ratio in C_3 and C_4 plants by Spectrophotometer.
9. Isolation of intact chloroplasts and estimation of chloroplast proteins by Spot Protein Assay.
10. To demonstrate Photophosphorylation in intact chloroplasts, resolve the phosphoproteins by SDS-PAGE and perform autoradiography, desalting of proteins by gel filtration chromatography embaying Sephadex G-25.
11. Biochemistry of carbohydrates and lipids.
12. Study of structure and formation of Root nodule in leguminous plants
13. Effect of enzyme concentration on enzyme activity e.g. Catalase, Amylase, Acid Phosphatase, Nitrate Reductase.
14. Effect of substrate concentration on enzyme activity eg. Catalase, Amylase
15. Demonstration of the substrate inducibility of the enzyme Nitrate Reductase.
16. Determination of Succinate Dehydrogenase activity, its kinetics and sensitivity to inhibitors.
17. Separation of Isoenzymes of Esterase, Peroxidases by native Polyacrylamide Gel Electrophoresis

Suggested readings

- Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley & Sons Inc., New York, USA.
- Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition), Springer - Verlag, New York, USA.
- Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition), Academic Press, San Diego, USA.
- Salisbury, F.B. and Ross, C.W. 1991. Plant Physiology IV edition, Wdsworth Publishing co., California, USA.
- Taiz l and Zeiger, E. 1998 . Plant Physiology II Edition, Sinauer Associates Inc. Publisher MS.
- Dennis, D.T., Terpin, D.H. Lefevere, D.D. and Layzell, D.V. 1997. Plant Metabolism II Ed. , Longman England.
- Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and molecular Biology of plants, American Society of Plants Physiologist, Maryland, USA.

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**III**
Subject	**Botany**
Paper	PG-304
	Paper IV
Title of the Paper	**Plant Ecology-II (Conservation & Utilization of Plant Resources)**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant biodiversity concept, status in India, and world. Concept of Biodiversity, evolution and differentiation of species, distribution and global pattern of terrestrial biodiversity. World centres of primary diversity of domesticated plants with special reference to Indo-Burmiese centre and secondary centres.	9
Unit-II	Sustainable development, utilization, of resources from forest, grassland, aquatic habitats, food, fodder, forage, timber and non wood forest products. Threats to quality and quantity of resources due to over exploitation. Speciation and extinction, IUCN categories of threat. Hot spots and inventory.	9
Unit-III	Strategies for conservation of resources- Social forestry, principle of conservation, In situ conservation (Sanctuaries, National Parks, Biosphere reserves), Ex situ conservation (Botanical Garden, Field gene bank, Seed bank, in vitro repositories, Cryo banks).	9
Unit-IV	Pollution and Climate change- Air, Water and Soil pollution(kinds, sources, quality parameters) and their effects on plants and ecosystem. Green house gases- CO_2 , CH_4, N_2O, CFCs (source, trend and role). Ozone layer and Ozone hole, consequences of climate change, (CO_2 as fertilizer, Global warming, sea level rise, UV radiation). Bioremediation (management of Pollution).	9
Unit-V	Resource Monitoring- Remote sensing- concepts and tools, Satellite remote sensing ,basics, sensors, visual and digital interpretation, EMR bands and their application, Indian remote sensing program, Thematic mapping of resources, application of Remote sensing.	9

Suggested Laboratory Exercise -

1. Study of locally available plants.
2. Food crops – Wheat, rise, maize, chickpea, potato tapioca, sweet potato, sugarcane , morphology , anatomy , economic importance.
3. Forage / fodder plants – study of any five important crops of locally available.
4. Textile fibres – cotton, jute, linen, sun hump, cannabis.
5. Maceration technique and staining technique of fibres.
6. Fibres for stuffing – silk cotton or Kapok.
7. Medicinal and aromatic plants:- morphology and importance of Papaver somnifera , Atropa balladona , Catharanthus roseus , Adhathoda vasaca , Rauwolfia serpentina , Withania somnifera , Phyllanthus nurori , Andrographis paniculata , Aloe barbedensis , Mentha arvensis , Rosa , Pogostemon cablin , Viteveris zizanioides , Jasminum grandiflorum , cymbopogon sp. , Rosa , Pandanus odoratissimus .
8. Prepare an inventory of medicinal and aromatic plants, bamboos and timber yielding plants of your area giving their scientific and local name their important uses appropriate illustrations.
   - Study of live or herbarium specimens or other visual materials to become familiar with these resource
9. Fire wood and timber yielding plants and Non wood forest products (NWFPs).
10. Morphology and Anatomy of oil yielding tissue and their test (Biochemical or by staining).
11. Remote sensing image interpretation.
12. Mapping of natural resourses (water and forest) of M.P.
13. Enlist wild and cultivated varieties of cereal crops of M.P.
14. Study of Pollution indicator plants.
15. Water and soil analysis.
16. Study of leaf injury.
17. Cellulose test for natural fibers.

Study of live or herbarium specimens or other visual materials to become familiar with these resource
The student should be taken to one of the following-

1. A protected areas (biosphere reserve- Pachmari, national park or a sanctuary).
2. A wet land.
3. Botanical survey of India (BSI).
4. CSIR Laboratory doing research on plants and their utilization.
5. Botanical Gardens or Museum.
6. FRI Forest Research Centre, Dehradun.
   Note- A field survey report is to be submitted.

Suggested Reading

- Brady, N.C.1990. The Nature and Properties of Soil, MacMillan.
- Heywood, V.H. and Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press.
- Hill, M.K. 1997. Understanding Environmental Pollution, Cambridge University Press.
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- Kothari, A. 1997. Understanding Biodiversity Life Sustainability and Equity.
- Orient Longman, Mason, C.F. 1991. Biology of fresh water Pollution, Longman.
- Nair, M.N.B.et.al.1998. Sustainable Management of Non Wood Forest Products.
- Faculty of Forestry, University Putra Malasia 434004 PM Serdong Selangor Malaysia.

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(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	**M.Sc.**
Semester	**IV**
Subject	Botany
Paper	PG-401
	Paper I
Title of the Paper	**Biotechnology and Tissue Culture**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant cell and tissue culture- General introduction, history, scope, concept of cellular differentiation and Totipotancy. Establishment of lab, aseptic technique and sterilization of glassware. Different types and preparation of media. Ex plant technique of tissue culture, meristem, anther, embryo culture and organogenesis.	9
Unit-II	Somatic Hybridization, protoplast isolation, fusion and culture, somatic cell genetics, application of tissue culture, artificial seed, somaclonal variation, production of secondary metabolites, cryopreservation, and germplasm storage.	9
Unit-III	Biotechnology principles and application of Biotechnology in Agriculture, Horticulture, Forestry, Food, and Industries, Health Care and Immunology, Environment Biotechnology, and ethics. Intellectual Property Right. Genetic engineering of plants, aims, strategies of transgenic Agrobcterium, T-DNA, Gene tagging microbial genetic manipulation, genetic improvement of industrial microbes, fermentation technology.	9
Unit-IV	Recombinant DNA technology- gene cloning, principle and technique, construction of genomic and c-DNA library, Vector, Plasmid, DNA synthesis, Polymerase Chain Reaction (PCR), DNA fingerprinting.	9
Unit-V	Genomics and proteomics, molecular markers, artificial chromosomes, high throughput sequencing, genome projects, bioinformatics, microarrays, protein profiling and its significance.	9

Suggested Laboratory Exercise:-

1. To prepare biotechnology lab.
2. Sterilization techniques.
3. Preparation of culture medium.
4. Sterilization of medium.
5. To demonstrate growth characteristics of E.coli using plating method.
6. To demonstrate growth characteristics of E.coli by turbidimetry method.
7. To study the effect of antibiotics on growth of microorganism.
8. To study fermentation techniques.
9. Study of nitrogen fixer & its applications.
10. To prepare tissue culture lab.
11. Stertization techniques.
12. Sterilization of glassware.
13. Preparation of tissue culture medium.
14. Stertization of Explants.
15. Study effect of plant growth hormones (PGR) on tissue culture.
16. To perform the techniques of micro propagation/ somatic embryogenesis /anandroganesis.
17. To perform the techniques of organogenesis.
18. Study of applications of tissue culture.
19. Raising of callus by isolation of an explants from Daucus carota on MS medium
20. Preparation of artificial seeds.
21.

Suggested Reading-

- Butenko, R.G. 2000. Plant Cell Culture, University Press Of pacific.
- Collin, H.A. and Edwards, S. 1998. Plant Cell culture, Bios scientific publishers Oxford,UK.
- Callow, J.A. Ford-Lioyd, B.V. and Newbury, H.J. 1997. Biotechnology and plant genetic Resources, Conservation and Use, CAB, International Oxon, UK.
- Dixon, R.A. 1987. Plant Cell Culture: A Practical Approach, IRL press, Oxford.
- George, E.F.1993. Plant Propagation by Tissue culture part- 1 and 2, Exegetics Ltd Edington, UK.
- Glick, B.R. and Thompson, J.E. 1993. Methods in Plant molecular Biology and Biotechnology, Grc Press Boca Raton, Florida.
- Primrose, S.B. 1995. Principles of Genome Analysis, Blackwell Science ltd., Oxford.

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	Botany
Paper	**PG 402**
	Paper II
Title of the Paper	**Applied Botany and Instrumentation**
Medium of Instructions (Teaching)	English/fgUnh/Both ¼nksuksa½
Question Paper Language	English
Max. Marks	70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plants used in daily life- plants used in cosmetics, herbal cosmetic products and applications. Plants used in hair care and skin care. Herbal dyes and their uses**.** Herbal beverages. Small scale industries.	6
Unit-II	Aromatherapy- introduction, history, modern concept of Aromatherapy. Essential oils, extraction technique by Sohxlate method. Applied aspects of Aromatherapy.	9
Unit-III	Organic Farming and applications, Bio-fertilizers, Vermiculture, Floriculture, Mushroom cultivation technique, Nursery management and applications, marketing strategies, possibilities and loan schemes. Entrepreneurial Development.	10
Unit-IV	Microscopy- principle and applications. Types of microscopes. Basic knowledge of spectrophotometer, Electrophoresis, Colorimeter, pH meter and Centrifuge.	10
Unit-V	Introduction to computer: fundamentals, MS ,DOS, MS WORD , MS EXCEL usage of computer in Biology, sample graph plotting, net working of computer, basic need and applications , modern strategies of literature search. Record and presentation of data and scope.	10

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Suggested Practical Exercises-

1. Extraction technique by sohxalate method of essential oils
2. methods of processing of crude plants and their storage.
3. Traditional method of beautification of skin and their application-

- Cleansing-Alove,Papaya,Lemon etc.
- Nutritive-Ashwagandha,Ginsing,Nagarmotha etc
- Bleaching-Amba haldi,Raktachuran,kachur,suganthi etc
- Anti wrinkle-Manjistha,papaya,suganthiets,Kumari etc

4. Hair care- amla, shikakai, Aritha, Nagarmotha etc.
5. Aromaterapy by –Chameli, Rose, Eucaliptus, Tulsi etc.
6. **Enlist herbal pesticides and herbicides.**
7. Techniques of vermiculture, Mushroom culture, nursery management
8. Perfoma preparation of proposal of marketing of plants
9. Herbal dyes and their uses.
10. Working principle and Practical based on pH meter, Electrophoresis, Spectrophotometer, Centrifuge etc
11. MS office,DOS,MS WORD , MS EXCEL .Usage of Computer in Botany.

Suggested Reading

- Biotechnology-R.C. Dubey
- Biostatistics and Computer Application- Dr. R Goswami
- Mushroom Cultivation-
- Vermiculture-
- Floriculture-
- Aromatherapy -a Complete Guide to the Healing Art- Kathi Kerthi and Mendy Green
- Essential oils for Radiant Health- Susanne Fischer Rizzi 1998
- Beauty through Herbs- Dr. Urjita Jain, Institute of Herbal Science, Mumbai,1997
- Text book of Cosmetology-Harry
- Cosmetic Science and technology-Sagarin C.B.
- The Skin care Book: Simple Herbal Recipes-Kathryn wartrochi, Ist Edition 1996,Paper Gooseberry Hill Publication.
- Natural organic Hair & Skin care :Including A to z Guide to natural & Synthetic Chemicals in cosmetics- ISBN-1990,Aubrey Hampton organic press
- Instrumentation-
- Wealth of India-CSIR New Delhi Publication
- Entrepreneurial Development concept and practices-Dilip Sarwate, Everest Himalaya Publication
- Entrepreneurial Development –S.S.Khan ,S Chand Publication
- Entrepreneurial Development in India- Dr. C. B. Gupta & Dr. N. P. Shrinivasan, S Chand Publication ,4th Edition

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**PG-403: Elective Paper-I**
	Paper III
Title of the Paper	
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers I

1. Environmental science
2. Limnology
3. Industrial microbiology
4. Taxonomy of Angiosperms
5. Applied Mycology
6. Forest Biology, Forest vegetation of India and Management of Forest Resources
7. Plants and Society

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Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper-I**
	Paper III
Title of the Paper	**PG-403: Environmental Science**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Unit	Syllabus	Period
Unit-I	Global distribution and Classification of climate (Koppen's classification); Climatic types and their distribution. Climate of India**.**Climatic Factors (Light, Temperature, Water) Soil types of India and Soil type of World	9
Unit-II	**Global warming and climate change**: Green house effect; consequences; responsible factors. Environmental Impact Assessment. Environmental management.	9
Unit-III	**Toxicology** : Radiation toxicants - Kinds, sources & biological effects. Chemical toxicants - Sources & biological effects of Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides. Bioremediation : Need , scope & technology .	9
Unit-IV	**Environmental Laws** : Goal, objectives and guiding principles of Environmental Laws; Indian Environmental Laws; National Environmental Policies ; Environmental priorities in India and sustainable development.	9
Unit-V	**Environmental Education and Organization** : Goal, objectives and guiding principles of Environmental Education ; Environmental Education in educational Institutes; Environmental organizations and agencies; Man and Biosphere Programme (MAB).	9

Suggested Practical exercises-

1. **Meteorological recording-**
   Determination of air temperature by Min.-Max. thermometer& humidity by hygrometer,Sling pschrometer .
   Determination of light intensity.
   Determination of clouds by Okta scale.
   Determination of wind velocity.
   Determination of precipitation by Rain Gauge.
   Determination of light penetration by Sachi disc.

2. **Non-conventional Bio-management of waste-**
   1. Planning of Root Zone treatment.
   2. Vermicomposting.

3. **Sampling for physico-chemical properties of water-**
   1. To measure temperature by thermometer.
   2. To measure pH by pH meter/pH indicator.
   3. To determine turbidity by turbidometer.
   4. To determine light intensity by photometer.
   5. To determine DO(dissolved oxygen) in eutrophic & oligotrophic water.
   6. To determine BOD(biological oxygen demand) of pond water.
   7. Determinetion of chloride/fluoride/nitrate/phosphate/hardness.

4. **Sampling for soil analysis-**
   1. To determine Nitrate, Phosphate, Carbonate,Potessium .
   2. To determine water holding capacity of soil.
   3. To determine organic matter content of soil.
   4. To determine bulk density and porosity of soil.

5.Exercises based on pollution-

- To study the foliar injuries of plants which are exposed to SO_2..
- To determine dust deposition on leaves of polluted and non polluted areas.
- To determine pH of plants growing in under polluted and non-polluted areas.
- To study environmental impact of a given developmental activity using checklist as AIE method.

The purpose of above practical exercises is to make the students aware of the issues related to environmental science specially global warming, climate change and impact on nature and for ecological services.

7. Study of Toxicants- Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides.
8. Study of Bioremidiation
9. Study of bioindicators

<u>SUGGESTED READINGS</u>

- Smith. R.L. 1996. Ecology and Field Biology, Harper Collins, New York.
- Muller-Dombois, D. and Ellenberg, H. 1974. Aims and Methods of Vegetation Ecology, Wiley, New York.
- Begon, M. Harper, J.L. and Townsend, C.R. 1996. Ecology, Blackwell Science, Cambridge.
- Ludwig, J. and Reynolds, J.F. 1988. Statistical Ecology, John Wiley & Sons.
- Odum,E.P. 1971. Fundamentals of Ecology, Saunders, Philadelphia.
- Odum, E.P. 1983. Basic Ecology, Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology,.Cummings Publication Company, California.
- Kormondy, E.J. 1996. Concepts of Ecology, Prentice-Hall of India Pvt. Ltd., New Delhi.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications, cambridge University Press, Cambridge, U.K.
- Moldan, B. and Billharz, S. 1997. Sustainability Indicators, John Wiley & Sons, New York.
- Treshow, M. 1985. Air Pollution and Plant Life, Wiley Interscience.
- Heywood, V.H. and Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press.
- Mason, C.F. 1991. Biology of Freshwater Pollution, Longman.
- Hill. M.K. 1997. Understanding Environmental Pollution, Cambridge University Press.

- Brady, N.C. 1990. The Nature and Properties of Soils, MacMillan.
- Mason, C.F. 1991. Biology of Freshwater Pollution, Longman.
- Hill, M.K. 1997. Understanding Environmental Pollution, Cambridge University Press.
- Kothari, A. 1997. Understanding Biodiversity: Life'Sustainability and Equity, Orient Longman.
- Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994. Tree Directory of Chandigarh, Lovedale Educational, New Delhi.
- Nair, M.N.B. et. al (Eds) 1998. Sustainable Management of Non-wood Forest Products, Faculty of Forestry, University Putra Malaysia. 434004 PM Serdong, Selangor, Malaysia.
- Rodgers, N.A. and Panwar, H.S. 1988. Planning a Wildlife Protected Area Network in India Vol. 1. The Report, Wildlife Institute of India, Dehradun.
- Walter, K.S. and Gillett, H.J. 1998. 1997 IUCN Red List of Threatened Plants, IUCN, the World Conservation Union. IUCN, Gland, Switzerland, and Cambridge,

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper-I**
	Paper III
Title of the Paper	**PG-403: Limnology**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

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Unit-1	General characteristics of Retention and replacement of water in lakes, origin of lakes. Zonation of lakes. lakes and classification of lakes. Definition depth of lakes.
Unit-2	Lake Flora Phytoplankton-classification of phytoplankton, phytoplankton flora, special distribution of phytoplankton, seasonal distribution and species composition of phytoplankton. Algal blooms effects of salinity and climatic stresses on the distribution of phytoplankton. Phytobenthos-classification
Unit-3	Lake Flora-Higher Plants. Categories of aquatic higher plants, zonation of rooted higher plans, some peculiarities of aquatic higher plants. Lake Bacteria-occurrence, characteristics and importance.
Unit-4	Physical factors affecting the flora. Light, temperature, waves and currents chemical factors affecting the flora-oxygen, carbon, dioxide, nutrients hydrogen ion, concentration.
Unit-5	Biotic relationship and interaction among organisms. Symbiosis, competition among algae, Parasitism of algae, predation of algae, impact of human being on algae.

PRACTICALS: ***Laboratory exercises corresponding to theory courses covering all Units.***

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Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper-I**
	Paper III
Title of the Paper	**PG-403: Industrial Microbiology**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

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Unit-1	Basic techniques in microbiology - Microscopy, staining techniques, Culture, Nutrition and growth of microorganisms. Replication and structure of viruses & other a cellular microorganisms, prokaryotic microorganisms, classification and diversity of Bacteria, Eukaryotic microorganisms.
Unit-2	Food Microbiology: Food spoilage, Food preservation methods, Microbiological production of food such as fermented products, alcoholic beverages, vinegar. Fermented vegetables. Single cell protein production in industry, fermented dairy products and uses.
Unit-3	Fermentation Industry: Selection of micro-organisms, Techniques and quality control, Production of antibiotics, steroids, Human proteins, Vaccines and vitamins. Survey of microorganisms of industrial uses. Production of organic acids, amino acids, Enzymes, Solvents and fuels.
Unit-4	Recovery of minerals by using microbes, Oil recovery, Bio deterioration, Mushroom culture, Biotech products including human insulin, Microbial Growth-Environmental influences, Physical control, Chemical control & Antibiotic controls.
Unit-5	Water quality in industry: Bacteriological safety of potable water, water quality analysis, importance of BOD. Biodegradation of wastes and pollutants, Primary, Secondary and Tertiary Sewage treatments.

PRACTICALS: ***Laboratory exercises corresponding to theory courses covering all Units.***

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Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper-I**
	Paper III
Title of the Paper	**PG-403: Taxonomy of Angiosperms**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

UNIT -1

Omenclature I.C.B.N. Principles, Rules, Recommendation, Articles, Typification, Principle of priority, Effective and Valid publication, citation of authority synonyms and homonyms.

The species concept Taxonomic hierarchy, topological & biological delimitation of Taxa and attribution of rank, salient features of the International code of botanical nomenclature.

Plant speciation- Allopetric, sympatric, hybrid Apomictic Abrupt and phylletic, speciation, Mechanism of Reproductive isolation Taxonomic tools-herbarium Floras, Botanical garden, Botanical survey of India. Modern trends in Taxonomy-Morphology, Anatomy Palynology, Embryology, Cytology, Ecology, Phytochemistry, Genomic analysis & Nucleic acid hybridization.

UNIT-II

ossils Angiosperms , origin and evolution of angiosperms Endangered plants of m,p System of angiosperms classification phenetic versus phylogenetic system,cladistic in taxonomy. Principle, outline, merits and demerits of Bentham and hooker, Englar &Prantle, Hutchinson, Conquest, APG system. Morphology and evolutionary trends in angiosperms .Morphology of carpel,& stamen Monographic nature of flower. Calculation of similarity coefficients & preparation of dendrogram.

UNIT-III

Systematic account of following families[Salient feature ,Morphological diversity, Phylogenetic relationship and Economic importance] Ranunculaceae,Magnoliaceae, Annonaceae, Nymphaeaceae, Papaveraceae, fumaraceae, Cruciferae(brassicaceae), Podostmaceae, Rosaceae, Linaceae, Capparidaceae,Violaceae,Caryophyllaceae, Dipterocarpaceae,Malvaceae, Tiliaceae , Sterculaceae, Rutaceae, Meliaceae, Rhamnaceae,Sapindaceae, Anacardiaceae, Salvadoraceae, Leguminoceae,Lythraceae, Myrtaceae, Onagraceae, Cucurbitaceae, Apiaceae, Tamericaceae, Caricaceae Cactaceae,

UNIT IV

Systematic account of Following Families[Salient feature, Morphological diversity , Phylogenetic relationship and Economic importance]Rubiaceae, Asteraceae, Primulaceae,Sapotaceae,Ileaceae Apocynaceae, Asclepiadaceae, Boraginaceae, Convolvulaceae, Solanaceae ,Pedaliaceae, Lentibulariaceae, Scrophulariaceae, Bignoniaceae, Acanthaceae,Verbinaceae, Labiatae, Amaranthaceae, Chenopodiaceae, Polygonaceae, Moraceae, Casuarinaceae, Combritaceae, Nyctaginaceae Bombacaceae, Urticaceae, Oxalidaceae, Moringaceae, Oliaceae, Malpighiaceae, Gentianaceae,Vitaceae

UNIT-V

Monocotyledons families and Phylogeny - lismaceae,Hydrochariaceae, Poaceae, Cyperaceae, Comelinaceae Arecaceae, Liliaceae Amaryllidaceae, Araceae Iridaceae, Musaceaae, Zingiberaceae, Cannaceae, Orchidaceous

Typhaceae, General characteristic phylogeny of following orderRanales, Amentiferae,Tubiflorae,Santalles, Centrospermatales, Halobiales, Floristic Works with reference to m.p.

Suggested Practical Exercise

1) Study of the technical terms, related to vegetative & floral parts of a plant used for description and for floral diagram preparation.
2) Studies of techniques to draw a correct floral diagram.
3) Exercise on classification & nomenclature
4) Exercise on Taxonomic literature. & Herbarium
5) Exercise on morphological characters & special floral features of some flowers. Exercise on preparation of Artificial key (using specimen from three or four species) Exercise on Identification of Taxa up to family, genus & species level.
6) Familiar with flora of botanical garden.
7) Preparation of chart/model of thermocol related to vascular skeleton of flower/ placentation/ovary position./floral parts etc.
8) Floristic studies of adjoining forests, National parks and sanctuaries.
9) Visit to different botanical garden & herbaria in India.
10) Description of specimen from representative, locally available families.
11) Description of species based on various specimens to study intra specific variation.
12) Location of key characters and use of keys at family level.
13) Comparison of different species of a genus and genera of a family to calculate similarity coefficient and preparation of dendrogram
14) Training in using flora and herbaria for identification of specimen describe in the classification.
15) Field trip with in and around the campus compilation of field notes & preparation herbarium sheet of such plants which are abundantly found either wild/ cultivated.(Prevent collecting plants from the wild. The student should be asked to prepare field report.)

BOOKS:-

1) Verma B.K.(2011)–Introduction to Taxonomy of Angiosperms.
2) Eames, A.J.(1961) Morphology of Angiosperms Mc-Graw Hill, New York.
3) Rendle. A.B. (1997) The Classification of flowering plants, Vol-1&II
4) Takhtajan, A.L.(1969) Flowering Plants- Origin and dispersal.
5) Lawrence,G.H.M. (1951)Taxonomy of Vascular plants MMacmillian, New York.
6) Naik, V.N.(1984) Taxonomy of Angiosperms Tata McGraw Hill Pub. Co. Ltd New Delhi.
7) Cronquist, A(1988) The Evolution and Classification of Flowering Plants, Bronix New York Botanical Garden.
8) Harrison,H.J. (1971) New Concept in Flowering Plants Taxonomy. Hiemann Edu. Book Ltd. London.
9) Sporne, K.K(1974)The morphology of angiosperms. New Delhi
10) Tiagi, Y.D. & Kshetrapal, S. (1974) Taxonomy of Angiosperms Ramesh Book Depot, Jaipur.
11) Stace, C.A. (1989) Plants Taxonomy & Biosystematics.
12). Woodland, D.W.(1991) Contemporary Plants systematics, Prentic Hall.
13) Sivaranjan, V.V.(1991) Introduction to the Principal of Plants Taxonomy. Oxford &IBH Pub. Co. Pvt. Ltd. New Delhi.
14) Nordenstam, Kassas M (2000) Plants Systematic for @1 century Portaland press Ltd, London.

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper-I**
	Paper III
Title of the Paper	**PG-403: Applied Mycology**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Particulars / fooj.k

Unit-1	General Characteristics of fungi, Taxonomic status and Classification of Fungi, fungi Harmful to mankind, Fungi as pathogen to plants, Animal & Human beings, Spoilage of foodstuffs.
Unit-2	Fungi as a food: Detailed account of mushrooms & their cultivation, Yeast & Its related Industries, Single cell proteins & its production. The Economic importance of the fructification of few edible Fungi.
Unit-3	Fungi as medicines: Industrial production of :- Ergot, Ephedrine , Steroids , Vitamins, Antibiotics
Unit-4	Fungi in Industries such as- Brewery, Baking and Dairy Industries. Fungi in Enzyme Production such as - Invertase, Zymase, Amylase, Cellulase, Fungi in production of organic Acids : Citric Acid, Gluconic Acid, Gallic Acid, Fumaric Acid.
Unit-5	Broad principles of Fungal disease management, Disease forecasting, Regulatory and physical measure of fungal disease management - management of disease by cultural produces, organic Amendments: Biocontrol of fungal diseases, chemical measures of disease management, Fungi in agriculture: As Scavangers As biological control Importance of Mycorrhiza in soil fertility, as growth hormones, as insecticides.

PRACTICALS: ***Laboratory exercises corresponding to theory courses covering all Units.***

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Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper-I**
	Paper III
Title of the Paper	**PG-403: Forest Biology, Forest Vegetation of India and Management of Forest Resources**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

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Unit-1	**Introduction:-** Forest and National Development. Forest composition, Forests in our national policy, Forest influences. Forest produce, Important non-wood forest products (NWFP). Forest & erosion, Forest & Man, Ethno botany in relation to Forest.
Unit-2	Locality factors of the forests: Climate : temperature, forest clouds, monsoon in India. light and wind. Edaphic and Biotic factors, Forest fire and control, Distribution of Epiphytes and the factors controlling them.
Unit-3	**Phytogeographical regions of India** Classifications of forests, Floral types of Indian forest, grasslands of India. Classification of forests of M.P., grassland of M.P., Biosphere reserve of M.P. Forest vegetation of Pachmarhi and Baster area.
Unit-4	Role of FRI (Forest research institute). Functional processes with in forest: - 1.Energy and organic matter dynamics. 2.Minerals and nutrient turn over. 3.Diversity and their conservation Natural and artificial regeneration of Forest. Afforestation and impact of afforestation on global climate.
Unit-5	Social forestry, Farm Forestry, Wasteland reclamation theory, Forest growth and forest Resource management, Forest in National economy, Environmental Laws, UNEP, IUCN, ICRAF.Ecology of Sal and Teak. Wild life Management: Silviculture approach and the management of Forest, Principles of forest protection - protection against fire, Grazing and Human interferences.

PRACTICALS: ***Laboratory exercises corresponding to theory courses covering all Units.***

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2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper-I**
	Paper III
Title of the Paper	**PG-403: Plants and Society**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

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Unit-1	History of plants and development of society, Role of plants in tracing human history, green revolution:- benefits and adverse consequences. Innovations for meeting world food demands. Early domestication centers of major cultivated plants, Plants in Mythology, folklores Role of Ethnobotony in relation to development of society.
Unit-2	Plants & Human Health, Usage of plants in different systems of medicine allopathic, Homeopathic Aurvedic, Herbal Medicine, and concept of Herbal Cosmetic. Plants as health hazards. Food spoilage. Viral, Bacterial and fungal diseases of human beings.
Unit-3	Plants in Enterprenural Areas-A: Techniques of cultivation and marketing of few Chlorophytum, Guggul, Commiphera wightii, Rauwolfia serpentina**.** Plants and other uses : Agriculture & Horticulture.
Unit-4	Plants in Enterprenural Areas - B: Use of plants in earning livelihood - Such as Bamboos, Rattans, Raw Materials of papermakings, Gums tannins, dyes, resins and fruits. Techniques of cultivation and marketing of - Aromatic Plants - Lemon grass, plasma Rosa, Floriculture - rose and gladioli.
Unit-5	Plants in Enterprenural Areas - C: Techniques of cultivation and marketing of - Mushroom Cultivation, Nursery management, Vermiculture & Vermicompost. Mass cultivation of few plants using tissue culture techniques. Bonsii Techniques.

PRACTICALS: ***Laboratory exercises corresponding to theory courses covering all Units.***

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**PG 404: Elective Paper-II**
	Paper IV
Title of the Paper	
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers II

1. Ethnobotany
2. Plant protection
3. Bioinformatics and computer applications and Biostatistics
4. Molecular biology and biotechnology
5. Pollution Ecology

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper- 404**
	Paper IV
Title of the Paper	**Ethnobotany**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Unit	Syllabus	Period
Unit-I	Definition and scope of Ethnobotany Historical review and outline idea of archaeoethnobotany. Ethnoecology, Ethnomedicines, Ethnonarcotics, Ethnopharmacology, Ethnotaxonomy, Ethnocosmetics, Ethnolinguistics, Ethnoorthopaedics, Ethnopaediatrics.	9
Unit-II	Preservation of Genetic diversity, plants used in various systems of medicines, Ayurvedic, Unani, Homoeopathic and Allopathic systems. Plants used by villagers and tribal people. Role of ethnobotany in the development of Society.	9
Unit-III	**Ethnobotanical importance of :***Aconitum napellus, Allium cepa, Mentha arvensis, Allium sativum, Nux-vomica, Aloe vera, Ocimum sanctum, Atropa belladona, Azadirchta indica, Piper nigrum, Butea monospera, Pterocarpus marsupium, Terminalia bellerica, Terminalia arjuna, Terminalia chebula , Eugenia aromatica, Eugenia jambolana, Hollarrhena antidysenterica, Withania somnifera, Lawsonia inermis.*	9
Unit-IV	**Ethnobotanical importance of**: Cassia *fistula, Cannabis sativa, Ricinus communis, Emblica officinalis, Santalum album.* Plants in mythology, Taboos and Totems in relation to plants, folklore and folk tales, Wild life protection by tribal, plants domestication by the tribals. Plants in similes and metaphors.	9
Unit-V	Detailed study of the common plants and their parts used in the treatment of following diseases:Expulsion of worms, Skin diseases, Bronchial inflammation and Asthma, Tuberculosis, Urino - genital problems, Amoebic dysentery, Malaria, Rheumatism, Leprosy, Jaundice, Heart diseases, Piles, Leukoderma.	9

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal
As Recommended by the Board of Studies 2021-22
M.Sc. Botany

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Investigation of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR
28. Somatic Hybridization
29. Biofertilizers and Bioinoculants
30. Transgenics
31. Exploitation of Rhizospheric microbes including mycorrhizae
32. Recycling of domestic, municipal and industrial wastes
33. Vermicomposting and Biomethanation
34. Environmental Monitoring
35. Assessment of Pollution in different habitats

Suggested Readings-

1. Pullaiah, T., Krishnamurthy, K.V. and Bahadur, B. 2017. Ethnobotany of India 5-Volume Set, Apple Academic Press.
2. Jain, S.K. 2010. Manual of ethnobotany, 2nd revised edition, scientific publishers (India).
3. Jain, S.K. A Hand book of Ethnobotany.
4. Schultes, R. E. and Reis, Sirivon, 2008. Ethnobotany: Evolution of a Discipline, Dioscorides press/ Timber press.
5. Terence, McKenna, D. The Encyclopedia of Psychoactive plants: Ethnopharmacology and its applications.
6. Patel, S. and Desi P.K., Forest Botany and Ethnobotany.
7. Jose L. Martinez, Amner Munoz Aoevedo and Mahendra Rai, 2018. Ethnobotany: Application of Medicinal Plants, CRC press.

List of Journals-

1. Indian journal of Multidisciplinary Research-CMRA Kerala.
2. National journal of Life Science.
3. International Journal of Biotechnology.
4. Journal of Biotechnology
5. Pollution Research.
6. Science Reporter.
7. University New- UGC.
8. Acta Botanica.
9. Acta Ecologica.
10. Tropical Ecology.
11. Annual Review of Plant Physiology and Molecular Biology.
12. Current Advance in Plant Science.
13. Nature Review: Molecular and Cell Biology.
14. Indian journal of Biotechnology (NISCAIR New Delhi).

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper- 404**
	Paper IV
Title of the Paper	**Plant Protection**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Particulars / fooj.k

Unit-1	History and development of Plant Protection Science. General Idea about the following pests: 1.Insects as pests of Gram, Soyabean and Teak 2. Weeds: Parthenium, Waterhyacinth and Cuscuta. 3. Remote sensing in plant protection.
Unit-2	Fungi as Plant Pathogens: General idea about causal organisms, Symptoms and disease cycles of following fungal diseases. collar rot, Damping off of seedlings, Late blight of Potato, Downy Mildew of Grapes, Powdery mildew of Wheat, Smut of Wheat, Rust of Wheat, Wilt of Arhar, Anthracnose of Soyabean, Tikka disease of Groundnut. General idea about the Problems of post harvest storage due to fungi and insects.
Unit-3	General idea about causal organism, Symptoms and disease cycle of following diseases. 1. Bacterial Diseases. Citrus canker, Blight of Paddy. 2. Viral diseases. Tobacco mosaic, Yellow vein mosaic of Bhindi, Bunchy of banana. Transmission of virus. 3. Mycoplasma Grossy shoot disease of Sugarcane, Little leaf of Bringal. 4. Nematodes: Root knot of vegetables.
Unit-4	Chemical Methods of plant protection types of chemical/formulations/Application methods and problems in environment. Cultural methods: Sanitation, Crop rotation and seed materials. Use of resistance varieties. Legislative methods : Plant Quarantine.
Unit-5	Biological Plant Protection: Use of biological pesticides from microbes (Fungi, Bacteria and viruses). Brief idea of management of Insects and Plant diseases (I.P.M.).

PRACTICALS: ***Laboratory exercises corresponding to theory courses covering all Units.***

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper- 404**
	Paper IV
Title of the Paper	**Bioinformatics, Computer Application and Biostatistics**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Particulars / fooj.k

Unit-1	Bioinformatics - Objectives and scope of Bioinformatics, Data-base Search creation, Preparation and management, Use of currently important Databases in bioinformatics. Modern strategies of literature search, Significance of keywords in Literature search, use of e-mail and internet. And retrieving information on biotechnology.
Unit-2	Introduction to computer fundamentals, permanent storage of number systems, decimal to binary and vice-versa; binary coded Decimal number; MS - DOS, MS - WORD, MS - EXCEL. Application of computer in biostatistical problems. RDBMS, Definition of relational database, basic SQL prompts; retrieval sorting indexing and merging; Programming logic & techniques, Algorithm, flowcharts.
Unit-3	Computer in biology : Sequence data bases; sequence analysis of proteins and nucleic acids, structure prediction, simple molecular Modeling, sample graph plotting. Networking of computer, need and advantage, overview of Indian network Such as NICNET, INFLIBNET, Detailed study of Internet.
Unit-4	Computer oriented numerical methods, solution of simple algebric and Transcendental equations. Solution of linear simultaneous equation, Numerical integration. Partial fraction, theory of quadratic equations, permutation and Combination, Binomial theorem, Finite and infinite series, Determinant. Differential and integral calculus - Theory and rules, methods of Differentiation and integration, Definite integral, Simple differential Equation.
Unit-5	**Basic statistical concepts:** Population and samples, classification, Summarization and presentation of data, Frequency distribution, Measures Of location and dispersion, **Statistical concepts: C**orrelation and regression, probability models, Nomial and bi-nomial distributions, normalizing transformation and test Of inference, Analysis of variance.

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper- 404**
	Paper IV
Title of the Paper	**Molecular Biology and Biotechnology**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Particulars / fooj.k

Unit-1	Biotechnology: A Historical overview major, landmark and achievements, Genetic Material of prokaryotes & eukaryotes properties and function Replication. Transcription, Reverse transcription, Inhibition of replication and transcription. Mechanism of gene expression in prokaryotes and eukaryotes, inhibition of gene expression, ploidy-status, Cryopreservation and its importance.
Unit-2	Genetic engineering: Recombinant DNA technology out line of genetic Engineering procedure Enzyme, isolation of Plasmid and chromosomal DNA molecule, PCR, cloning vector DNA hybridization techniques, Southern, Western & Northern Blotting insertion of particular DNA Molecule into a vector.
Unit-3	Transformation and growth of cell, Detection of Recombination molecular, selection & Screening, Sequencing of DNA gene identification and mapping, Expression of Cloned Gene. History of Tissue culture:- Cell and Tissue Culture (Animal and Plants) Media Preparations, culture technique. Production of haploids anther & pollen culture organogenesis and embryogenesis Somaclonal variations, Hybrodomas and monocloal antibodies (MAB).
Unit-4	Development of Trasgenic Plants and animal Hibridoma technology, Asepectic technique & sterilization. Application of Biotechnology in Agriculture, horticulture, forestry Food And industries, Health care and immunology, Environment Biotechnology And ethics.
Unit-5	Basis principles of instrumentation. Application of different techniques in Biology Spectrophotometer, Electrophoresis Chromatography and Microscopy. Importance of statistics in Biological studies Test of Significance based on small and large samples t,z, xz and F test, Analysis of variance, correlation and Regression. Computer Application - Computer in biology Basics of Computers simple graph plotting, Bio informatics.

PRACTICALS: ***Laboratory exercises corresponding to theory courses covering all Units.***

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate SEMESTER WISE Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session	**2021-22**
Class	M.Sc.
Semester	**IV**
Subject	**Botany**
Paper	**Elective Paper- 404**
	Paper IV
Title of the Paper	**Pollution Ecology**
Medium of Instructions (Teaching)	English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language	English
Max. Marks	70+CCE30=100

Particulars / fooj.k

Unit-1	Pollution: Status and Concerns • Classification of contaminants and pollutants. • Brief account of major environmental disasters of the past. • Indicator concept-biological indicators of pollution.
Unit-2	Air pollution • Sources and causes of air pollution. • Effects of air pollution on flora and fauna, materials and structures, soil atmosphere, water bodies and on human health. • Transport and dispersion of pollutants.
Unit-3	Water Pollution • Sources and causes of water pollution • Status of water pollution in India and M.P. • Water harvesting and recharging of water resources-concerns and remedies.
Unit-4	Soil pollution and other pollution types • Causes and sources of soil pollution. • Pesticidal and heavy metal pollution-sources, causes and effects • Nuclear, thermal and noise pollution-sources, causes and effects
Unit-5	Pollution: Monitoring and Control • Monitoring systems and analytical methods for air, water and soil pollution. • Control and abatement measures for air, water and soil pollution. • Brief account of legislation and environmental protection acts in India.

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate **SEMESTER WISE** Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

M.Sc Botany

SEMESTER-I

Practical scheme for Part-I

(Based on Course PG 101 and 102)

Time: 4 hrs **Max.Marks-100**

S.No.	Exercise	Marks
1	Prepare a slide of given material A (fungi).Draw well labelled diagrams. Identify giving reasons	16
2	Bacterial Staining	10
3	Prepare slide of given material B (Algae), Draw well labelled diagrams. Identify three algae with giving reasons.	24
4	Spotting (1 to 10)	20
5	Viva	10
6	Sessional	20
Total Marks		**100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate **SEMESTER WISE** Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

M.Sc Botany

SEMESTER-I

Practical scheme for Part-II

(Based on Course PG 103 and 104)

Time: 4 hrs **Max.Marks-100**

S.No.	Exercise	Marks
1	Prepare a slide of given material A (Bryophyte). Draw well labelled diagrams. Identify giving reasons.	15
2	Prepare a slide of given material B (Pteridophyte). Draw well labelled diagrams. Identify giving reasons.	15
3	Monographic study of given material C Gymnosperm) Draw well labelled diagrams. Identify giving reasons.	20
4	Spotting (1 to 10)	20
5	Viva	10
6	Sessional	20
Total Marks		**100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate **SEMESTER WISE** Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

M.Sc Botany

SEMESTER-II

Practical scheme for Part-I

(Based on Course PG 201 and 202)

Time: 4 hrs **Max.Marks-100**

S.No.	Exercise	Marks
1	Exercise based on Cell Biology	15
2	Exercise based on Cytogenetics	10
3	Study of Anther / Ovule / Seed	15
4	Demonstration of Emasculation Tech	10
5	Spotting (1 to 10)	20
6	Viva	10
7	Sessional	20
Total Marks		**100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate **SEMESTER WISE** Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

M.Sc Botany

SEMESTER-II

Practical scheme for Part-II

(Based on Course PG 203 and 204)

Time: 4 hrs **Max.Marks-100**

S.No.	Exercise	Marks
1	Exercise based on Physiology (major)	15
2	Exercise based on Physiology (minor)	10
3	Exercise based on ecology (community study)	10
4	Exercise based on ecological adaptation	15
5	Spotting (1 to 10)	20
6	Viva	10
7	Sessional	20
Total Marks		**100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate **SEMESTER WISE** Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

M.Sc Botany

SEMESTER-III

Practical scheme for Part-I

(Based on Course PG 301 and 302)

Time: 4 hrs **Max.Marks-100**

S.No.	Exercise	Marks
1	Exercise based on Taxonomy (Study of given plant up to genus level)	15
2	Exercise based on Morphology (Study of stamens/ carpels/ placentation)	10
3	Exercise based on Molecular Biology	15
4	Exercise based on Plant Breeding	10
5	Spotting (1 to 10)	20
6	Viva	10
7	Sessional	20
Total Marks		**100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate **SEMESTER WISE** Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

M.Sc Botany

SEMESTER-III

Practical scheme for Part-II

(Based on Course PG 303 and 304)

Time: 4 hrs **Max.Marks-100**

S.No.	Exercise	Marks
1	Exercise based on Physiology	15
2	Exercise based on Biochemistry and Metabolism	10
3	Exercise based on Ecology of Food/Forage/Fodder/Medicinal Plants	15
4	Report on field survey	10
5	Spotting (1 to 10)	20
6	Viva	10
7	Sessional	20
Total Marks		**100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate **SEMESTER WISE** Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

M.Sc Botany

SEMESTER-IV

Practical scheme for Part-I

(Based on Course PG 401 and 402)

Time: 4 hrs **Max.Marks-100**

S.No.	Exercise	Marks
1	Exercise based on Biotechnology	15
2	Exercise based on Tissue culture	10
3	Exercise based on Applied Botany	15
4	Exercise based on Instrumentation	10
5	Spotting (1 to 10)	20
6	Viva	10
7	Sessional	20
Total Marks		**100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Post Graduate **SEMESTER WISE** Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

M.Sc Botany

SEMESTER-IV

Practical scheme for Part-II

(Based on Course PG 403 and 404)

Time: 4 hrs **Max.Marks-100**

S.No.	Exercise	Marks
1	Major Exercise based on Elective - I	15
2	Minor Exercise based on Elective - I	10
3	Major Exercise based on Elective - II	15
4	Minor Exercise based on Elective - II	10
5	Spotting (1 to 10)	20
6	Viva	10
7	Sessional	20
Total Marks		**100**

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE, SHIVAJI NAGAR, BHOPAL

(Accredited 'A' Grade by NAAC)

Syllabus of Botany

2021-22

(As Recommended by the Central Board of Studies and approved by Governor of M.P.)

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College, Shivaji Nagar, Bhopal – 462016

Syllabus
2021-2022

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Date of submission in Autonomous Examination cell:

Signature H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College, Shivaji Nagar, Bhopal – 462016

Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

Session (2021-22)

Course: Botany						**Course Code:C085(BZC), C062(BTC)**
B.Sc. (3 Years Degree Course)						
Theory Papers/ practical	**Title of paper**	**Compulsory /Optional**	**CCE**		**Theory Marks**	**Total**
			CCE I	**CCE II**		
B.Sc. I Year (ANNUAL SYSTEM)						
Paper I	Applied Botany (Major) S1-BOTA1T	Compulsory	10 (Assignment/ Presentation)	20 (Class Test)	70 (UE)	100
Paper II	Basic Botany (Minor) S1-BOTA2T	Optional	10 (Assignment /Presentation)	20 (Class Test)	70 (UE)	100
Practical I	Applied Botany Practical S1-BOTA1P	Compulsory	30 Internal Assessment		70 External Assessment	100
Practical II	Basic Botany Practical S1-BOTA2P	Optional	30 Internal Assessment		70 External Assessment	100
Elective Paper I	Nursery Management S1-BOTA1G	Elective	10 (Assignment/ Presentation)	20 (Class Test)	70 (UE)	100
Elective Paper II	Herbal Cosmetics S1-BOTA2G	Elective	10 (Assignment/ Presentation)	20 (Class Test)	70 (UE)	100
B.Sc. II Year (ANNUAL SYSTEM)						
Paper I	Taxonomy and Embryology of Angiosperms	Compulsory	10	15	50	75
Paper II	Plant Ecology, Biodiversity and Phytogeography	Compulsory	10	15	50	75
Practical	Botany Practical (based on paper I&II)	Compulsory			50	50
		Total Marks				**200**

B.Sc. III Year (ANNUAL SYSTEM)						
Paper I	Plant Physiology and Biochemistry	Compulsory	10	15	50	75
Paper II	Cell Biology, Genetics and Biotechnology	Compulsory	10	15	50	75
Practical	Botany Practical (based on paper I&II)	Compulsory			50	50
		Total Marks				**200**

Signature with date

Member Board of Studies:

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B.Sc. (Botany) Program Specific Outcomes

Programme specific outcomes (PSOs) :- Students completing this course will be able to-

- **PLO1** Critically evaluate the relevant information about the plants and their classification;
- **PLO2** B.Sc. Botany graduates develop the core competency in the subject and their theoritical and practical applicability is ensured;
- **PLO3** Botany graduates are equipped with the knowledge related to competitive exams;
- **PLO4** Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Botany;
- **PLO5** Apart from subject specific skills, the outcomes would lead to gain knowledge and skills for futher higher studies.

COURSE OUTCOMES

B.Sc. II year(Botany)

Paper I : Taxonomy and Embryology of Angiosperms	The objective of this course is to provide fundamental knowledge of plant taxonomy, reproduction and embryology of Angiosperms. **CO1** Study of taxonomy helps the students to understand the flora of any area and make them able to identify the plant species; **CO2** The above knowledge makes students competent to work in department of forestry, Biodiversity conservation board, Pollution control board, Environmental protection Agencies; **CO3** Students will be more capable in the field of Horticulture floriculture Nursery management and plant cultivation; **CO4** By the study of embryology of Angiosperms student will be able to understand plant and plant interaction, Pollination phenomena explains plant animal relationship which significant for maintenance of Ecological balances, modern techniques of Ecological balance, modern techniques of embryology helps in conservation of plant species; **CO5** Students will be able to learn the seed and fruit formation phenomenon which helps in commercial use of seeds and fruits.
Paper II: Plant Ecology Biodiversity Phytogeography	The objective of this course is to develop understanding about our environmental structure function conservation and its utilization; **CO1** Students will be able to understand the structure of various ecosystem on the earth; **CO2** Knowledge about ecological factors will be helpful to understand the pollution status and its control; The above knowledge makes students competent in the field of Pollution Control department. Environmental Protection Agencies; **CO3** Students will be able to understand the biodiversity, plant animal relationship and their role in ecological balance; **CO4** They will be able to understand the pattern of vegetation in India and its significance for human society; **CO5** They will be able to utilize the knowledge in the field of Eco Commercial development of our country.

B.Sc. III year(Botany)	
Paper I: **Plant Physiology and Biochemistry**	On completion of this course the students will be able to: **CO1** Understand water relation of plants with respect to various physiological processes; **CO2** Explain role of plant nutrition; **CO3** Recognize the functional importance of biomolecules in plants, their structure and classification; **CO4** Interpret the biological nitrogen fixation, nitrogen and lipid metabolism; **CO5** Explain the significance of photosynthesis and respiration; **CO6** Understand the utility of enzymes and hormones in plant life.
Paper II: **Cell Biology, Genetics and Biotechnology**	On completion of this course the students will be able to: **CO1** Identify the concept that explains the structure and function of cellwall, membrane and different cell organells; **CO2** Understand the chromosomal organization and its details and about the cell division process; **CO3** Comprehend the effect of chromosomal abnormalities in numerical as well as structural changes leading to genetic disorders; **CO4** Have conceptual understanding Mandelism and law of inheritance, gentic basis of alleles; **CO5** Explain the concept of gene and transfer of genetic information; **CO6** Understand the concept of plant breeding and its significance; **CO7** Understand the core concepts and fundamentals of plant biotechnology and genetic engineering; **CO8** Develop their competency on plant tissue culture; **CO9** Refect upon various tools and techniques of recombinant DNA technology & DNA finger printing; **CO10** Develop skills in data interpretation through Biostatistical methods.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

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Part A- Introduction **Hkkx v & ifjp;**			
Program: Certificate dk;ZØe% izek.k i=	Class : B.Sc. I st year d{kk % ch-,l-lh- izFke	Year: 2021 o"kZ% 2021	Session: 2021-22 l=% 2021&22

Subject: Botany **fo"k;% ouLifr'kkL=**		
1	**Course Code**	S1- BOTA1T
	ikB~;Øe dk dksM	S1- BOTA1T
2	**Course Title**	Applied Botany (Paper 1)
	ikB~;Øe dk 'kh"kZd	vuqiz;qDr ouLifr'kkL= ¼isij 1½
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Core Course
	ikB~;Øe dk izdkj% ¼dksj dkslZ@bysfDVo@tsusfjd bysfDVo@cksds'kuy@-----½	dksj dkslZ ¼ewy ikB~;Øe½
4	**Pre-requisite (if any)**	To Study this course, a student must have had the subject Biology/Life Sciences/Agriculture in class 12th.
	iwokZis{kk	bl dkslZ dk v/;;u djus ds fy;s Nk= us ouLifr foKku@thofoKku fo"k; ls d{kk 12 oha v/;;u fd;k gksA
5	**Course Learning Outcomes (CLO)**	By the end of this course the student should have: • Understood the significance and role of botany. • Learnt the basic aspects of applied botany. • Gained knowledge about employment opportunities in field of botany • Gained knowledge about start-up opportunities in the field of botany

		• Learnt about opportunities of social services • Gain knowledge about best health paractices	
	ikB~;Øe v/;;u dh ifjyfC/k;ka	bl ikB~;Øe ds var rd Nk= ds ikl gksuk pkfg,% • ouLifrfoKku ds egRo vkSj Hkwfedk dks le>kA • vuqiz;qDr ouLifr foKku ds cqfu;knh igyqvksa dks lh[kkA • ouLifr foKku ds {ks= esa jkstxkj ds voljksa ds ckjs esa tkudkjh izkIr djsxkA • lkekftd lsokvksa ds voljksa ds ckjs esa lh[kkA • lokZsRre LokLF; izFkkvksa ds ckjs esa Kku izkIr djsxkA	
6	**Course Value**	04 Credit	
	ØsfMV eku	04 ØsfMV	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35
	dqy vad	vf/kdre vad% 30$70	U;wure mRrh.kZ vad% 35

Part B- Content of the course

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Total No. of Lectures - 60 Hours Tutorials - 00 Practical - 00 (04 Hours per week):L-T-P:

O;k[;kuksa dh dqy la[;k&60 ?kaVs V~;wVksfj;y& 00 izSfDVdy & 00 ¼izfr lIrkg 04 ?kaVs½% ,y&Vh&Ikh%

Unit	Topic	No. of Lecture
bdkbZ	**fo"k;**	**O;k[;kuksa dh la[;k**
I	1.1 Introduction, objectives and importance of Applied Botany 1.2 History and evolution of Botany 1.3 Relation of plants to man and relation with other services 1.4 Various disciplines of botany and their aplications to human	12

	welfare.	
I	1-1 ifjp;] mn~ns'; vkSj egRo vuqiz;qDr ouLifrfoKku 1-2 ouLifrfoKku dk bfrgkl vkSj fodkl 1-3 ikni dk euq"; vkSj vU; lsokvksa ds lkFk laca/k 1-4 ouLifrfoKku ds fofHkUu fo"k; vkSj muds ekuo dY;k.k ds fy;s vuqiz;ksx	12
II	1.1 Definition and types of pollution and pollutants 1**.2 Phytoremediation**: Air, water, soil, noise and thermal pollutants (Any 5 plants with botanical name, family) and their role in pollution control. 1.3 Bioremediation: Definition and types	12
II	1-1 iznw"k.k vkSj iznw"kd& ifjHkk"kk vkSj izdkj 1-2 QkbVksjsesfM,'ku% ok;q]ty] feV~Vh 'kksj vkSj FkeZy iznw"kd ¼dksbZ Hkh 5 ikS/ks okuLifrd uke vkSj dqy½ vkSj iznw"k.k fu;a=.k esa mudh HkwfedkA 1-3 ck;ksjsesfM,'ku% ifjHkk"kk vkSj izdkj	12
III	1.1 Ancient agricultural practices. **1.2 Modern agriculture practices:** Polyhouse, Drip irrigation, hydroponics, computer-based agriculture, terrace farming, **1.3 Organic Farming:** Introduction, objective and brief technique **1.4 Horticulture**: Definition and role in human welfare **1.5 Forestry**: Definition, branches and role in human welfare 1**.6 Silviculture**: Definition and management practices	12
III	1-1 izkphu d`f"k i/nfr;k¡ 1-2 vk/kqfud d`f"k i/nfr;k¡% ikWyhgkml] fMªi flapkbZa] gkbMªksiksfuDl] dEI;wVj vk/kkfjr d`f"k] Vsjsl xkMZuA 1-3tSfod [ksrh% ifjp;] mn~ns'; vkSj laf{kIr rduhd 1-4 ckxokuh% ifjHkk"kk vkSj Hkwfedk 1-5 okfudh% ifjHkk"kk] 'kk[kk,sa vkSj ekuo dY;k.k esa Hkwfedk	12

	1-6 flYohdYpj% ifjHkk"kk vkSj izca/ku dk;Z iz.kkyhA	
IV	1.1 Role of Botany in Rural development 1.2 **Ethnobotany**: Introduction and importance **1.3 Ethnomedicine**: Definition and examples. (Local name, Botanical name, family and importance of Neem, Aloe, Clove, Ginger, Tulsi, Turmeric, Giloy, Emblica, Ashwagandha, Arandi) **1.4 Ethno-Fibres**: Definition and examples.(Local name, Botanical name, family and importance of Ankara, Coconut, elephant grass, cotton) **1.5 Ethno- food crops**: Definition and examples.(Local name, Botanical name, family and importance of Garadu, Singada, Kutaki, Sama, Kodo, Bathua, Sehjan, Jowar, Makka, Bajra, Jau)	12
IV	1-1 xzkeh.k fodkl esa ouLifrfoKku dh Hkwfedk 1-2 ekuo ouLifrfoKku¼,FkuksckWVuh½% ifjp; vkSj egRo 1-3 ,FkuksesfMflu% ifjHkk"kk vkSj mnkgj.kA uhe] ,yks;] yksax] vnjd] rqyLkh] gYnh] fxyks;] vk¡oyk] v'oxa/kk vjaMh ¼LFkkuh; uke] okuLifrd uke] dqy vkSj egRo½ 1-4 ,Fkuks&Qkbcj% ifjHkk"kk vkSj mnkgj.kA lqikjh] ukfj;y] gkFkh?kkl] dikl ¼LFkkuh; uke] okuLifrd uke] dqy vkSj egRo ½ 1-5 ,Fkuks&[kk| Qly% ifjHkk"kk vkSj mnkgj.kA xjkMw] fla?kkM+k] dqVdh] lek] dksnksa] cFkqvk] lgtu] Tokj] eDdk] cktjk] tkS ¼LFkkuh; uke] okuLifrd uke] dqy vkSj egRo ½	12
V	**1.1 Plant tissue culture**: Definition, types and Importance. 1**.2 DNA Recombinant technique**: Introducton, tools and importance. 1.3 Role of recombination in present era **1.4 Bioinformatics:** Definition, concept and tools **1.5 Introduction of bioinformatics software**: Basic idea of BLAST	12

	and FASTA Importance of bioinformatics	
V	1-1 ikni Ård lao/kZu% ifjHkk"kk] izdkj vkSj egRoA 1-2 Mh,u, iqu%la;kstd rduhd% ifjp;] vkStkj vkSj egRo] orZeku ;qx esa rduhd dh HkwfedkA 1-3 tSo izkS|ksfxd foKku% ifjHkk"kk] vo/kkj.kk vkSj vkStkj 1-4 tSo lwpuk izkS|ksfxdh foKku lkW¶Vos;j dk ifjp;% BLAST, FASTA 1-5 tSo lwpuk foKku dk egRo eq[; 'kCn% ikni Ård lao/kZu] tSo izkS|ksfxdh foKku] BLAST, FASTA	12

Keywords/Tags: Applied Botany, History of Botany, Evolution of Botany, Botany in human welfare,: Pollution, Pollutants, Phytoremediation, Bioremediation, Hydroponics, polyhouse, Terrace farming, Organic farming, Horticulture, Silviculture, Ethnobotany, Ethnomedicine, Ethno-fibers, Ethno-food crops, Bioinformatics, BLAST, FASTA, Recombinant DNA, Plant tissue culture.

lkj fcUnq ¼dh oMZ½@VSx% vuqiz;qDr ouLifrfoKku] ouLifr foKku dk bfrgkl] ouLifr foKku dk fodkl] ekuo dY;k.k esa ouLifr foKku] iznw"k.k] iznw"kd] ikni mipkj] tSomipkj] gkbMªksiksfuDl] ikWyhgkml] Vsjsl xkMZu] tSfod [ksrh] ckxokuh] flYohdYpj] ekuo ouLifr foKku& ,FukscksVuh] ,Fkuks&Qkbcj] tkrh;&[kk| Qlysa] tSo lwpuk izkS\|ksfxdh] BLAST, FASTA iqu% la;kstd Mh,u,] ikni Ård lao/kZu

Part C- Learning Resources

Hkkx l & vuq'kaflr v/;;u lalk/ku

Text Books, Reference Books, Other resources

ikB~;iqLrdsa] lanHkZ iqLrdsa] vU; lalk/ku

Suggested Readings:

1. Levetin E. and Mcmohan K. " Plants and Society" McGraw Hill Education. 2007
2. Maiti R., Rodriguez H.G. and Thakur A.S. "Applied Botany" American Academic Press. 2017
3. Negi S.S."Forest Botany" M/S Bishen Singh Mafendra Pal Singh. 2012
4. Agrahari R.P. "Environmental Ecology, Biodiversity, Climate Change and Disaster Management" McGrew Hill Education. 2020
5. Sharma D.K. " Biodiversity Conservation: Current Status and Future Strategies" Write and Print Publication. 2017
6. Singh J. "Biodiversity Environment and Sustainability" MD Publication Pvt Ltd. 2008
7. Gupta P.K. " Molecular Biology and Genetics Engineering" Rastogi Publications. 2005
8. Sharma V., Munjal A and Shankar A. "Bioinformatics" Rastogi Publications. 2008

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1- ysosfVu bZ- vkSj eSdeksgu ds- **IykaV~l ,aM lkslkbVh^^ eSd xzks fgy ,tqds'kuA 2007

2- eSrhvkj-] jksfMªXt ,p-th- vkSj Bkdqj ,-,l- **,IykbM ckWVuh^^ vesfjdu ,dsMfed izslA 2017

3- usxh ,l-,l- ^^ ou ouLifr foKku^^ esllZ fc'ku flag ekQsaUnz iky flagA 2012

4- vxzgkjh vkj-ih- ^^ i;kZoj.k ikfjfLFkfrdh] tSo fofo/krk] tyok;q ifjorZu vkSj vkink izca/ku^^ eSd xzks fgy ,tqds'kuA 2020

5- 'kekZ Mh-ds- ^^ tSo fofo/krk laj{k.k% orZeku fLFkfr vkSj Hkfo"; dh j.kuhfr;k¡^^ fy[ks vkSj fizaV izdk'kuA 2017

6- flag ts- ^^ tSo fofo/krk i;kZoj.k vkSj fLFkjrk^^ ,eMh izdk'ku izkbosV fyfeVsMA 2008

7- xqIrk ih-ds- ^^ vkf.od thofoKku vkSj vkuqoaf'kd bathfu;fjax^^ jLrksxh izdk'kuA

2005

8- 'kekZ oh-] eqatky ,- vkSj 'kadj ,- ^^ ck;ksbuQkWjeSfVDl^^ jLrksxh izdk'kuA 2008

Suggested digital platforms web links

vuq'kaflr fMftVy lysQkWeZ osc fyad%

Suggested equivalent online courses:

vuq'kaflr led{k vkWuykbu ikB~;Øe%

Part D- Assessment and Evaluation

Hkkx n & vuq'kaflr ewY;kadu fof/k;k¡

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Internal Assessment: Continuous Comprehensive Evaluation(CCE): 30	Class Test Assignment/ Presentation	20 10 Total = 30
External Assessment: Annual Exam Section: 70 Time: 03.00 Hours	**Section (A):** Five Objective Type Questions **Section (B):** Five Short Answer Type Questions (200 Words each) **Section (C):** Three Long Answer Type Questions (500 Words each)	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 Total = 70

Any remarks/suggestions:

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vf/kdre vad% 100

vkarfjd	Dykl VsLV	20

ewY;kadu% lrr~ O;kid ewY;kadu(CCE) **% 30**	vlkbuesaV@ izLrqrhdj.k	10 dqy vad % 30
vkdyu% okf"kZd ijh{kk % 70 le;& 03-00 ?kaVs	**vuqHkkx ¼v½%** ikWap oSdfYid iz'u **vuqHkkx ¼c½%** ikWap y?kq mRrjh; iz'u ¼izR;sd 200 'kCn½ **vuqHkkx ¼l½%** rhu nh?kZ mRrjh; iz'u ¼izR;sd 500 'kCn½	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 dqy vad = 70

dksbZ fVIi.kh@lq>ko%

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Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

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Part A- Introduction **Hkkx v & ifjp;**			
Program: Certificate dk;ZØe% izek.k i=	Class : B.Sc. I st year d{kk % ch-,l-lh- izFke	Year: 2021 o"kZ% 2021	Session: 2021-22 l=% 2021&22
Subject: Botany **fo"k;% ouLifr'kkL=**			

1	**Course Code**	S1- BOTA1P
	ikB~;Øe dk dksM	S1- BOTA1P
2	**Course Title**	Applied Botany Practical (Paper 1)
	ikB~;Øe dk 'kh"kZd	vuqiz;qDr ouLifr'kkL= izk;ksfxd ¼isij 1½
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Core Course
	ikB~;Øe dk izdkj% ¼dksj dkslZ@bysfDVo@tsusfjd bysfDVo@cksds'kuy@---	dksj dkslZ

	--½		
4	**Pre-requisite (if any)**	To Study this course, a student must have had the subject Biology/Life Sciences/Agriculture in class 12th.	
	iwokZis{kk	bl dkslZ dk v/;;u djus ds fy;s Nk= us ouLifr foKku@thofoKku fo"k; ls d{kk 12 oha v/;;u fd;k gksA	
5	**Course Learning Outcomes (CLO)**	On completion of this course, learners will be able to: By the end of this course the student should have knowledge of practical skill related with ethnobotany, tissue culture, application of bioinformatics software and tools of recombinant DNA technology.	
	ikB~;Øe v/;;u dh ifjyfC/k;ka	bl ikB~;Øe ds var rd Nk= bFkuks ouLifr'kkL=] Ård lao/kZu] tSolwpuk izkS|ksfxdh lkW¶Vos;j dk mi;ksx ,oa fjdkWfEcusUV Mh,u, rduhdh ds vkStkjksa dh izk;ksfxd tkudkjh izkIr dj ysaxsaA	
6	**Course Value**	02 Credit	
	ØsfMV eku	02 ØsfMV	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35
	dqy vad	vf/kdre vad% 30$70	U;wure mRrh.kZ vad% 35

Part B- Content of the course

Hkkx c & ikB~;Øe dh fo"k;oLrq

Total No. of Lectures - 00 Hours Tutorials - 00 Practical - 30 (02 Hours per week):L-T-P:

O;k[;kuksa dh dqy la[;k&00 ?kaVs V~;wVksfj;y& 00 izSfDVdy & 30 ¼izfr lIrkg 02 ?kaVs½% ,y&Vh&Ikh%

Unit	Topic	No. of Lecture
bdkbZ	**fo"k;**	**O;k[;kuksa dh la[;k**
I to V	1. Identification of ethnomedicinal plants. 2. Preparation of soil health card of any agricultural field 3. Study of vermicompost and composting of kitchen waste 4. Use of BLAST and FASTA	30

	5. Prepare the list of important air, water and soil pollutants of local areas 6. **Plant tissue culture technique**: Sterilization, inoculation, culture media, acclimatization and hardening 7. Preparation of list of ethnomedicinal, food, fiber plant locally available 8. **Tools of recombinant DNA technology:** Restriction enzymes, plasmid vectors and other enzymes 9. Study of global warming, acid rain and water quality (pH and Conductivity) 10. Study of local plants grown around agricultural field 11. *Practical can be decided on theory basis according to availability. 12. *Case and field study can be designed accordingly.	
I to V	1. bFkuks okuLifrd ikni dh igpku 2. LFkkuh; d`f"k {ks= dh e`nk LokLF; dkMZ rS;kj djuk 3. oehZdEiksLV o jlksbZ ?kj ls fudys mRlthZ inkFkkZsa dh dEiksfLVax dk v/;;u 4. BLAST, FASTA dk mi;ksx 5. LFkkuh; {ks= ds egRoiw.kZ ok;w] ty o e``nk iznw"kdksa dh lwph rS;kj djuk 6. **ikni Ård lao/kZu**% folaØe.k] bukdqys'ku] lao/kZu ek/;e] vuqdqyu o dBksjrk dk v/;;u 7. LFkkuh; miyC/k bFkuks vkS"k/kh;] [kk| o rarq iznku djus okys ikniksa dh lwph rS;kj djuk 8. **Mh,u, fjdkWfEcusUV rduhdh ds vkStkjksa dk v/;;u%** jsLVªhd'ku ,atkbe] lykfTeM osDVj o vU; ,atkbe 9. oSf'od riu] vEy o"kkZ o ty xq.koRrk¼ih-,p- o dUMfDVfoVh½ dk v/;;u 10. LFkkuh; Lrj ij d`f"k {ks=ksa ds pkjksa vkSj mxus okys ikS/kksa dk v/;;u	30

	11. *miyC/krk o lS/nkafrd vk/kkj ij iz;ksxksa dh lwph cukbZ tk ldrh gSaA 12. *LFkkuh; izd`fr ds vk/kkj ij eSnkuh; {ks=ksa dk v/;;u fd;k tk ldrk gSA	

Keywords/Tags:

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Part C- Learning Resources

Hkkx l & vuq'kaflr v/;;u lalk/ku

Text Books, Reference Books, Other resources

ikB~;iqLrdsa] lanHkZ iqLrdsa] vU; lalk/ku

Suggested Readings:

1. Levetin E. and Mcmohan K. " Plants and Society" Mcgraw Hill Education. 2007
2. Maiti R., Rodriguez H.G. and Thakur A.S. "Applied Botany" American Academic Press. 2017
3. Negi S.S."Forest Botany" M/S Bishen Singh Mafendra Pal Singh. 2012
4. Agrahari R.P. "Environmental Ecology, Biodiversity, Climate Change and Disaster Management" Mcgrew Hill Education. 2020
5. Sharma D.K. " Biodiversity Conservation: Current Status and Future Strategies" Write and Print Publication. 2017
6. Singh J. "Biodiversity Environment and Sustainability" Md Publication Pvt Ltd. 2008
7. Gupta P.K. "Molecular Biology and Genetics Engineering" Rastogi Publications. 2005
8. Sharma V., Munjal A and Shankar A. "Bioinformatics" Rastogi Publications. 2008

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1- ysosfVu bZ- vkSj eSdeksgu ds- **IykaV~l ,aM lkslkbVh^^ eSd xzks fgy ,tqds'kuA 2007

2- eSrhvkj-] jksfMªXt ,p-th- vkSj Bkdqj ,-,l- **,IykbM ckWVuh^^ vesfjdu ,dsMfed izslA 2017

3- usxh ,l-,l- ^^ ou ouLifr foKku^^ esllZ fc'ku flag ekQsaUnz iky flagA 2012

4- vxzgkjh vkj-ih- ^^ i;kZoj.k ikfjfLFkfrdh] tSo fofo/krk] tyok;q ifjorZu vkSj vkink izca/ku^^ eSd xzks fgy ,tqds'kuA 2020

5- 'kekZ Mh-ds- ^^ tSo fofo/krk laj{k.k% orZeku fLFkfr vkSj Hkfo"; dh j.kuhfr;k¡^^ jkbV ,aM fizaV izdk'kuA 2017

6- flag ts- ^^ tSo fofo/krk i;kZoj.k vkSj fLFkjrk^^ ,eMh izdk'ku izkbosV fyfeVsMA 2008

7- xqIrk ih-ds- ^^ vkf.od thofoKku vkSj vkuqoaf'kd bathfu;fjax^^ jLrksxh izdk'kuA 2005

8- 'kekZ oh-] eqatky ,- vkSj 'kadj ,- ^^ ck;ksbuQkWjeSfVDl^^ jLrksxh izdk'kuA 2008

Suggested digital platforms web links

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Suggested equivalent online courses:

vuq'kaflr led{k vkWuykbu ikB~;Øe%

Part D- Assessment and Evaluation

Hkkx n & vuq'kaflr ewY;kadu fof/k;k¡

Suggested Continuous Evaluation Methods:

Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction/ Quiz		Viva Voce on Practical	
Attendance		Practical Record File	
Assignments (Charts/Model/Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visit/ Survey/ Idustrial Visit)		Table Work/ Experiments	
Total 100	**30**		**70**

Any remarks/suggestions:

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vkarfjd ewY;kadu	**vad**	**ckg~;**	**vad**

		ewY;kadu	
d{kk esa laokn@ iz'uksRrjh		izk;ksfxd ekSf[kdh	
mifLFkfr		izk;ksfxd fjdkWMZ Qkby	
vlkbuesaV ¼pkVZ@ekWMy@lsfeukj@xzkeh.k lsok@izkS|ksfxdh izlkj@ Hkze.k¼dLd'kZu½@ fjiksVZ@loZs{k.k@ iz;ksx'kkyk Hkze.k ¼ySc foftV½@ vkS|ksfxd ;k=k½		Vscy odZ@ iz;ksx	
dqy vad 100	**30**		**70**

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Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate ANNUAL Pattern Syllabus of Botany

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2021-22

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Part A- Introduction **Hkkx v & ifjp;**			
Program: Certificate dk;ZØe% izek.k i=	Class : B.Sc. I st year d{kk % ch-,l-lh- izFke	Year: 2021 o"kZ% 2021	Session: 2021-22 l=% 2021&22
Subject: Botany **fo"k;% ouLifr'kkL=**			
1	**Course Code**	S1- BOTA2T	
	ikB~;Øe dk dksM	S1- BOTA2T	

2	**Course Title**	Basic Botany (Paper 2)
	ikB~;Øe dk 'kh"kZd	vk/kkjHkwr ouLifr'kkL= ¼iz'u i= 2½
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Core Course
	ikB~;Øe dk izdkj% ¼dksj dkslZ@bysfDVo@tsusfjd bysfDVo@cksds'kuy@-----½	dksj dkslZ
4	**Pre-requisite (if any)**	To Study this course, a student must have had the subject Biology/Life Sciences/Agriculture in class 12th.
	iwokZis{kk	bl dkslZ dk v/;;u djus ds fy;s Nk= us ouLifr foKku@thofoKku fo"k; ls d{kk 12 oha v/;;u fd;k gksA
5	**Course Learning Outcomes (CLO)**	• This course will help the student to understand the diversity of plants and evolutionary process in plant kingdoms. • It gives accounts of plant adaptation from aquatic condition to colonize terrestrial habitat. • The changes in morphological, anatomical and reproductive structures that propel plant evolution can be investigated. • the economic importance and significance of plants in nature will be understood. • They will be acquainted with locally prevalent microbial diseases of plants and humans.
	ikB~;Øe v/;;u dh ifjyfC/k;ka	• ;g ikB~;Øe fo|kFkhZ dks ikni dh fofo/krk] ikni txr esa fodkloknh izfØ;k dks le>us esa enn djsxkA • ;g tyh; ls LFkyh; vkokl dh LFkkiuk ds fy, ikni ds vuqdwyu dk fooj.k nsrk gSA • ikni ds fodkl dks c<+kok nsus okys vkdkfjdh] vkarfjd vkSj ckgjh lajpuk vkSj iztuu lajpukvksa esa ifjorZu dk v/;;u fd;k tk,xkA • izd`fr esa ikni ds vkfFkZd egRo dks le>k

		tk,xkA • os ikni vkSj ekuo esa lw{etho tfur jksxkssa ls ifjfpr gksaxsA	
6	**Course Value**	04 Credit	
	ØsfMV eku	04 ØsfMV	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35
	dqy vad	vf/kdre vad% 30$70	U;wure mRrh.kZ vad% 35

Part B- Content of the course Hkkx c & ikB~;Øe dh fo"k;oLrq		
Total No. of Lectures - 60 Hours Tutorials - 00 Practical - 00 (04 Hours per week):L-T-P:		
O;k[;kuksa dh dqy la[;k&60 ?kaVs V~;wVksfj;y& 00 izSfDVdy & 00 ¼izfr lIrkg 04 ?kaVs½% ,y&Vh&Ikh%		
Unit	**Topic**	**No. of Lecture**
bdkbZ	**fo"k;**	**O;k[;kuksa dh la[;k**
I	1**.1 History of Botany and Indian Contributions**. 1.2 Morphological characteristics of lower and higher plants (Angiosperms) 1.3 Types of leaves, Inflorescence, Flowers and Fruits. 1.4 Structure of Plant cell and cell organelles, Prokaryotic and Eukaryotic Cells, types of Cell division. 1.5 Microscope structure and function of light microscopes (Magnification and resolving power) 1.6 Various types of Microscopes: Bright field, Phase Contrast, SEM and TEM	12
I	**1-1 ouLifrfoKku vkSj Hkkjrh; ;ksxnku dk bfrgkl** 1-2 fuEu ikni vkSj mPp ikni ¼vko`Rrchth½ dh vkdkfjdhA 1-3 ifRr;ksa ds izdkj] iq"iØe] iq"i vkSj QyA 1-4 ikni dksf'kdk vkSj dksf'kdkax lajpuk& izksdSfj;ksfVd vkSj ;wdsfj;ksfVd dksf'kdk,saA dksf'kdk foHkktu ds izdkjA 1-5 lw{en'khZ lajpuk vkSj izdk'k lw{en'khZ dk dk;Z ¼vko/kZu vkSj foHksnu {kerk½ 1-6 fofHkUu izdkj ds lw{en'khZ% czkbV {ks=lw{en'khZ] Qsl daUVªkLV, SEM vkSj TEMA	12
II	**1 Algae** 1.1 General Characteristics 1.2 Range of thallus organization, reprodution.	12

	1.3 Types of life-cycles in algae. 1.4 Role of algae in nature and its economic importance. **2 Bryophytes** 2.1 General Characteristics, Ecology. 2.2 Range of thallus organization, morphology, anatomy (internal and external features) and reproduction of any one Bryophyte. 2.3 Economic importance of Bryophyes.	
II	**1 'kSoky** 1-1 lkekU; fo'ks"krk,sa 1-2 laxBu vkSj iztuu 1-3 thou&pØ ds izdkj 1-4 izd`fr esa 'kSoky dh Hkwfedk vkSj vkfFkZd egRo **2 czk;ksQkbV~l** 2-1 lkekU; fo'ks"krk,sa 2-2 ikfjfLFkfrdh] FkSyl laxBu] vkdkfjdh] vkarfjd vkSj ckgjh lajpuk vkSj fdlh Hkh ,d czk;ksQkbV~l dk iztuu 2-3 czk;ksQkbV~l dk vkfFkZd egRo	12
III	**1 Pteridophytes** 1.1 General Characteristics and morphology. 1.2 Stelar organization and reproduction. 1.3 Heterospory and seed habit. 1.4 Economical importance. **2 Gymnosperms** 2.1 General description and their distribution. 2.2 Economical importance of Gymnosperms. **3 Paleobotany** 3.1 Indian contribution in Paleobotany. 3.2 Brief knowledge of Fossils and Geological time scale.	12
III	**1 VsfjMksQkbV~l** 1-1 lkekU; fo'ks"krk,sa vkSj vkdkfjdh 1-2 jEHk&ra= laxBu vkSj iztuu	12

	1-3 fo"kechtk.kqrk vkSj cht LoHkko 1-4 vkfFkZd egRo **2 vuko`Rrchth** 2-1 lkekU; fooj.k vkSj forj.k 2-2 vkfFkZd egRo **3 thok'eh; ouLifrfoKku ¼iSfy;ksckWVuh½** 3-1 Hkkjrh; ;ksxnku 3-2 thok'eksa dk laf{kIr Kku vkSj HkwoSKkfud le; lkj.kh	
IV	**1 Fungi** 1.1 General characteristics and cell wall composition. 1.2 Mode of nutrition 1.3 Types of reproduction 1.4 Economics importance 1.5 Parasexuality and Mycorrhiza **2 Lichens:** Brief knowledge and their significance.	12
IV	**1 dod** 1-1 lkekU; fo'ks"krk,sa 1-2 dksf'kdkfHkfRr dh lajpuk vkSj iks"k.k dk rjhdk 1-3 iztuu ds izdkj 1-4 vkfFkZd egRo 1-5 iSjklsDlqvfyVh] dodewy 2 ykbdsu vkSj muds egRo dk laf{kIr KkuA	12
V	**1 Microbes** 1.1 Brief outline of various types of Microbes 1.2 Archaebacteria, Eubacteria, Cynobacteria, Mycoplasma, Actinomycetes and Virus. 1.3 Beneficial and harmful roles.	12
V	**1 lw{etho** 1-1 laf{kIr :ijs[kk 1-2 lw{ethoksa ds izdkj] vkfdZcSDVhfj;k ;wcSDVhfj;k]	12

	lkbukscSDVhfj;k] ekbdksIykTek] ,fDVuksekblsVhl vkSj fo"kk.kq 1-3 ykHkdkjh vkSj gkfudkjd Hkwfedk,saA	

Keywords/Tags: History Of Botany, Paleobotany, Prokaryotes, Eukaryotes, Algae, Bryophyta, Pteridophyta, Gymnosperms, Fungi, Mycorrhiza , Lichens, Bacteria, Virus.

lkj fcUnq ¼dh oMZ½@VSx% ouLifr foKku dk bfrgkl] thok'e ouLifrfoKku] izksdSfj;ksfVd] ;wdsfj;ksfVd] 'kSoky] czk;ksQkbV] VsfjMksQkbVk] vuko`Rrchth] dod] ekbdksjkbtk] ykbdsu] cSDVhfj;k] fo"kk.kq

Part C- Learning Resources

Hkkx l & vuq'kaflr v/;;u lalk/ku

Text Books, Reference Books, Other resources

ikB~;iqLrdsa] lanHkZ iqLrdsa] vU; lalk/ku

Suggested Readings:

1. Oladele Ogunseitan, Microbial Diversity: Form and Function in Prokaryotes, Wiley Blackwell, 2008.
2. Pelczar, M.J.et al., Microbiology, Tata McGraw-Hill Co, New Delhi, 5th Edition, 2001.
3. Presscott, L. Harley, J. and Klein, D., Microbiology, Tata McGraw-Hill Co, New Delhi, 6th Edition, 2005.
4. Fritsch, F.E., The Structure and Reproduction of Algae, Vol. I and II, Cambridge University Press, Cambridge, U.K. 1945.
5. Smith, G.M., Cryptogamic Botany, Vol. I: Algae, Fungi and Lichens, Mc Graw-Hill Book Co., New York, 1955.
6. IanMorris, An Introduction to the Algae, Hutchinson, London, 1967.
7. Alexopoulos, C.J., Mims, C.W. and Blackwell, M., Introductory Mycology, John Wiley and Sons, 1996.
8. Webster, J., Introduction toFungi, Cambridge University Press 2nd edn., 1999.
9. Cavers F., The inter-relationships of the Bryophyta, The New Phytologist, Indian Reprint, Vol. 10, issue 1-2,p.1-21, 1911.
10. Parihar, N.S. An Introduction to Embryophyta: BryoPhyte, Vol.I, Central Book Depot, Allahabad, 1965.

11. Watson, E.V., British Mosses and Liverworts, Cambridge University Press, U.K.,1968.
12. Eames, A.J., Morphology of Vascular Plants: Lower Groups, Mc Graw-Hill Book Co., New York, 1936.
13. Parihar, N.S., An Introduction to Embryophyta: Pteridophyte, Vol.II, Central Book Depot, Allahavad, 1965.
14. Sporne, K.R., The Morphology of Pteridophytes: The Structure of Ferns and Allied Plants, Hutchinson University Library, London, 1970.
15. Bierhorst, D.W., Morphology of Vascular Plants, The Mac Millan Co., N.Y. and Collier- Mac Millan Ltd., London, 1971.
16. Coulter, J.M. and Chamberlain, C.J., Morphology of Gymnosperms Central Book Depot, Allahabad, 1964.
17. Sporne, K.R., The Morphology of Gymnosperms: The Structure and Evolution of Primitive Seed Plants, Hutchinson University Library, London, 1971.
18. Dutta, S.C., An Introduction to Gymnosperms, Kalyani Publishers, NewDelhi, 1984.
19. Sharma, O.P. and Shivani Dixit, Gymnosperms, Pragati Prakashan, Meerut, 2015.
20. Vasishtha, P.C., Botany for Degree Students: Gymnosperms, revised edn., S. Chand and Comp.Ltd., NewDelhi, 2018.
21. Bhatnagar, S.P. and Alok Moitra, Gymnosperms, New age international (P.) Ltd., NewDelhi, 2000.

vuq'kaflr lgk;d iqLrdsa@xazFk@vU; ikB~;lalk/ku@ikB~;lkexzh%

1- vksykMsy vksxulsVu] Microbial Diversity: Form and Function in Prokaryotes, foys CySdosy] vesfjdkA 2008

2- isYtkj] ,e-t-,V vy-] ekbØksck;ksykWth] VkVk eSdxzks&fgy daiuh] ubZ fnYyh] 5 th edn., 2001.

3- izsldkWV] ,y- gkyZs] ts- vkSj Dyhu] Mh-] ekbØksck;ksykWth]VkVk eSdxzks&fgy daiuh] ubZ fnYyh] 6 th edn., 2005

4- fQzV~lp,Q-bZ-] The Sturcture and Reproduction of Algae, Vol.I and Vol. II, dSafczt ;wfuoflZVh izsl] dSafczt] ;w-ds-] 1945-

5- fLeFk] th-,e-] Cryptogamic Botany, Vol.I: Algae, Fungi and Lichens, eSdxzks&fgy cqd daiuh] U;w;kdZ] 1955-

6- b;ku ekWfjl] An Introduction to the Algae, gfpulu fo'ofo|ky; iqLrdky;] yanu] 1967-

7- ,ysDlksiksyksl] lh-t-] ehEl] lh- MCY;w- vkSj CySdosy],e-] Introductory Mycology, tkWu foys ,aM lal] vesfjdk] 1996-

8- oscLVj]ts-] Introduction to Fungi, dSafczt fo'ofo|ky; izsl] ;w-ds- 2nd edn., 1999-

9- dSolZ] ,Q-] The inter-relationships of the Bryophyte, U;w QkbVksYkkWftLV] Hkkjrh; iqueZqnz.k] Vol. 10, issue 1-2,p. 1-21, 1911.

10- ifjgkj] ,u-,l-] An Introduction to Embryophyta: Bryophyte, Vol.I, lsaVªy cqd fMiks] bykgckn] 1965-

11- okVlu] bZ-oh-] British Mosses and Liverworts, dSafczt ;wfuoflZVh izsl] dSafczt] ;w-ds-] 1968-

12- bZEl] ,-ts-] Morphology of Vascular Plants: Lower Groups, eSdxzks&fgy cqd daiuh] U;w;kdZ] 1936-

13- ifjgkj] ,u-,l-] An Introduction to Embryophyta: Pteridophyte, Vol.II, lsaVªy cqd fMiks] bykgckn] 1965-

14- LiksuZ] ds-vkj-] The Morphology of Pteridophytes: The Structure of Ferns and Allied Plants, gfpulu fo'ofo|ky; iqLrdky;] yanu] 1970-

15- fo,jgkLVZ] Mh- MCY;w-] Morphology of Vascular Plants, eSdfeyu daiuh] U;w;kdZ vkSj dksfy;j&eSdfeyu fyfeVsM] yanu] 1971-

16- dksYVj] ts-,e- vkSj psEcjfyu] lh-ts-] Morphology of Gymnosperms, lsaVªy cqd fMiks] bykgckn] 1964-

17- LiksuZ] ds-vkj-] The Morphology of Gymnosperms: The Structure and Evolution of Primitive Seed Plants, gfpulu fo'ofo|ky; iqLrdky;] yanu] 1971-

18-nRrk],l-lh-] An Introduction to Gymnosperms, dY;k.kh izdk'kd] ubZ fnYyh] 1984-

19- 'kekZ] vks-ih- vkSj f'kokuh nhf{kr] Gymnosperms, izxfr izdk'ku] esjB] 2015-

20- of'k"B] ih-lh-] Botany for Degree Students: Gymnosperms, revised edn., ,l-pkan ,aM dkW-fyfeVsM] ubZ fnYyh] 2018-

21- HkVukxj] ,l-lh- vkSj vkyksd eksb=k] Gymnosperms, U;w ,t baVjus'kuy ¼ih-½fyfeVsM] ubZ fnYyh] 2000-

Suggested digital platforms web links

vuq'kaflr fMftVy lysQkWeZ osc fyad%

Suggested equivalent online courses:

vuq'kaflr led{k vkWuykbu ikB~;Øe%

Part D- Assessment and Evaluation

Hkkx n & vuq'kaflr ewY;kadu fof/k;k¡

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Internal Assessment: Continuous Comprehensive Evaluation(CCE): 30	Class Test Assignment/ Presentation	20 10 Total = 30
External Assessment: Annual Exam Section: 70 Time: 03.00 Hours	**Section (A):** Five Objective Type Questions **Section (B):** Five Short Answer Type Questions (200 Words each) **Section (C):** Three Long Answer Type Questions (500 Words each)	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 Total = 70

Any remarks/suggestions:

vuq'kaflr lrr~ ewY;kadu fof/k;k¡%

vf/kdre vad% 100

vkarfjd ewY;kadu% lrr~ O;kid ewY;kadu(CCE) **% 30**	Dykl VsLV vlkbuesaV@ izLrqrhdj.k	20 10 dqy vad % 30

vkdyu% okf"kZd ijh{kk % 70 le;& 03-00 ?kaVs	**vuqHkkx ¼v½%** ikWap oSdfYid iz'u **vuqHkkx ¼c½%** ikWap y?kq mRrjh; iz'u ¼izR;sd 200 'kCn½ **vuqHkkx ¼l½%** rhu nh?kZ mRrjh; iz'u ¼izR;sd 500 'kCn½	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 dqy vad = 70

dksbZ fVIi.kh@lq>ko%

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

izk;ksfxd iz'ui= ds ikB~;Øe

Part A- Introduction **Hkkx v & ifjp;**			
Program: Certificate dk;ZØe% izek.k i=	Class : B.Sc. I st year d{kk % ch-,l-lh- izFke	Year: 2021 o"kZ% 2021	Session: 2021-22 l=% 2021&22

Subject: Botany **fo"k;% ouLifr'kkL=**		
1	**Course Code**	S1- BOTA2P
	ikB~;Øe dk dksM	S1- BOTA2P
2	**Course Title**	Basic Botany Practical (Paper 2)
	ikB~;Øe dk 'kh"kZd	vk/kkjHkwr ouLifr'kkL= izk;ksfxd ¼isij 2½
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Core Course
	ikB~;Øe dk izdkj% ¼dksj dkslZ@bysfDVo@tsusfjd bysfDVo@cksds'kuy@-----½	dksj dkslZ
4	**Pre-requisite (if any)**	To Study this course, a student must have had the subject Biology/Life Sciences/Agriculture in class 12th.

	iwokZis{kk	bl dkslZ dk v/;;u djus ds fy;s Nk= us ouLifr foKku@thofoKku fo"k; ls d{kk 12 oha v/;;u fd;k gksA	
5	**Course Learning Outcomes (CLO)**	• students will learn to carry out practical work in the laboratory. • Interpreting plant morphology and anatomy of varous groups of lower and higher plants. • Students will be able to identify the major groups of microorganisms.	
	ikB~;Øe v/;;u dh ifjyfC/k;ka	• fo|kFkhZ iz;ksx'kkyk esa O;kogkfjd dk;Z djuk lh[ksaxs • fuEu ikni vkSj mPp ikni ds fofHkUu lewgksa ds vkarfjd vkSj ckg~; lajpuk dh O;k[;k djukA • fo|kFkhZ lw{ethoksa ds izeq[k lewgksa dh igpku djus esa l{ke gksaxsA	
6	**Course Value**	02 Credit	
	ØsfMV eku	02 ØsfMV	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35
	dqy vad	vf/kdre vad% 30$70	U;wure mRrh.kZ vad% 35

Part B- Content of the course

Hkkx c & ikB~;Øe dh fo"k;oLrq

Total No. of Lectures - 00 Hours Tutorials - 00 Practical - 30 (02 Hours per week):L-T-P:

O;k[;kuksa dh dqy la[;k&00 ?kaVs V~;wVksfj;y& 00 izSfDVdy & 30 ¼izfr lIrkg 02 ?kaVs½% ,y&Vh&Ikh%

Unit	Topic	No. of Lecture
bdkbZ	**fo"k;**	**O;k[;kuksa dh la[;k**
I to V	1. Study of various types of leaves, inflorescence, flowers and fruits. 2. Understanding various parts of Microscope (Simple and compound microscope)	30

	3. Study of plant cells (e.g. Onion etc.) 4. Study of permanent slides of Mitosis and Meiosis 5. Study of Electron Micrographs of cell and organelles from internet, you-tube. 6. Identification of various algae from specimens, slides and temporary mounts of water from near by areas like- *Nostoc, Oscillatoria, Volvox, Spirogyra, Oedogonium, Chara,* and pictographs of marine algae like - *Ectocarpus, Sargassum, Polysiphonia.* 7. Study and identification of some Bryophytes like- *Riccia, Marchantia, Anthoceros, Funaria* and Field visit. 8. Study of some fossils (Specimens and slides) 9. Study of some Pteridophytes like- *Lycopodium, Sellaginella, Equisetum, Marselia* and study of any one fern. 10. Section cutting of Pteridophytes and Gymnosperms: Stem, root and leaves. 11. Specimen study of Pteridophytes and Gymnosperms cones. 12. Study of fungal structures and preparation of temporary mounts of *Mucor, Rhizopus, Aspergillus, Yeast, Pencillium, Alternaria, Albugo, Helimenthosporium*. 13. Permanent slides of *Puccinia* on host. 14. Study of various fungal plant diseases. 15. Observation of symptoms of virus and bacteria on plants. 16. Gram staining techniques.	
1 ls 5 rd	1. fofHkUu izdkj dh ifRr;ksa] iq"iØeksa] iq"i vkSj Qyksa dk v/;;uA 2. lw{en'khZ ds fofHkUu Hkkxksa dks le>uk ¼ljy vkSj la;qDr lw{en'khZ½ 3. ikni dksf'kdkvksa dk v/;;u ¼tSls I;kt dh dksf'kdk vkfn½ 4. lelw=h foHkktu vkSj v/kZlw=hfoHkktu dh LFkk;h LykbMksa dk v/;;u	30

	5. baVjusV] ;w&V~;wc ls ikni dksf'kdk vkSj dksf'kdkax ds bysDVªkWu ekbØksxzkQ dk v/;;uA 6. LFkk;h LykbM vkSj vkl&ikl ds {ks=ksa ls ikuh ds vLFkk;h ekmaV ls fofHkUu 'kSoky dh igpku tSls & uksLVkWd] vkslhysVksfj;k] okWyokWDl] Likbjksxkbjk] mMksxksfu;e] dkjk vkSj uewus tSls leqnzh 'kSoky dsfiDVksxzkQ vkSj ,DVksdkiZl] ljxkle] ikWyhlkbZQksfu;k dk v/;;uA 7. dqN czk;ksQkbV~l dk v/;;u vkSj igpku tSls& fjfDl;k] ekdZsfU'k;k] ,saFkksfljksl] ¶;wusfj;k vkSj QhYM v/;;uA 8. dqN thok'eksaa dk v/;;u ¼izn'kkZs vkSj LykbM½ 9. dqN VsfjMksQkbV dk v/;;u tSls & ykbdksiksfM;e] flysftusyk] bfDoflVe] eklsZfy;k vkSj fdlh Hkh ,d QuZ dk v/;;u 10. VsfjMksQkbV~l vkSj ftEuksLieZ% ruk] tM+ vkSj ifRr;ksa dk vuqizLFk dkV dk v/;;u 11. VsfjMksQkbV~l vkSj ftEuksLieZ ds 'kadq dk v/;;uA 12. dodh; lajpukvksa dk v/;;u vkSj vLFkk;h LykbM dk v/;;u% E;wdj] jkbtksil] ,Lijftyl] ;hLV] isfuflfy;e] vYVjusfj;k] vYCkwxks] gsfyesaFkksLiksfj;e 13. iks"kd ij idlhfu;k dh LFkk;h LykbM dk v/;;uA 14. fofHkUu dodh; ikS/kksa ds jksxksa dk v/;;u 15. ikS/kksa ij fo"kk.kq] thok.kq ds y{k.kksa dk voyksdu 16. xzke vfHkjatu rduhdA	

Keywords/Tags: Microscope, Algae, Brophytes, Pteridophytes, Gymnosperms, Fungi.

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Part C- Learning Resources

Hkkx l & vuq'kaflr v/;;u lalk/ku

Text Books, Reference Books, Other resources

ikB~;iqLrdsa] lanHkZ iqLrdsa] vU; lalk/ku

Suggested Readings:

1. Bendre Ashok and Ashok Kumar, A Text Book of Practical Botany, Vol. I, Rastogi Pub., Meerut, 1984.
2. Pandey, B.P., Modern Practical Botany, Vol. I, S. Chand and Co. Ltd. NewDelhi, 17 th edn., 1999.
3. Singh, M.P., Choudhary, S.B. and Sahu, H.B., Text book of Practical Botany, Daya Pub. House, NewDelhi, 2005.
4. Shahezad, Akil Mohd., Practical Botany, Shanti Prakashan, Gwalior, 2016.
5. Elizabeth, Margaret and Angela, G., Practical mannual of Botany, Vol. I, New Age (Pub) Ltd., Delhi. 2007

vuq'kaflr lgk;d iqLrdsa@xazFk@vU; ikB~;lalk/ku@ikB~;lkexzh%

1- csanzs v'kksd vkSj v'kksd dqekj] A Text Book of Practical Botany, Vol. I, jLrksxh izdk'ku] esjB] 1984-

2- ikaMs] ch-ih-] Modern Practical Botany, Vol. I, ,l-pkan ,aM daiuh fyfeVsM] ubZ fnYyh] 17 oh- ,Mh'ku] 1999-

3-flag] e-i-] pkS/kjh] ,l-ch- vkSj lkgw] ,p-ch- Text book of Practical Botany, n;k izdk'ku gkml] ubZ fnYyh] 2005-

4- 'kgktkn] vdhy eksgEen] Practical Botany, 'kkafr izdk'ku] Xokfy;j] 2016-

5- ,fytkcsFk] ekxZjsV vkSj ,atsyk] th-] Practical mannual of Botany, Vol. I , U;w,st izdk'ku fyfeVsM] fnYyh] 2007-

Suggested digital platforms web links

vuq'kaflr fMftVy lysQkWeZ osc fyad%

Suggested equivalent online courses:

vuq'kaflr led{k vkWuykbu ikB~;Øe%

Part D- Assessment and Evaluation

Hkkx n & vuq'kaflr ewY;kadu fof/k;k¡

Suggested Continuous Evaluation Methods:

Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction/ Quiz		Viva Voce on Practical	
Attendance		Practical Record File	
Assignments (Charts/Model/Seminar/ Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visit/ Survey/ Idustrial Visit)		Table Work/ Experiments	
Total 100	**30**		**70**

Any remarks/suggestions:

vuq'kaflr lrr~ ewY;kadu fof/k;k¡%

vkarfjd ewY;kadu	**vad**	**ckg~; ewY;kadu**	**vad**
d{kk esa laokn@ iz'uksRrjh		izk;ksfxd ekSf[kdh	
mifLFkfr		izk;ksfxd fjdkWMZ Qkby	
vlkbuesaV ¼pkVZ@ekWMy@lsfeukj@xzkeh.k lsok@izkS|ksfxdh izlkj@ Hkze.k¼dLd'kZu½@ fjiksVZ@loZs{k.k@ iz;ksx'kkyk Hkze.k ¼ySc foftV½@ vkS|ksfxd ;k=k½		Vscy odZ@ iz;ksx	

dqy vad 100	**30**		**70**

dksbZ fVIi.kh@lq>ko% Vscy dk;Z@ iz;ksx LFkkuh; Lrj ij miyC/k lalk/ku ij vk/kkfjr gksaxsA

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

lS/nkafrd iz'ui= ds ikB~;Øe

Part A- Introduction **Hkkx v & ifjp;**			
Program: Certificate dk;ZØe% izek.k i=	Class : B.Sc. I st year d{kk % ch-,l-lh- izFke	Year: 2021 o"kZ% 2021	Session: 2021-22 l=% 2021&22

Subject: Botany **fo"k;% ouLifr'kkL=**		
1	**Course Code**	S1- BOTA1G
	ikB~;Øe dk dksM	S1- BOTA1G
2	**Course Title**	**Nursery Management**
	ikB~;Øe dk 'kh"kZd	**ulZZjh izca/ku**
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Elective
	ikB~;Øe dk izdkj% ¼dksj dkslZ@bysfDVo@tsusfjd bysfDVo@cksds'kuy@-----½	bysfDVo
4	**Pre-requisite (if any)**	**This Course can be opted as an elective by the students of all faculty/ Oper for all.**
	iwokZis{kk	**bl ikB~;Øe dks lHkh fo"k;ksa ds Nk=ksa }kjk ,d oSdfYid fo"k; ds :i esa pquk tk ldrk gSA lHkh ds fy;s miyC/k A**

5	**Course Learning Outcomes (CLO)**	• It is directly related with entrepreneurship development at small and large scale. • It gives an opportunity to understand the methods of propagation, techniques of implementation, advance knowledge of micro propagation including commercial management practices. • High-tech nursery establishment as a venture is possible after completing this course. • It also provides skills of practical application for nursery establishment and related businesses such as marketing of coco pear, compost, green manure, soil media and perlite etc.	
	ikB~;Øe v/;;u dh ifjyfC/k;ka	• ;g izR;{k :i ls y?kq vkSj o`gn~ Lrj ij m|ferk ls lacaf/kr gSA • ;g izlkj.k ds fof/k;ksa] rduhdksa dh dk;kZUo;u] lw{eizo/kZu ds mUur Kkuokf.kfT;d izca/ku fof/k lfgr lw{e izlkj ds vfxze Kku le>us dk volj nsrk gSA • bl ikB~;Øe dks iwjk djus ds ckn m|e ds :i esa gkbZVsd ulZjh dh LFkkiuk laHko gSA • ;g ulZjh LFkkiuk vkSj lacaf/kr O;olk;ksa tSls dksdksihV] [kkn] gjh [kkn] e`nk ehfM;k vkSj isykZbV vkfn ds foi.ku ds fy;s O;kogkfjd vuqiz;ksx dk dkS'ky Hkh iznku djrk gSA	
6	**Course Value**	04 Credit	
	ØsfMV eku	04 ØsfMV	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35
	dqy vad	vf/kdre vad% 30$70	U;wure mRrh.kZ vad% 35
Part B- Content of the course **Hkkx c & ikB~;Øe dh fo"k;oLrq**			
Total No. of Lectures - 60 Hours Tutorials - 00 Practical - 00 (02 Hours per week):L-T-P:			
O;k[;kuksa dh dqy la[;k&60 ?kaVs V~;wVksfj;y& 00 izSfDVdy & 00 ¼izfr			

lIrkg 02 ?kaVs½% ,y&Vh&Ikh%		
Unit	**Topic**	**No. of Lecture**
bdkbZ	**fo"k;**	**O;k[;kuksa dh la[;k**
I	Introduction to nursery 1.1 Introduction, Nursery tools and containers, Types of nursery. 1.2 Nursery techniques. 1.3 Factors affecting plant growth, Plant growth regulators. 1.4 Introduction to landscaping and Lawn making. 1.5 Special practices in nursery management- Micro propagation (in vitro cultue), Soilless culture.	15
I	jksi.k dk ifjp; 1-1 ifjp;] ulZjh midj.k vkSj xeys] ulZjh ds izdkj 1-2 ulZjh rduhdsa 1-3 ikS/kksa dh o`f/n dks izHkkfor djus okys dkjd] ikni o`f/n fu;ked 1-4 yS.MLdsi vkSj ykWu cukus dk ifjp; 1-5 ulZjh izca/ku dh fo'ks"k fof/k& lw{eizo/kZu ¼ikni Ård lao/kZu@bufoVªks dYpj½ e`nk jfgr lao/kZuA	15
II	Vegetative Propagation- 1.1 Plant propagation- Importance, advantages, methods and classification. 1.2 Propagation through stolons, runners, offsets, bulbs, corns, rooted crowns, division, cuttings, layering. 1.3 Grafting and budding. 1.4 Rootstock-scion relationship. Top working.	15
II	dkf;d izlkj& 1-1 ykHk] fof/k;k¡ vkSj oxhZdj.k 1-2 LVksyu] juj] vkWQlsV] cYc] dkWeZ] :VsM Økmu] foHkktu] dye] nkc ds ek/;e ls izlkj 1-3 dey cka/kus vkSj dfydk;u	15

	1-4 ewy Ldan& VkWi ofdZax	
III	Regular nursery management- 1.1 Nursery site selection, layout , record keeping 1.2 Nursery structures, seed treatments 1.3 Soil preparation, potting, repotting 1.4 Preparation of nusery beds and sowing of seeds 1.5 Progeny orchard establishment and management.	15
III	fu;fer ulZjh izca/ku& 1-1 ulZjh lkbV& LFkku] p;u] vfHkfoU;kl] vfHkys[k la/kkju 1-2 ulZjh lajpuk,a] cht mipkj 1-3 feV~Vh dh rS;kjh] ikWfVax] fjiksfVax 1-4 ulZjh csM rS;kj djuk vkSj cht cksuk 1-5 larfr ckxksa dh LFkkiuk ,oa izca/ku	15
IV	Commercial nusery management 1.1 Nursery management of major crops in India. 1.2 Nursery accreditation and certification. 1.3 Problems in nursery management and its control 1.4 Pest and disease management. 1.5 Hi-tech nursery establishment and management. 1.6 Marketing strategies.	15
IV	O;kolkf;d ulZjh izca/ku 1-1 Hkkjr esa izeq[k Qlyksa dk ulZjh izca/ku 1-2 ulZjh izR;k;u vkSj izek.ku 1-3 ulZjh izca/ku vkSj mlds fu;a=.k esa leL;k,sa 1-4 dhV ,oa jksx izca/ku 1-5 gkbZVsd ulZjh dh LFkkiuk vkSj izca/ku 1-6 foi.ku j.kuhfr;k¡A	15
Keywords/Tags: Nursery Tools, Nursery Techniques, Landscaping, Vegetative Propagation, Plant Tissue Culture, Seed Treatment, Progeny Orchard, Pest and Disease Management, Marketing.		

lkj fcUnq ¼dh oMZ½@VSx% ulZjh vkStkj] ulZjh rduhd] ySaMLdsfiax] dkf;d izo/kZu] ikni Ård lao/kZu] ulZjh lajpuk,sa] cht mipkj] larfr ckx] izek.ku] dhV vkSj jksx izca/ku] foi.ku j.kuhfr;k¡] gkbZVsd ulZjhA

Part C- Learning Resources

Hkkx l & vuq'kaflr v/;;u lalk/ku

Text Books, Reference Books, Other resources

ikB~;iqLrdsa] lanHkZ iqLrdsa] vU; lalk/ku

Suggested Readings:

1. Singh Jitendra, Basic Horticulture, Kalyani Publications, New Delhi, 2011
2. Kirad K.S., Barche Swati and Gupta N.K., Fundamentals of Horticulture, Brillion Publishing, New Delhi, 2018
3. Chaddha K.L., Hand Book of Horticulture, (ICAR) ICAR, NewDelhi, 2001
4. Hartmann H.T. and Kester D.E., Plant Propagation Principles and practices, Prentice Hall of India Pvt. Ltd. Bombay, 1976
5. Saiprasad S.V., Shridhar, Iqbal Sanjeeda and Choudhary J., Agri-facts Objective Horticulture, New Vishal Publication, New Delhi, 2017

vuq'kaflr lgk;d iqLrdsa@xazFk@vU; ikB~;lalk/ku@ikB~;lkexzh%

1- flag ftrsanz] csfld gkWfVZdYpj] dY;k.kh izdk'ku] ubZ fnYyh] 2011

2- fdjkM ds-,l-] ckjps Lokfr vkSj xqIrk ,u-ds-] ckxokuh ds ewy fl/nkar] fczfy;u izdk'ku] ubZ fnYyh] 2018

3- pM~<k ds-,y-] ckxokuh dh iqfLrdk] vkbZlh,vkj¼vkbZlh,vkj½] ubZfnYyh] 2001

4- gkVZeSu ,p-Vh- vkSj dsLVj Mh-bZ-] ikni izlkj fl/nkar vkSj izFkk,sa] izsafVl gkWy vkWQ bafM;k izkbosV fyfeVsM] ckEcs] 1976

5- lkbZa izlkn ,l-oh-] Jh/kj] bdcky lathnk] pkS/kjh ts-] d`f"krF; mn~ns';& ckxokuh] U;w fo'kky izdk'ku] ubZ fnYyh] 2017

Suggested digital platforms web links

vuq'kaflr fMftVy lysQkWeZ osc fyad%

Suggested equivalent online courses:

vuq'kaflr led{k vkWuykbu ikB~;Øe%

Part D- Assessment and Evaluation
Hkkx n & vuq'kaflr ewY;kadu fof/k;k¡

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Internal Assessment: Continuous Comprehensive Evaluation(CCE): 30	Class Test Assignment/ Presentation	20 10 Total = 30
External Assessment: Annual Exam Section: 70 Time: 03.00 Hours	**Section (A):** Five Objective Type Questions **Section (B):** Five Short Answer Type Questions (200 Words each) **Section (C):** Three Long Answer Type Questions (500 Words each)	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 Total = 70

Any remarks/suggestions:

vuq'kaflr lrr~ ewY;kadu fof/k;k¡%

vf/kdre vad% 100

vkarfjd ewY;kadu% lrr~ O;kid ewY;kadu(CCE) **% 30**	Dykl VsLV vlkbuesaV@ izLrqrhdj.k	20 10 dqy vad % 30
vkdyu% okf"kZd ijh{kk % 70 le;& 03-00 ?kaVs	**vuqHkkx ¼v½%** ikWap oSdfYid iz'u **vuqHkkx ¼c½%** ikWap y?kq mRrjh; iz'u ¼izR;sd 200 'kCn½ **vuqHkkx ¼l½%** rhu nh?kZ mRrjh; iz'u ¼izR;sd 500 'kCn½	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 dqy vad = 70

dksbZ fVIi.kh@lq>ko%

Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

lS/nkafrd iz'ui= ds ikB~;Øe

Part A- Introduction **Hkkx v & ifjp;**			
Program: Certificate dk;ZØe% izek.k i=	Class : B.Sc. I st year d{kk % ch-,l-lh- izFke	Year: 2021 o"kZ% 2021	Session: 2021-22 l=% 2021&22

Subject: Botany **fo"k;% ouLifr'kkL=**		
1	**Course Code**	S1- BOTA2G
	ikB~;Øe dk dksM	S1- BOTA2G
2	**Course Title**	**Herbal Cosmetics**
	ikB~;Øe dk 'kh"kZd	**gcZy dkWLesfVDl**
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/...)**	Elective
	ikB~;Øe dk izdkj% ¼dksj dkslZ@bysfDVo@tsusfjd bysfDVo@cksds'kuy@-----½	bysfDVo
4	**Pre-requisite (if any)**	**This Course can be opted as an elective by the students of all faculty/ Oper for all.**
	iwokZis{kk	**bl ikB~;Øe dks lHkh fo"k;ksa ds Nk=ksa }kjk ,d oSdfYid fo"k; ds :i esa pquk tk ldrk gSA lHkh ds fy;s miyC/k A**
5	**Course Learning Outcomes (CLO)**	• Students will learn about raw materials used in herbal cosmetics including the skin and hair care, herbal products preparation and their evaluation. • Students can seek the opportunity of setting up their own business of herbal cosmetics after this course.
	ikB~;Øe v/;;u dh ifjyfC/k;ka	• Ropk vkSj ckyksa dh ns[kHkky ds fy;s iz;ksx gksus okys gcZy lkSan;Z izlk/kuksa esa iz;qDr dPps eky] gcZy mRiknksa dh rS;kjh vkSj muds ewY;kadu

		ds ckjs esa fo|kFkhZ tkusaxsA • fo|kFkhZ bl ikB~;Øe dks iw.kZ djus ds ckn gcZy lkSan;Z izlk/kuksa dk viuk O;olk; LFkkfir djus ds volj dh ryk'k dj ldrs gSaA	
6	**Course Value**	04 Credit	
	ØsfMV eku	04 ØsfMV	
7	**Total Marks**	Max. Marks: 30+70	Min. Passing Marks: 35
	dqy vad	vf/kdre vad% 30$70	U;wure mRrh.kZ vad% 35

Part B- Content of the course

Hkkx c & ikB~;Øe dh fo"k;oLrq

Total No. of Lectures - 60 Hours Tutorials - 00 Practical - 00 (02 Hours per week):L-T-P:

O;k[;kuksa dh dqy la[;k&60 ?kaVs V~;wVksfj;y& 00 izSfDVdy & 00 ¼izfr lIrkg 02 ?kaVs½% ,y&Vh&Ikh%

Unit	Topic	No. of Lecture
bdkbZ	**fo"k;**	**O;k[;kuksa dh la[;k**
I	1.1 Cosmetics- Classification and categories 1.2 Brief history of herbal cosmetics 1.3 Difference between herbal and synthetic cosmetic products, benefits of herbal cosmetic products. 1.4 Challenges in formulating herbal cosmetics.	15
I	1-1 izlk/ku lkexzh& oxhZdj.k vkSj Jsf.k;k¡ 1-2 gcZy lkSan;Z izlk/kuksa dk laf{kIr bfrgkl 1-3 gcZy vkSj flaFksfVd dkWLesfVd mRiknksa ds chp varj] gcZy dkWLesfVd mRiknksa ds ykHk 1-4 gcZy lkSan;Z izlk/ku rS;kj djus esa pqukSfr;k¡	15
II	1.1 Raw materials, Machinery and Equipments used in preparation of herbal cosmetics	15

	1.2 Processes used in the manufacture of herbal cosmetics 1.3 Plants used in skin care products like scrub, 'ubtan', packs, moisturizer etc. 1.4 Plants used in hair care products like oil, shampoo, conditioner hair tonic etc.	
II	1-1 gcZy lkSan;Z izlk/kuksa dh rS;kjh esa iz;qDr dPps eky] e'khujh vkSj midj.k 1-2 gcZy lkSan;Z izlk/kuksa ds fuekZ.k esa iz;qDr izfØ;k;sa 1-3 Ropk ns[kHkky mRiknksa tSls LØc] mcVu] iSd] ekWbLpjkbtj bR;kfn esa mi;ksx fd;s tkus okys ikS/ks 1-4 ckyksa dh ns[kHkky ds mRiknksa esa mi;ksx fd;s tkus okys ikS/ks tSls& rsy] 'kSEiw] daMh'kuj] gs;j VkWfud vkfnA	15
III	1.1 Preparation of - Scrub, face packs, vanishing cream, face wash, soap, moisturizer, talcum powder, sunscreen. 1.2 Preparation of - Shampoo, hair oil, hair conditioners, hair dye. 1.3 Preparation of - toothpaste, toothpowder, 'Kajal', nail polish, lipstick, lipbalm, deodorant, shaving cream, after shave solution.	15
III	1-1 LØc] Qsl iSd] oSafuf'kax Øhe] QslokW'k] lkcqu] ekWbLpjkbtj] VSYde ikmMj] luLØhu rS;kj djuk 1-2 'kSEiw] gs;j vkW;y] gs;j daMh'kuj] gs;j MkbZ rS;kj djuk 1-3 VwFk isLV] VwFk ikmMj] dkty] usy ikWfy'k] fyifLVd] fyicke] fMvksMksjsaV] 'ksfoax Øhe] vkW¶Vj 'kso lkWY;w'ku rS;kj djukA	15
IV	1.1 Introduction to Aromatherapy, Plants used aromatherapy 1.2 Methods of extraction of essential oils. 1.3 Sanitary practices in cosmetic manufacturing. 1.4 Basic idea of storage of raw material, pre production preparation, production management, packaging and labeling, marketing and	15

	pricing of herbal cosmetics. 1.5 Quality assurance, ISO certification.	
IV	1-1 vjksekFksjsih dk ifjp;] vjksekFksjsih esa bLrseky gksus okys ikS/ks 1-2 ,lsaf'k;y vkWby ds fu"d"kZ.k ds rjhds 1-3 dkWLesfVd fuekZ.k esa LoPNrk vH;kl 1-4 dPps eky ds HkaMkj.k] iwoZ&mRiknu dh rS;kjh] mRiknu izca/ku iSdsftax vkSj ysofyax] gcZy lkSan;Z izlk/kuksa ds foi.ku vkSj ewY; fu/kkZj.k dk ewy fopkj 1-5 xq.koRrk vk'oklu] vkbZ,lvks izek.kuA	15

Keywords/Tags: Cosmetics, formulation of herbal cosmetics, Herbal cosmetics, skin care products, hair care products, scrub, sunscreen, conditoner, aromatherapy, essential oils, packaging, marketing.

lkj fcUnq ¼dh oMZ½@VSx% izlk/ku lkexzh] Jsf.k;k¡] gcZy izlk/kuksa dk QkeZwys'ku] gcZy lkSan;Z izlk/ku] iz;qDr dPps eky] Ropk ,oa ckyksa dh ns[kHkky ds mRikn] LØc] luLØhu] daMh'kuj] vjksekFksjsih] ,lsaf'k;y vkWby] iSdsftax] foi.ku

Part C- Learning Resources

Hkkx l & vuq'kaflr v/;;u lalk/ku

Text Books, Reference Books, Other resources

ikB~;iqLrdsa] lanHkZ iqLrdsa] vU; lalk/ku

Suggested Readings:

1. Classification of cosmetic raw materials and adjuncts IS3958 of Indian Standard.
2. Smith R.V., Stewart J.T. Text book of Bio Pharmaceutical analysis, Lia and Febiger, Philadelphia, 1982.
3. Behl P.N., Shrivastava G., Herbs useful in dermatiological therapy, CBS, 2002.
4. Karnik C.R. Pharmacopoeia standards of herbs, Shri Satguru Publications Delhi, 1994.
5. Bore P. Cosmtics analysis: Selective methods with techniques, Marcel Dekker, 1985.
6. Sharma P.P. Cosmetics- Formulation, Manufacturing and Quality Control, Vandana Publications, 2014.
7. Panda H. Herbal Cosmetics handbook, Asia Pacific Business press, 2015.

8. Chattopadhyay P.K. Herbal cosmetics and ayurvedic medicines, National Institute of Industrial research, 2008.
9. Panda H. The complete technology book on herbal perfumes and cosmetics, NIIR Project consultancy services, 2012.
10. Kirtikar K.R. and Basu B.D. 8 volume Indian medicinal plants, Bio-Green Books, 2012.
11. Drugs and cosmetics acts and rules Govt of India Publications.
12. Guenther Ernest Vol I the Essential Oils, Ingram short title, 2007.
13. Indian Standard Institution Booklets.
14. Nadkarni K.M. Indian Materia Medica, Popular Prakashan, 1994.
15. Wealth of India C.S.I.R.
16. Shrivastava S.B., Perfume Flavour and Essential Oil Industries, Small Industry Research Institute.
17. Das Kuntal, Herbal Plants and their Application in cosmaceuticals, CBS Publication, 2014.
18. Krishnamurthy K.H., Ayurvedic Technical Studies and Herbal Cosmetics of Ancient India, B.R. Publishing Corporation, 2001.
19. Chopra R.N., Nayar S.L., Chopra L.C., Glossary of Indian Medicinal Plants, National Institute of Science Communication and Information Resources, 1956.
20. Saxena Rajan, Marketing Management, McGraw Hill Education, 2009
21. Saraf Swarnlata, Saraf Shailendra, Cosmetics a practical manual, 2015, BSP Books Pvt. Ltd.
22. EIRI Board, Herbal Cosmetics and Beauty Products with formulations, Engineers India Research Institute, 2015.
23. NIIR Board, Handbook on herbal products National Institute of Industrial Research, 2002.

vuq'kaflr lgk;d iqLrdsa@xazFk@vU; ikB~;lalk/ku@ikB~;lkexzh%

1- Hkkjrh; ekud ds DlkflfQds'ku vkWQ dkWLesfVd jkW eSVsfj;Yl ,aM ,MtaDVl IS3958

2- fLeFk vkj=oh-] LVhoVZ ts-Vh-] VsDLV cqd vkWQ ck;ks QkekZL;qfVdy ,ukfyfll] fy;k ,aM Qsfcxj] fQykMsfYQ;k] 1982A

3-cgy ih-,u-] JhokLro th-] gClZ ;wtQqy bu MeZsVksykWftdy Fksjsih] lhch,l] 2002A

4- dkf.kZd lh-vkj-] QkekZdksfi;k LVSaMM~lZ vkWQ gClZ] Jh lrxq: izdk'ku] fnYyh] 1994A

5- cksj ih-] dkWLesfVd ,ukfyfll% lsysfDVo esFkM~l foFk VsfØDl] eklZsy Msdj] 1985A

6- 'kekZ ih-ih-] dkWLesfVd&QkeZwys'ku] eSU;qQSDpfjax ,aM DokfyVh daVªksy] oanuk izdk'ku] 2014A

7- ikaMk ,p-] gcZy dkWLesfVDl gSaMcqd] ,f'k;k iSflfQd fctusl izsl] 2015A

8- pVksik/;k; ih-ds-] gcZy dkWLesfVDl ,aM vk;qoZsfnd esfMflUl] jk"Vªh; vkS|ksfxd vuqla/kku laLFkk] 2008A

9- ikaMk ,p-] n dEiyhV VsDuksykWth cqd vkWu gcZy ij¶;we ,aM dkWLesfVDl] ,uvkbZvkbZvkj izkstsDV dalYVsalh lfoZlst] 2012A

10- dhfrZdj ds- vkj- ,aM clq ch-Mh-] bafM;u esfMfluy IykaV~l] 8 [kaM] ck;ks&xzhu cqDl] 2012A

11- MªXl ,aM dkWLesfVDl ,DV~l ,aM :Yl xoZesaV vkWQ bafM;k ifCyds'kuA

12- xsaFkj vuZsLV] n ,lsaf'k;y vkW;Yl] okWY;we I] buxzke 'kkWVZ VkbVy] 2007A

13- Hkkjrh; ekud laLFkku iqfLrdk,saA

14- ukMd.khZ ds-,e-] bafM;u eVsfj;k esfMdk] ikWiyqj izdk'ku] 1994A

15- osYFk vkWQ bafM;k] lh-,l-vkbZ-vkj-

16- JhokLro ,l-ch-] ij¶;we ¶ysoj ,aM ,lsaf'k;y vkWby baMLVªht] Leky baMLVªht fjlpZ baLVhV~;wVA

17- nkl dqary] gcZy IykaV~l ,aM ns;j ,Iyhds'ku bu dkWLeklqfVdYl] lhch,l] 2014A

18- d`".kewfrZ ds-,p-] vk;qoZsfnd VsfDudy LVMht ,aM gcZy dkWLesfVDl vkWQ ,fUl,aV bafM;k] ch-vkj- ifCyf'kax dkjiksjs'ku] 2001A

19- pksiM+k vkj- ,u-] uk;j ,l-,y-] pksiM+k ,y-lh-] XykWlksjh vkWQ bafM;u esfMfluy IykaV~l] us'kuy bafLVV~;wV vkWQ lkbal dE;qfuds'ku ,aM buQkWesZ'ku fjlkslZst] 1956A

20- lDlsuk jktu] ekdZsfVax eSustesaV] eSdxzk fgy ,tqds'ku] 2009A

21- ljkQ Lo.kZyrk] ljkQ 'kSysUnz] dkWLesfVDl , izSfDVdy eSuqvy] ch,lih cqDl izkbosV fyfeVsM] 2015A

22- bZvkbZvkjvkbZ cksMZ] gcZy dkWLesfVDl ,aM C;wVh izksMDV~l foFk QkWeZwys'ku] bathfu;lZ bafM;k fjlpZ baLVhV~;wV] 2015A

23-,uvkbZvkbZvkj cksMZ] gSaMcqd vkWu gcZy izksMDV~l] jk"Vªh; vkS|ksfxd vuqla/kku laLFkku] 2002A

Suggested digital platforms web links
vuq'kaflr fMftVy lysQkWeZ osc fyad%
Suggested equivalent online courses:
vuq'kaflr led{k vkWuykbu ikB~;Øe%

Part D- Assessment and Evaluation

Hkkx n & vuq'kaflr ewY;kadu fof/k;k¡

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Internal Assessment: Continuous Comprehensive Evaluation(CCE): 30	Class Test Assignment/ Presentation	20 10 Total = 30
External Assessment: Annual Exam Section: 70 Time: 03.00 Hours	**Section (A):** Five Objective Type Questions **Section (B):** Five Short Answer Type Questions (200 Words each) **Section (C):** Three Long Answer Type Questions (500 Words each)	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30 Total = 70

Any remarks/suggestions:

vuq'kaflr lrr~ ewY;kadu fof/k;k¡%

vf/kdre vad% 100

vkarfjd ewY;kadu% lrr~ O;kid ewY;kadu(CCE) **% 30**	Dykl VsLV vlkbuesaV@ izLrqrhdj.k	20 10 dqy vad % 30
vkdyu% okf"kZd ijh{kk % 70	**vuqHkkx ¼v½%** ikWap oSdfYid iz'u **vuqHkkx ¼c½%** ikWap y?kq mRrjh; iz'u ¼izR;sd 200 'kCn½	05 x 02 = 10 05 x 06 = 30 03 x 10 = 30

le;& 03-00 ?kaVs	**vuqHkkx ¼l½%** rhu nh?kZ mRrjh; iz'u ¼izR;sd 500 'kCn½	dqy vad = 70

dksbZ fVIi.kh@lq>ko%

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate ANNUAL Pattern Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

2021-22

Theory

Session		**2021-22**
Class		**B.Sc.II nd Year**
Paper		**I**
Subject	(English)	**Botany**
	¼fgUnh½	ouLifr'kkL=
Title of the Paper	(English)	**Taxonomy and Embryology of Angiosperms**
	¼fgUnh½	vko`rchft;ksa dh oxhZdh ,oa Hkzwf.kdh
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English/fgUnh/Both ¼nksuksa½
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Taxonomy:** Origin and evolution of Angiosperms. Principles and rules of Botanical Nomenclature, Museum, Herbarium and Botanical Gardens. Comparative account of various systems of classification of Angiosperms: Bentham and Hooker system, and Modern trends in Taxonomy including Molecular taxonomy. APG IV System.	09
	¼fgUnh½	**oxhZdh %** vko`rchft;ksa dk mn~xe ,oa fodklA okuLifrd ukedj.k ds fl)kar ,oa fu;e] laxzgky; gjcsfj;e ,oa okuLifrd m|ku] vko`rchft;ksa ds oxhZdj.k ds fofHkUu ra=ksa dk rqYkukRed v/;;u% csUFke rFkk gqdj dh i)frA ofxZdh esa vk/kqfud izo`fRr;kW ,oa vk.kfod oxhZdh] ,ihth prqFkZ i)frA	
Unit-II	(English)	**Taxonomy**: Terminology for plant description in semi-technical language. Diagnostic characteristics and economic importance of Families– Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, Apiaceae, Magnoliaceae, Rosaceae, Dipterocarpaceae and Cucurbitaceae.	09
	¼fgUnh½	**oxhZdh** %ikS/kksa ds okuLifrd fooj.k dh v/kZrduhfd 'kCnkoyhA jsuudqyslh] cszlhdslh] ekyoslh] :Vslh] Qscslh] ,fi,lh, esXuksfy;slh]	

		jkstslh] fMIVsjksdkjislh ,oa dqdjfcVslh dqyksa ds fof'kf"V y{k.k ,oa vkfFkZd egRoA	
Unit-III	(English)	**Taxonomy:** Diagnostic characteristies & economic importance of Families– Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Poaceae, Asclepiadaceae, Verbenaceae , Arecaceae, Musaceae and Orchidaceae.	09
	¼fgUnh½	**oxhZdh** %:fc,lh] ,sLVsjslh] ,siklkbuslh] lksysuslh] ysfe,lh] ;wQksjfc,lh] fyfy,lh] iks,lh] ,LDysfiMslh] ofcZuslh] ,jsdslh] E;wtslh ,oa vkWfpZMslh dqyksa ds fof'k"V y{k.k ,oa vkfFkZd egRoA	
Unit-IV	(English)	Embryology: Concept of flower as a modified shoot. Structure of Anther, Microsporogenesis and Male Gametophyte. Structure of Pistil, Ovules, Megasporogenesis and Development of Female Geametophyte (Embryo Sac) and its types. Pollination– mechanism and agencies of Pollination, Pollen-Pistil interactions and Self incompatibility.	09
	¼fgUnh½	**Hkzwf.kdh** %iq"i ,d :ikarfjr izjksg dh vo/kkj.kkA ijkxdks"k dh lajpuk y?kqchtk.kqtuu ,oa uj ;qXedksn~fHkn~A L=hdslj dh lajpuk] chtk.M] xq:chtk.kqtuu] eknk ;qXedksn~fHkn~ dk fodkl ¼Hkwz.k dks"k½ ,oa izdkjA ijkx.k&ijkx.k dh izfØ;k ,oa ,tsUlh] ijkx L=hdslj dh ikjLifjd fØ;k ,oa Lovfu"ksP;rkA	
Unit-V	(English)	**Embryology:** Double Fertilization and triple fusion. Development and types of endosperm and its morphological nature. Development of Embryo in Monocot and Dicot plants, Polyembryony and Apomixis. Application of Palynology, Experimental Embrylogy including Pollen storage and test tube fertilization. Fruit development and maturation (Fruit Ripening) and its molecular basis. Seed structure and dispersal. Mode of Vegetative Propagation.	09
	¼fgUnh½	**Hkwzf.kdh** %f}fu"kspu ,oa f=la;kstuA Hkwz.kiks"k dk fodkl] izdkj ,oa bldh vkdkfjdh; izÑfrA ,dchti=h; vkSj f}chti=h; ikS/kksa esa Hkzw.k dk fodklAcgqHkzw.krk ,oa vlaxtuu ijkx.kq foKku ds vuqiz;ksx] iz;ksxkRed HkzkSf.kdh ,oa ijkx la/kkj.k] ij[kuyh ¼VsLV V~;wc½ fu"kspu] Qy dk fodkl ifjiDou ,oa bldk vkf.od vk/kkj] Qyksa dk ifjo/kZu ,oa ifjiDorkA cht dh lajpuk ,oa izdh.kZuA dkf;d izo/kZu ds izdkjA	

Practical work based on theory -

Suggested Books:

- Gangulee, H.C., Das, K. S. And Dutta, C. 2007. College Botany Vol.I, New Central Book Agency (P) Ltd. Kolkata.

- Heywood, V.H. and Moore, D.M. (eds) 1984. Current concepts in plant Taxonomy, Acedemic press London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant taxonomy (III edition), Mc Graw Hill Book Co., New York.
- Maheshwari, P.1978. Plant Embryology.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi.
- Radford, A.E. 1986. Fundamentals of Plant Systematics, Harper and Row, New York.
- Shrivastava and Das. Modern text book of Botany Vol-III & IV.
- Singh, V., Pande P.C. and Jain , D. K. Structure & Development in Angiosperms, Rastogi Publication, Meerut.
- Banson, L.B. 1957. Plant Classification, Health and Co., Boston.
- Davis, P.R and Heywood, V.H. 1973. Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. Co., New York, USA.
- Eames, A.J. 1961. Morphology of Angiosperms, Mc-Graw Hill, New York.
- Jeffery, C. 1968. An Introduction to Plant Taxonomy , J. and H. Churchill Limited.
- Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants, Macmillan, NewYork.
- Naik, V. N. 1984. Taxonomy of Angiosperms, Tata Mc-Graw Hill Pub. Co. Ltd. ,New Delhi.
- Porter, L.L. 1959. Taxonomy of Flowering Plants, San Francisco.
- Radfor, A.E., Dickinson, W.C., Massey, J.R . and Ben, C.R. 1974. Vascullar Plant Systematics, Harper & Row, New York.
- Fahn, Plant Anatomy
- Vashishtha, Anatomy
- Panday,B.P., Plant Anatomy
- Esau, Plant Anatomy
- Bhojwani and Bhatnager, Embryology

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2021-22

Theory

Session		**2021-22**
Class		**B.Sc.II nd Year**
Subject	(English)	**Botany**
	¼fgUnh½	ouLifr'kkL=
Paper		**II**
Title of the Paper	(English)	**Plant Ecology, Biodiversity Phytogeography**
	¼fgUnh½	Ikkni ikfjfLFkfrdh] tSo fofo/krk ,oa ikni HkkSxksfydh
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English/fgUnh/Both ¼nksuksa½
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Ecosystems :** Structure and types, Biotic and Abiotic components, Trophic levels, Food Chain, Food Web, Ecological Pyramids, Energy Flow, Concept of Biogeochemical Cycles: Gaseous Liquid and Sedimentary cycles: Carbon, Nitrogen, Water, Phosphorus and Sulphur cycle.	09
	¼fgUnh½	**ikfjfLFkfrd ra=** %lajpuk ,oa izdkj tSfod ,oa vtSfod ?kVd] iks"k.kLrj] [kk|J`[kyk [kk|tky] ikfjfLFkfrd fijkfeM] ÅtkZ izokgA tSo Hkw&jklk;fud pØ% vo/kkj.kk] xSlh;]nzo rFkk volknh; pØ% dkcZu] ukbVªkstu] ty] QklQksjl ,oa lYQj pØA	
Unit-II	(English)	**Ecological adapations :** Morphological, Anatomical and physiological responses water adaptation (Hydrophytes and Xerophytes) Temperature adaptation (Thermoperiodism and Vernalization), Light adaptation (Heliophytes and Sciophytes), Photoperiodism, Plant Succession: causes, trends and processes, Types of succession – Hydrosere and Xerosere.	09
	¼fgUnh½	**ikfjfLFkfrd vuqdwyu**% vkdkfjdh] vkarfjdh rFkk dkf;Zdh vuqfØ;k] ty vuqdwyu ¼tyksn~fHkn~ rFkk e:n~fHkn½] rkiØe vuqdwyu ¼rkidkfyrk ,oa clarhdj.k½ izdk'k vuqdwyu ¼izdk'kjkxh rFkk Nk;kjkxh½ izdk'knhlrhdkfyrkA ikni vuqØe.k % dkj.k] izo`fRr ,oa izfØ;k] vuqØe.k ds izdkj gkbMªksfl;j ¼tyh; vuqØe.k½ thjksfl;j] ¼'kq"d vuqØe.k½	
Unit-III	(English)	**Biodiversity &Poputation Ecology:** Distribution patterns, Density, Natality, Mortality, Growth curves, Ecotypes and Ecads: Community Ecology: Frequency, Density, Abundance, Cover and Life forms. Biodiversity: Basic concept, definition, Importance, Biodiversity of	09

		India. Hotspots, in situ and ex- situ conservation. Biosphere reserves, Sancturies and National parks of Madhya Pradesh. Endangered and Threatened species, red data book.	
	¼fgUnh½	**tSofofo/krk ,oa tula[;k ikfjfLFkfrdh%** forj.k iz.kkyh] ?kuRo] tUenj] e`R;qnj] o`f)oØ] bdksVkbi ,oa bØsM~l] leqnk;ikfjLFkfrdh % vko`fRr] ?kuRo] cgqyrk] vkPNknu ,oa thou:iA tSofofo/krk&vk/kkjHkwr ifjdYiuk] ifjHkk"kk] egRo] Hkkjr dh tSofofo/krk] RkIRkLFky] LoLFkkus rFkk ckg~; LFkkus laj{k.kA tSo e.My lap;r] e0iz0 ds vHk;kj.k ,oa jk"Vªh; m|ku] foyqIrizk; rFkk [krjs esa iM+h iztkfr;kW] jsM MkVkcqdA	
Unit-IV	(English)	**Soil&Pollution:**Physical and chemical properties, soil formation, Development of Soil Profile, Soil classification, Soil composition, soil factors;Environmental Pollution: Definition, Types, Causes & Control Global Warming, Acid Rain, Climate Change and Ozone Layer &Ozone Hole. Plant Indicators, Environmental Protection Act, Farmer's Right and Intellectual Property Right.	09
	¼fgUnh½	**e`nk ,oa iznw"k.k %** HkkSfrd ,oa jklk;fud xq.k e`nk fuekZ.k] e`nk ifjPNsfndk dk fodkl] e`nk dk oxhZdj.k] e`nk laxBu e`nk dkjdA i;kZoj.kiznw"k.k% ifjHkk"kk]izdkj]dkj.k ,oa fu;a=.k] oSf'od riu]vEyh; o"kkZ tyok;q ifjorZu]vkstu ijr ,oa vkstksu fNnzA ikni lwpd] i;kZoj.k laj{k.k vf/kfu;e] d`"kd vf/kdkj ,oa ckSf)d laink dk vf/kdkjA	
Unit-V	(English)	**Phytogeography:** Phytogeographical regions of India. Vegetation types of Madhya Pradesh. Natural resources: definition and classification. Conservation and management of natural resources, Land resource management, Water and wet land resource management. Economic and Ethobotany.	09
	¼fgUnh½	**Ikkni HkkSxksfydh %** Hkkjr ds ikni HkkSxksfyd {ks=A e0iz0 ds okuLifrd izdkjA izkÑfrd L=ksr& ifjHkk"kk ,oa oxhZdj.k] lj{k.k ,oa izca/kuA Hkw&Lkzksr izca/kuA ty ,oa vknzZHkwfe L=ksr izca/kuA vkfFkZd ,oa yksdokufLifrdhA	

Practical work based on theory

Suggested Books:

- Odum, E.J. 2004. Fundamentals of Ecology 5th ed, Natraj Pub.
- Odum, E.J. 1983. Basic ecology, Saunders, Philadeliphia.
- Kormondy, 1996. Ecology.
- Ambasth, R.S. and Ambasth, N.K.2011. A Textbook of Plant Ecology, C.B.S. Pub., NewDelhi.
- Doubenmre, R.F. and Silver, R.A. 1959. Plant and Environment, Wiley Pub.
- Puri, G.S. 1960. Indian Forest Ecology, Oxford Book and Stationary.
- Sagarcya, K.P., Forest and Forestry.
- Pandhi, Indian Forestry.
- Shukla, R.S. and Chandel, P.S. 2006. A Text book of plant Ecology, S.Chand Pub.
- Kumar, U.K. 2006.Biodiversity principles and conservation, Agrobios, Jodhpur.
- Banargee, S.1998. Biodiversity conservations, Agrobotamica, Bikaner.

- Tandan, R.K . , Biodiversity taxonomy & ecology, Scientific pub., Jodhpur.
- Sharma, P.D. 1998. Ecology and Environment 7th ed, Rastogi Pub.,Meerut.

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2021-22

Theory

Session		**2021-22**
Class		**B.Sc. III Year**
Subject	(English)	Botany
	¼fgUnh½	**ouLifr 'kkL=**
Paper		**I**
Title of the Paper	(English)	**Plant Physiology and Biochemistry**
	¼fgUnh½	**ikni dkf;Zdh vkSj tSo jlk;u**
Medium of Instructions (Teaching)		English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language		English/**fgUnh**/Both **¼nksuksa½**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Plant water relations**: Properties of water, Importance of water in plant life, Diffusion, osmosis and osmotic relation to plant cell, water absorption, Ascent of sap. **Transpiration**: Structure & physiology of stomata, mechanism of transpriation, factors affecting rate of transpiration.	09
	¼fgUnh½	**ikni ty laca/**k % ty ds xq.k] ikni thou esa ty dk egRo] folj.k ijklj.k rFkk ikni dksf'kdk ds ijklj.k laca/k] ty vo'kks"k.k] jlkjksg.kA **ok"iksRltZu** % ja/kz dh lajpuk ,oa dkf;dh] ok"iksltZu dh fØ;kfof/k] ok"iksRltZu dks izHkkfor djus okys dkjdA	
Unit-II	(English)	**Plant Nutrition, Biomolecules & Metabolism:** Mineral nutrition, essential macro & micro nutrients and their role. Absorption of mineral nutrients& hydroponics, translocation of organic solutes. **Biomolecules:** Sructure, classification and functions of Carbohydrates, Amino acids, Proteins and Lipids, Nitrogen Fixation, Nitrogen and Lipid Metabolism.	09

	¼fgUnh½	ikni iks"k.k] tSfod v.kq rFkk mikip;% [kfut iks"k.k] vko’;d nh?kZ ,oa y?kq iks"kd rRo ,oa mudh Hkwfedk] [kfut yo.kksa dk vo’kks"k.k] ty lao/kZu] dkcZfud foys; dk LFkkukarj.kA tSfod v.kq% dkckZsgkbMªsV] vehukas vEy] izksVhu ,oa fyfiM dh lajpuk] oxhZdj.k vkSj dk;Z] ukbVªkstu fLFkjhdj.k] ukbVªkstu rFkk olk mikip;A	
Unit-III	(English)	**Photosynthesis**: Chloroplast, Photosynthetic pigments, Concept of two photosystems, Light reaction, Red drop and Emerson’s effect, Dark reaction – Calvin cycle, Hatch & Slack cycle, CAM cycle, factors affecting rate of Photosynthesis and Photorespiration.	09
	¼fgUnh½	**izdk'k la'ys"k.k %** DyksjkslykLV] izdk’k la'ys"kh; o.kZd] nks izdk'k ra= dh vo/kkj.kk] izdk'k vfHkfØ;k] jsM Mªki rFkk bejlu izHkko] va/kdkj vfHkfØ;k] dsyfou pØ] gsp ,oa Lysd pØ] lh-,-,e- pØ] izdk'k la'ys"k.k dks izHkkfor djus okys dkjd ,oa izdk'kh; 'oluA	
Unit-IV	(English)	**Respiration**: Mitochondria, aerobic and anaerobic respiration, fermentation, Respiratory coefficient. Mechanism of respiration-Glycolysis, Kreb’s cycle, Pentose phosphate pathway, Electron transport system, Factors affecting rate of respiration, Redox Potential and theories of ATP synthesis.	09
	¼fgUnh½	**'olu %** ekbVksdkWfUMª;k] vkDlh ,oa vukDlh 'olu] fd.ou] 'olu xq.kkad] 'olu dh fØ;kfof/k & Xykbdksfyfll] Øsc pØ] isUVksl QkLQsV ekxZ] bysDVªku vfHkxeu ra=] 'olu dh nj dks izHkkfor djus okys dkjd] vkDlhdj.k & vip;u foHko] ,-Vh-ih- la'ys"k.k ds fl}karA	
Unit-V	(English)	**Enzymology and Plant Hormones:** Classification, nomenclature and characteristics of enzymes, concept of holoenzyme, apoenzyme, co-enzymes and co-factors, Mode and mechanism of enzyme action, Factors affecting enzyme activity. **Plant Harmones**: Discovery, structure, mode of action and role of Auxins, Gibberellins, Cytokinin, Abscissic acid and Ethylene.	09
	¼fgUnh½	**,satk;eksykWth rFkk ikni gkekZsu %&** fodjkas dk oxhZdj.k] ukedj.k ,oa vfHkyk{kf.kd xq.k] gksyks,Utkbe] ,iks,Utkbe] dks,Utkbe ,oa dksQsDVlZ dh vo/kkj.kk] fodj dh dk;Ziz.kkyh ,oa fØ;kfof/k] fodj fØ;k dks izHkkfor djus okys dkjd **ikni gkeksZu%** vkfDlu] ftCcjsfyu] lk;Vksdk;fuu rFkk ,Clhfld vEy ,oa bFkhfyu dh [kkst] lajpuk] dk;Ziz.kkyh ,oa HkwfedkA	

Pratical work based on theory paper

Suggested Books:

- Hopkins, W.G. 1995. Introduction of plant physiology, John wiley and sons Pub., New York.
- Salisbury, F.D. and Ross, C.W. 1992. Plant physiology, Wadsworth pub. Co., California.
- Taiz and Zeiger, E. 1998. Plant physiology, Sinauer associates, inc. pub, Massachusetts.
- Jain, V.K.1974. Fundamentals of plant physiology, S. Chand & company.
- Verma, S.K. and Verma, M.A. 1995.Text book of plant physiology and Biotechnology, S.Chand & company.
- Verma, V. 1995. Plant physiology, Emkey pub.
- Devid, L.N. and Michael, M.C. 2000. Leninger Principle of Biochemistry, Macmillan Worth Pub., New York.
- Gangulee, H.C., Das, K.S., Dutta,C.and Sen, S.2007.College Botany Vol. II, New Centre Book Agency (P) Ltd., Kolkotta.

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2021-22

Theory

Session		**2021-22**
Class		**B.Sc. IIIrd year**
Subject	(English)	Botany
	¼fgUnh½	**ouLifr 'kkL=**
Paper		**II**
Title of the Paper	(English)	**Cell Biology , Genetics and Biotechnology**
	¼fgUnh½	**dksf'kdk foKku] vkuqokaf'kdh ,oa tSoizkS|ksfxdh**
Medium of Instructions (Teaching)		English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language		English/**fgUnh**/Both **¼nksuksa½**
Max. Marks		**50**

Unit	Syllabus	Periods

Unit-I	(English)	**The cell envelops and cell organelles:** Techniques of cell biology, Prokaryotic and Eukaryotic cell structure, plasma membrane, lipid bilayer structure, function of the cell wall. Structure and function of cell organells: Nucleus, Chloroplast, Mitochondrion, Golgibodies, ER, Peroxisome and Vacuole. Cell signalling and cell receptors, Signal transduction.	09
	¼fgUnh½	**dksf'kdk vkoj.k ,oa dksf'kdkax** % dksf'kdk thofoKku dh rduhdh] iwoZukfHkd ,oa lR;ukfHkd dksf'kdk lajpukA IykTekf>Yyh] f}Lrjh; fyfiM lajpuk dksf'kdk fHkfÙk ds dk;ZA dksf'kdk vaxdksa dh lajpuk ,oa dk;Z% dsUnzd] gfjr yod] ekbVksdkWf.Mª;k xkWYthdk;] var%nzO;h tkfydk] ijvkWDlhlksEl] fjfDrdk,¡] dksf'kdk ladsru ,oa dksf'kdk xzkgh] ladsr ikjxeuA	
Unit-II	(English)	**Chomosomal organization:** Structure and functions of chromosome, centromere and telomere, Nucleosome model special types of chromosomes. Mitosis and Meosis. **Variations in chromosome structure**: Deletion, duplication, translocation and inversion, **variation in chromosome number**, Euploidy, Aneuploidy. DNA the genetic material, DNA structure and replication.	09
	¼fgUnh½	xq.klw= laxBu % xq.klw=] lsaVªksfe;j ,oa Vhyksfe;j dh vkdkfjdh ,oa dk;Z] U;wfDy;kslkse ekWMy] fo'ks"k izdkj ds ØkseksIksEl] lelw=h ,oa v/kZlw=h foHkktuA xq.klw= lajpuk esa fofHkUurk,¡ % foyksiu] f}xq.ku] LFkkukUrj.k] izfryksehdj.kA xq.klw= la[;k esa fofHkUurk,¡] ;IwykW;Mh ,oa ,U;IwykW;Mh A Mh-,u-,- % vkuqoakfa'kd inkFkZ] Mh-,u-,- dh lajpuk ,oa iqujko`fRrA	
Unit-III	(English)	**Genetic inheritance**: Mendelism: Law of Dominance, Law of segregation and independent assortment; linkage analysis; interactions of genes. Cytoplasmic inheritance, mutations-spontaneous and induced; transposable elements; DNA damage and repair.	09
	¼fgUnh½	vkuqokfa'kd o'akkxfr % es.Myokn% izHkkfork dk fu;e] i`FkDdj.k ,o Lora= viO;wgu ds fu;e] lgyXurk fo'y"sk.k] thu dh vU;ksU; fØ;k,¡A dksf'kdk nzOkh; oa'kkxfr] mRifjorZu] Lor% ,oa izsfjr mRifjorZu] LFkkUkkarj.k'khy vo;o] Mh-,u-,- {kfr ,oa lq/kkjA	
Unit-IV	(English)	**Gene:** Development of Genetics, Structure of gene, Gene Verses Allele Concept, genetic code, transfer of genetic information; Trascription, Translation, Protein Synthesis, tRNA and Ribosomes. Regulation of gene expression in prokaryotes	09

		and eukaryotes. Organic Evolution- Role of RNA in origin and evolution.	
	¼fgUnh½	Tkhu & vkuqokaf'kdh dk fodkl] thu dh ljapuk] thu ,oa ;qXe fodYih vo/kkj.kk] vkuqokafa'kd dksM] vkuqokafa'kd lwpuk dk LFkkukUrj.k] vuqys[ku] vuqokn] izksVhu l'ay"sk.k] Vªklaqj vkj-,u-,-] jkbckslksEl] izksdsfj;kVs~l ,oa ;wdSfj;kVs~l esa thu vfHkO;fDr dk fu;euA tSo mn~fodkl & vkj-,u-,- dk mn~Hko ,oa mn~fodkl esa HkwfedkA	
Unit-V	(English)	**Plant Breeding**: Introducton, Methods Selection and Hybridization (Pedigree, backcross, mass selection and bulk method). **Biotechnology:** Definition; basic aspects of plant tissue culture; cellular totipotancy, differentiation and morphogenesis, important achievements of Biotechnology in Agriculture. **Genetic Engineering:** Tools and techniques of recombinant DNA technology; cloning vectors, Biology of Agrobacterium, vector for gene delivery and marker gene. DNA Fingerprinting, Genomic and cDNA library; gene mapping and chromosome walking. **Biostatistics** : Introduction and application.	09
	¼fgUnh½	**ikni vfHktuu**% ifjp;] fof/k] p;u ,oa ladj.k ¼oa'kkoyh] izfrladj.k] lewg p;u] iw¡t fof/k½ **tSo izkS|ksfxdh** % ifjHkk"kk] ikni Ård lao/kZu ds vk/kkjHkwr rRo] dks'khdh; VksVhiksaVsalh] foHksnhdj.k ,oa ekQksZtsusfll] tSo izkS|ksfxdh dh d`f"k {ks= esa izeq[k miyfC/k;k¡A **vkuqokaf'kd vfHk;kaf=dh** % iqu;ksZtd Mh-,u-,- rduhdh ds vkStkj ,oa rduhd] Dyksuy okgd] ,xzksoSDVhfj;e dh tSfodh] thu fMfyojh ds okgd ,oa ekdZj thu] Mh-,u-,- vaxqyhNkiu] thuksfed rFkk lh- Mh-,u-,- ykbZczsjh] thu eSafiax rFkk xq.klw= okfdaxA **tSo lkaf[;dh%** ifjp; ,oa vuqiz;ksxA	

Pratical work based on theory paper

Suggested Books:

- Gupta, P.K. 1999. A text book of Cell and Molecular biology, Rastogi Pub, Meerut.
- Gupta, P.K.1999. Genetics, Rastogi Pub, Meerut.

- Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. 2019. Molecular Biology of the Cell, Garland Publishing Inc., New York.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA.
- Ross, T. et. al. 1998. Plant Biology, Wadsworth Publishing Co., California, USA.
- Krishanmurthy, K .V. 2000. Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida, USA.
- Buchanan, B.B. Groissem, W. and Jones, R.L. 2000. Biochemistry And Molecular Biology of Plants, American Society of Plant Physiologists, Maryland, USA.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate **ANNUAL** Pattern of Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

Practical scheme 2021-22 (based on Paper I&II)

B.Sc. II Year (Botany)

Time: 4 hrs **Max.Marks-50**

S.No.	Exercise	Marks
1	Taxonomy	10
2	Embryology – Anther/Ovule/Placentation	05
3	Exercise based on Ecology	10
4	Exercise based on Phytogeography/National Parks	05
5	Spotting (1 to 5)	10
6	Viva	05
7	Sessional	05
Total Marks		**50**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal

Under Graduate **ANNUAL** Pattern of Syllabus of Botany

(As Recommended by the Central Board of Studies and approved by Governor of M.P.**)**

Practical scheme 2021-22 (based on Paper I&II)

B.Sc. III Year (Botany)

Time: 4 hrs **Max.Marks-50**

S.No.	Exercise	Marks
1	Exercise based on Physiology	10
2	Biochemical Test	05
3	Exercise based on Cytology (Slide preparation identification of stages)	10
4	Exercise based on Genetic Problem	05
5	Spotting (1 to 5)	10
6	Viva	05
7	Sessional	05
Total Marks		**50**

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE
SHIVAJI NAGAR, BHOPAL

Syllabus of Botany

As Recommended by the Board of Studies
2020-21

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College

Shivaji Nagar, Bhopal – 462016

Syllabus

2020-2021

Subject: BOTANY

Details			Page No.
Under Graduate Level			
	Theory	**B.Sc.I Paper- I**	…5-6
	„ „	**B.Sc.I Paper- II**	…7-8
	„ „	**B.Sc.II Paper- I**	…9-10
	„ „	**B.Sc.II Paper- II**	…11-12
	„ „	**B.Sc.III Paper- I**	…13-14
	„ „	**B.Sc.III PaperII**	…15-16
	Practical	**B.Sc.I**	…57
	„ „	**B.Sc.II**	…58
	„ „	**B.Sc.III**	…59
Post Graduate Level	**Theory**	**Semester I**	…19-27
	„ „	**Semester II**	…28-37
	„ „	**Semester III**	…38-45
	„ „	**Semester IV**	…46-56
	Practical	**Semester I**	…60
	„ „	**Semester II**	…61
	„ „	**Semester III**	…62
	„ „	**Semester IV**	…63

Date of submission in Autonomous Examination cell:

Signature H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College
Shivaji Nagar, Bhopal – 462016
Syllabus of Botany: As Recommended by the Board of Studies
2020-21
Scheme of examination

Course:Botany **B.Sc. (3 Years Degree Course)**

Theory Papers/practical	Title of paper	Compulsory/ Optional	Marks
B.Sc. I Year ANNUAL SYSTEM			
Paper I	Diversity of Lower Plants	Compulsory	50
Paper II	Diversity of Higher Plants	Compulsory	50
Paper I&II	CCE		50
Practical	Botany Practical(based on paper I&II)	Compulsory	50
Total Marks			**200**
B.Sc. II Year ANNUAL SYSTEM			
Paper I	Taxonomy and Embryology of Angiosperms	Compulsory	50
Paper II	Plant Ecology, Biodiversity and Phytogeography	Compulsory	50
Paper I&II	CCE		50
Practical	Botany Practical(based on paper I&II)	Compulsory	50
Total Marks			**200**
B.Sc. IIIYear ANNUAL SYSTEM			
Paper I	Plant Physiology and Biochemistry	Compulsory	50
Paper II	Cell Biology, Genetics and Biotechnology	Compulsory	50
Paper I&II	CCE		50

Practical	Botany Practical(based on paper I&II)	Compulsory	50
Total Marks			**200**

Signature with date

Member Board of Studies:

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Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal
Under Graduate ANNUAL PATTERN SYLLABUS of Botany
(As Recommended by the Board of Studies)
2020-21
Theory / Practical

Session		**2020-21**
Class		**B.Sc. Ist Year**
Subject	(English)	**Botany**
Paper		**I**
Title of the Paper	(English)	**Diversity of Lower plants**
		निम्न श्रेणी के पादपो की विविधता
Medium of Instructions (Teaching)		English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language		English/**fgUnh**/Both **¼nksuksa½**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Viruses and Prokaryots**: Viruses, Viroids**,** and Prion**.** Characteristics of Viruses, general account of TMV and T4 bacteriophage. Bacterial structure, nutrition, reproduction and economic importance; General account of Mycoplasma Cynobacteria and Actinomycetes.Application of Microbiology. Important crop Diseases as Late Blight of Potato, Downy Mildew of Grapes, Peach Leaf Curl, Red Rod of Sugarcane, Tikka Disease of Groundnut, their prevention and control measures.	09
	(हिन्दी)	**वाइरस एवं प्रोकेरियोट** : विषाणु, वायराइड्स एवं प्रियॉन। विषाणुओं के सामान्य लक्षण, टी एम.वी एवं टी फोर बैक्टीरियोफेज का सामान्य विवरण। जीवाणु की संरचना, पोषण, प्रजनन एवं आर्थिक महत्व, मायकोप्लाज्मा सायनो–बेक्टीरिया एवं एक्टीनोमाइसीटीज का सामान्य विवरण। सूक्ष्म जैविकी के अनुप्रयोग। महत्वपूर्ण फसलों के रोग जैसे – आलू का लैट ब्लाइट रोग, अंगुर का डॉनी मिल्यू, गन्ने का लाल तना रोग, मूंगफली का टिक्का रोग, निवारण एवं रोकथाम।	
Unit-II	(English)	**Algae:** General characters, classification and economic importance. Important features and life history of Chlorophyceae- *Volvox*, *Oedogonium*, Charophyceae- *Chara*, Xanthophyceae - *Vaucheria*, Phaeophyceae - *Ectocarpus*, Rhodophyceae -*Polysiphonia.*	09
	(हिन्दी)	**शैवाल** : शैवालों के सामान्य लक्षण, वर्गीकरण एवं आर्थिक महत्व, मुख्य लक्षण, एवं जीवन चक्र क्लोरोफायसी–वॉल्वॉक्स, ऊडोगोनियम, कैरोफायसी–कारा, जैन्थोफायसी– वाउचेरिया फियोफायसी–एक्टोकार्पस, रोडोफायसी–पोलीसाइफोनिया।	
Unit-III	(English)	**Fungi**: General characters, classification and economic importance, Important features and life history of Oomycetes- Albugo, Zygomycetes -*Mucor*, Ascomycetes –*Yeast* , *Peziza*, Basidomycetes - *Puccinia*, Deurteromycetes –*Alternaria.* General account of lichens.	09
	(हिन्दी)	**कवक** : कवकों के सामान्य लक्षण एवं वर्गीकरण एवं आर्थिक महत्व। प्रमुख लक्षणों एवं जीवन इतिहास का अध्ययन, उमाइसिटीज़ – अल्ब्यूगो, जायगोमायसिटीज़ – म्यूकर। एस्कोमायसिटीज़ – यीस्ट, पेजाइजा, बेसिडियोमायसिटीज़ –पक्सीनिया,	

		डयूटेरोमायसिटीज – अल्टर्नेरिया। लाइकेन्स का सामान्य विवरण।	
Unit-IV	(English)	**Bryophyta** :Genral characters and classification, study of morphology, anatomy,and reproduction of Hepaticopsida- *Riccia*, *Marchantia*, Anthrocerotopsida -*Anthoceros*, Bryopsida- *Polytrichum*	09
	(हिन्दी)	**ब्रायोफाइटा** : सामान्य लक्षण एवं वर्गीकरण, बाह्य आकारिकी, आतंरिक संरचना एवं प्रजननः हिपेटीकोप्सिडा– रिक्सियाए मारकेन्षिया , एन्थेसिरोटोप्सिडा–एन्थोसिरोसए ब्रायोप्सिडा–पॉलीट्राइकम।	
Unit-V	(English)	**Pteridophyta:** Important characters and classification. Stelar organization. Morphology and anatomy of Rhynia. Structure, anatomy and reproduction in *Lycopodium*, *Selaginella*, *Equisetum and Marsilea*.	09
	(हिन्दी)	**टेरिडोफाइटाः** प्रमुख लक्षण एवं वर्गीकरण। स्टीलर सगंठन, राहिनिया की बाह्य एवं आंतरिक सरंचना। लाइकापोडियम, सिलेजिनेला, इक्वीसिटम एवं मारसीलिया की बाह्य तथा आंतरिक संरचना एवं प्रजनन।	

Pratical work based on theoty paper

Suggested Books

1. G.M. Smith 1971 Cryptogamic Botany. Vol - I Algae & Fungi Tata McGrraw Hill . Pub. Co. NewDelhi
2. G.M. Smith 1971 Cryptogamic Botany. Vol -II Bryophytes & Pteridophytes. Tata McGrraw HillPub. Co. New Delhi.
3. O.P.Sharma,1992. Text book of Thallophyta McGrraw Hill Pub. Co.
4. O.P.Sharma,1990. Text book of Pteridophyta McMillan india Ltd .
5. P.D.Sharma 1991. The Fungi. rastogi & Co. Meerut.
6. H.C. Dubey.1990. an introduction of Fungi.Vikas Pub. house pvt.ltd.
7. P.Puri 1980. Bryophyta Atma ram & Sons, Delhi.
8. A.Clifton.1958. Introduction to the Bacteria. Mcgrew Hillpub. Co.New delhi.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Under Graduate ANNUAL Pattern Syllabus of Botany
(As Recommended by the Board of Studies)
2020-21
Theory / Practical

Session		**2020-21**
Class		**B.Sc.. Ist Year**
Subject	**(English)**	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**II**
Title of the Paper	(English)	**Diversity of Higher plants**
	(हिन्दी)	**उच्च पादपो की विविधता**
Medium of Instructions (Teaching)		English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language		English/**fgUnh**/Both **¼nksuksa½**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Gymnosperm**: General characters and Classification and **distribution of Gymnosperms in India**. Heterospory and Origin of Seed Habit. Diversity of Gymnosperm: Geological Time Scale and Fossilization. **Types of Fossils, tools and techniques.** Fossil Gymnosperms: *Lyginopteris* and *Williamsonia*.	09
	(हिन्दी)	**अनावृत्तबीजीः अनावृत्तबीजियों के सामान्य लक्षण, वर्गीकरण एवं भारत में वितरण।** विषमबीजाणुकता एवं बीज स्वभाव का उद्गम, अनावृत्तबीजियों की विविधताएँ, भू–वैज्ञानिक समय सारणी एवं जीवाश्मीभवन, **जीवाष्म के प्रकार**, **साधन एवं तकनीक**। अनावृत्तबीजी जीवाश्म : लाइजीनोप्टेरिस एवं विलियमसोनिया।	
Unit-II	(English)	**Gymnosperm**: **General account of Cycadofilicales, Bennettiales and Gnetales . General account of Gingoals**. Morphology, Anatomy Reproduction and life cycle, of *Cycas*, *Pinus* and *Ephedra*.	09
	(हिन्दी)	**अनावृत्तबीजीः साइकेडिओफिलीकेल्स, बेनिटाइटेल्स एवं निटेल्स के सामान्य लक्षण। जिंगोएल्स के सामान्य लक्षण।** साइकस, पाइनस, एवं एफिड्रा की आकारिकी, आन्तरिक संरचना, प्रजनन तथा जीवन–चक्र।	
Unit-III	(English)	**Tissue System**. Types of vascular bundles, apical meristem, Classification of meristem. **The Root System**: Root apical meristem. Differentiation of primary and secondary tissues and their role. Anatomy of Monocot and Dicot root. Secondary growth in root. Modification of root for Various Functions, Interaction of root with microbes.	09
	(हिन्दी)	**ऊतक तंत्र** : संवहन पूल के प्रकार, शीर्षस्थ प्रविभाजी ऊतक, प्रविभाजी ऊतक का वर्गीकरण। **जड़ तंत्र** : जड़ का शीर्षस्थ प्रविभाजी ऊतक : प्राथमिक एवं द्वितीयक ऊतकों का विभेदन एवं उनके कार्य। एकबीजपत्री जड़ एवं द्विवीबीजपत्री जड़ की आंतरिक संरचना, जड़ में द्वितीयक वृध्दि। विभिन्न कार्यों हेतु जड़ के रूपान्तरण। सूक्ष्मजीवों के साथ जड़ की पारस्परिक क्रिया।	

Unit-IV	(English)	**The Shoot system**: Shoot apical meristem and histological organization, Anatomy of Monocot and Dicot stem: Vascular cambium and its functions, Secondary growth in stem. Characteristics of growth rings: Sapwood and Heart wood, Secondary Phloem, Cork Cambium and Periderm.**Anatomy of C_3 and C_4 plants**. Anomalous Secondary growth in Nyctanthus, Boerhhavia, Achyranthus, Leptadenia, Salvadora, Bignonia and Dracaena.	09
	(हिन्दी)	**प्ररोह तंत्र** : प्रराहे शीर्षस्थ विभज्योतक एवं ऊतकीय सगंठन, एकबीजपत्री एवं द्विबीजपत्री तने की आन्तरिक संरचना सवंहन एधा एवं उसके कार्य, तने में द्वितीयक वृद्धि : वृद्धि वलय की विशेषतायें, सैप काष्ठ एवं हार्ट काष्ठ, द्वितीयक फ्लोएम, कार्क कैम्बियम एवं पेरीडर्म। तने में असामान्य वृध्दि – निक्टेन्थस, बोरहाविया, एकाइरेन्थस, लेप्टाडीनिया, सेल्वाडोरा, बिग्नोनिया, ड्रेसीना।	
Unit-V	(English)	**The Leaf system**: Origin and Development of leaf, Diversity in size, shape and arrangement, Internal structure of Dicot and Monocot leaf. Adaptations to photosynthesis and water stress, senescence and abscission.	09
	(हिन्दी)	**पर्ण तंत्र** : पर्ण की उत्पत्ति एवं विकास, प्रमाप, आकार एवं विन्यास में विविधताएं, एकबीजपत्री एवं द्विबीजपत्री पर्ण की आतंरिक सरंचना, प्रकाश सश्लेषण एवं जलीय प्रतिबल का अनुकुलन, जीर्णता एवं विलगन।	

Pratical work based on theory paper

SUGGESTED READINGS:-

- Agarwal, S.B. 2007. Unified Botany, Shivlal Agarwal & Company Indore.
- Bhatnagar, S. P. and Moitra 1996. Gymnosperms. New Age International Limited, New Delhi.
- Davis, P.H. and Heywood, V.H. 1963, Principles of Angiosperm taxonomy. Oliver and Boyd, London.
- Gangulee, H. C. & Kar, A. K. 2006. College Botany Voll.III, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Heywood, V.H. and Moore, D.M. (eds) 1984. Current concepts in plant taxonomy. Academic press London.
- Jeffery, C. 1982. An Introduction of plant taxonomy. Cambridge University Press Cambridge, London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematic. Mc Graw Hill Book Co. New York.
- Kaushik, M.P. 2003. Modern Textbook of Botany, Prakash Publication Muzaffar Nagar U.P.
- Mukherjee, S.K. 2006. College Botany Voll.II, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi- 110055.
- Radford, A.E. 1986. Fundamentals of Plant Systmatics, Happer and Raw, New York.
- Saxena and Sarabhai. 1989. Text book of Botany. Rastogi Publication Meerut.
- Singh, G. 1999. Plant Systematics : Theory and Practice. Oxford and IBH Pvt. Ltd.New Dehli
- Vasishta, P.C. 2005. Botany for degree students Voll. V, Gymnosperms. S. Chand & Company Ltd. Ramnagar, New Delhi- 110055

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Under Graduate ANNUAL Pattern Syllabus of Botany
(As Recommended by the Board of Studies)
2020-21
Theory / Practical

Session		**2020-21**
Class		**B.Sc.II nd Year**
Paper		**I**
Subject	(English)	**Botany**
	¼fgUnh½	**ouLifr 'kkL=**
Title of the Paper	(English)	Taxonomy and Embryology of Angiosperms

	¼fgUnh½	**vko`rchft;ksa dh oxhZdh ,oa Hkzwf.kdh**
Medium of Instructions (Teaching)		English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language		English/**fgUnh**/Both **¼nksuksa½**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Taxonomy :**Origin and Evolution of Angiosperms: Principles and rules of Botanical Nomenclature, Museum, Herbarium and Botanical Gardens; Classification of Angiosperms: Bentham and Hooker, and Modern trends in Taxonomy including Molecular taxonomy. APG IV System.	09
	¼fgUnh½	**oxhZdh %** vko`rchft;ksa dk mn~xe ,oa fodklA okuLifrd ukedj.k ds fl)kar ,oa fu;e] laxzgky; gjcsfj;e ,oa okuLifrd m|ku] vko`rchft;ksa dk oxhZdj.k % csUFke rFkk gqdj dh i)frA ofxZdh esa vk/kqfud izo`fRr;kW ,oa vk.kfod oxhZdh] ,ihth ıvi)frA	
Unit-II	(English)	**Taxonomy :**Terminology for plant description in semi-technical language: Diagnostic characteristics and Economic Importance of Families – Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, and Apiaceae.	09
	¼fgUnh½	**oxhZdh %**ikS/kksa ds okuLifrd fooj.k dh v/kZ rdfudh 'kCnkoyhA jsuudqyslh] cszlhdslh] ekyoslh] :Vslh] Qscslh ,oa ,fi,lh dqyksa ds fof'kf"V y{k.k ,oa vkfFkZd egRoA	
Unit-III	(English)	**Taxonomy :**Diagnosticcharacteristies & Economic Importance to Families – Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Euphorbiaceae. Liliaceae, and Poaceae.	09
	¼fgUnh½	**oxhZdh %**:fc,lh] ,sLVsjslh] ,siklkbuslh] lksysuslh] ysfe,lh] ;wQksjfc,lh] fyfy,lh ,oa iks,lh dqyksa ds fof'k"V y{k.k ,oa vkfFkZd egRoA	
Unit-IV	(English)	**Embryology :** Concept of flower as a modified shoot. Structure of Anther, Microsporogenesis and Male Gametophyte. Structure of Pistil, Ovules, Megasporogenesis and Development of Female Geametophyte (Embryo Sac) and its types. Pollination – Mechanism and Agencies of Pollination, Pollen Pistil interactions and Self incompatibility.	09
	¼fgUnh½	**Hkzwf.kdh %**iq"i ,d :ikarfjr izjksg dh vo/kkj.kkA	

		ijkxdks"k dh lajpuk y?kqchtk.kqtuu ,oa uj ;qXedksn~fHkn~A L=hdslj dh lajpuk] chtk.M] xq:chtk.kqtuu] eknk ;qXedksn~fHkn~ dk fodkl ¼Hkwz.k dks"k½ ,oa izdkjA ijkx.k&ijkx.k dh izfØ;k ,oa ,tsUlh] ijkx L=hdslj dh ikjLifjd fØ;k ,oa Lovfu"ksP;rkA	
Unit-V	(English)	**Embryology :** Double Fertilization and triple fusion. Development and types of endosperm and its morphological nature, Development of Embryo in Monocot and Dicot plants, Polyembryony and Apomixis, Application of Palynology, Experimental Embrylogy including Pollen storage and test tube fertilization Fruit development and maturation,(Fruit Ripening) Its molecular basis seed structure and dispersal. Mode of Vegetative Propagation.	09
	¼fgUnh½	**Hkwzf.kadh %**f}fu"kspu ,oa f=la;kstuA Hkwz.kiks"k dk fodkl] izdkj ,oa bldh vkdkfjdh; izÑfrA ,dchti=h; vkSj f}chti=h; ikS/kksa esa Hkzw.k dk fodklAcgqHkzw.krk ,oa vlaxtuu ijkx.kq foKku ds vuqiz;ksx] iz;ksxkRed HkzkSf.kdh ,oa ijkx la/kkj.k] ij[kuyh ¼VsLV V~;wc½ fu"kspu Qy dk fodkl ifjiDou ,oa bldk vkf.od vk/kkj] Qyks dk ifjo/kZu ,oa ifjiDork] cht dh lajpuk ,oa izdh.kZuA dkf;d izo/kZu ds izdkjA	

Practical work based on theory -

- **Suggested Books:** Gangulee, H.C., Das, K. S. And Dutta, C. 2007. College Botany Vol.I, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Heywood, V.H. & Moore, D.M. (eds) 1984. Current concepts in plant Taxonomy. Acedemic press London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986, Plant taxonomy (III edition) Mc Graw Hill Book Co. New York.
- Maheshwari, P.1978. Plant Embryology.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi- 110055.
- Radford, A.E. 1986. Fundamentals of Plant Systematics, Harper and Row,New York.
- Shrivastava and Das. Modern text book of Botany Vol-III & IV.
- Singh, V., Pande P.C. and Jain , D. K. Structure & Development in Angiosperms. Rastogi Publication, Meerut.
- Banson, L.B.; 1957: Plant Classification, Health& Co. Boston.
- Davis, P.R & Heywood, V.H 1973: Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. *Co.* New *York*, USA
- Eames, AJ.; 1961: Morphology of Angiosperms, Mc-Graw Hill, New York.
- Jeffery, C.; 1968: An Introduction to Plant Taxonomy J. & H. Churchill Limited.
- Lawrence, G .H.M.; 1951: Taxonomy of Vascular Plants Macmillan, NewYork.
- Naik V. N.; 1984: Taxonomy of Angiosperms. Tata Mc-Graw Hill Pub. Co. Ltd. New Delhi.
- Porter, L.L.; 1959: Taxonomy of Flowering Plants. San Francisco. Radfor~ *AE*. Dickinson, W.C. MasseyJ.R and. Ben. C.R: 1974: VQ~llar Plant SYstematics, Harper & Row, New York.

- Fahn: Plant Anatomy
- Vashishtha: Anatomy
- Panday,B.P.,: Plant Anatomy
- Esau: Plant Anatomy
- Bhojwani & Bhatnager: Embryology

(As Recommended by the Board of Studies)
2020 -21
Theory / Practical

Session		**2020-21**
Class		B.Sc.II nd Year
Subject	(English)	**Botany**
	¼fgUnh½	**ouLifr 'kkL=**
Paper		**II**
Title of the Paper	(English)	Plant Ecology, Biodiversity Phytogeography
	¼fgUnh½	**Ikkni ikfjfLFkfrdh] tSo fofo/krk ,oa ikni HkkSxksfydh**
Medium of Instructions (Teaching)		English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language		English/**fgUnh**/Both **¼nksuksa½**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Ecosystems :** Structure and types, Biotic and Abiotic components, Trophic levels, FoodChain, Food Web, Ecological Pyramids, Energy Flow, Concept of Biogeochemical Cycles: Gaseous Liquid and Sedimentary cycles: Carbon, Nitrogen, Water, Phosphorus and Sulphur cycle.	09
	¼fgUnh½	**ikfjfLFkfrd ra= %**lajpuk ,oa izdkj tSfod ,oa vtSfod ?kVd] iks"k.kLrj] [kk|J`[kyk [kk|tky] ikfjfLFkfrd fijkfeM] ÅtkZ izokgA tSo Hkw&jklk;fud pØ% vo/kkj.kk] xSlh;]nzo rFkk volknh; pØ% dkcZu] ukbVªkstu] ty] QklQksjl ,oa lYQj pØA	
Unit-II	(English)	**Ecological adapations :** Morphological, Anatomical and physiological responses water adaptation (Hydrophytes and Xerophytes) Temperature adaptation (Thermoperiodism and Vernalization), Light adaptation (Heliophytes and Sciophytes), Photoperiodism, Plant Succession: causes, trends and processes, Types of succession – Hydrosere and Xerosere.	09
	¼fgUnh½	**ikfjfLFkfrdvuqdwyu %**vkdkfjdh] vkarfjdh rFkk dkf;Zdh vuqfØ;k] ty vuqdwyu ¼tyksn~fHkn~ rFkk e:n~fHkn½] rkiØe vuqdwyu ¼rkidkfyrk ,oa olrhdj.k½ izdk'k vuqdwyu ¼izdk'kjkxh rFkk Nk;kjkxh½ izdk'knhlrhdkfyrkA ikni vuqØe.k % dkj.k] izo`fRr ,oa izfØ;k] vuqØe.k ds izdkj gkbMªksfl;j ¼tyh; vuqØe.k½ thjksfl;j] ¼'kq"d vuqØe.k½	
Unit-III	(English)	**Biodiversity &Poputation Ecology :** Distribution patterns, Density, Natality, Mortality, Growth curves, Ecotypes and Ecads : Community Ecology: Frequency, Density, Abundance, Cover and Life forms. Biodiversity : Basic concept, definition, Importance, Biodiversity of India. Hotspots, in situ and ex- situ conservation. Biosphere reserves, Sancturies and National parks of Madhya Pradesh. Endangered and Threatened species, red data book.	09
	¼fgUnh½	**tSofofo/krk ,oa tula[;k ikfjfLFkfrdh%**forj.k iz.kkyh] ?kuRo] tUenj] e`R;qnj] o`f)oØ] bdksVkbi ,oa bØsM~l] leqnk;ikfjLFkfrdh % vko`fRr] ?kuRo] cgqyrk] vkPNknu ,oa	

		thou:iA tSofofo/krk&vk/kkjHkwr ifjdYiuk] ifjHkk"kk] egRo] Hkkjr dh tSofofo/krk] RkIRkLFky] LoLFkkus rFkk ckg~; LFkkus laj{k.kA tSo e.My lap;r] e0iz0 ds vHk;kj.k ,oa jk"Vªh; m|ku] foyqIrizk; rFkk [krjs esa iM+h iztkfr;kW] jsM MkVkcqdA	
Unit-IV	(English)	**Soil&Pollution:**Physical and chemical properties, soil formation, Development of Soil Profile, Soil classification, Soil composition, soil factors;Environmental Pollution: Definition, Types, Causes & Control Global Warming, Acid Rain, Climate Change and Ozone Layer &Ozone Hole. Plant Indicators, Environmental Protection Act, Farmer's Right and Intellectual Property Right.	09
	¼fgUnh½	**e`nk ,oa iznw"k.k %** HkkSfrd ,oa jklk;fud xq.k e`nk fuekZ.k] e`nk ifjPNsfndk dk fodkl] e`nk dk oxhZdj.k] e`nk laxBu e`nk dkjdA i;kZoj.kiznw"k.k% ifjHkk"kk]izdkj]dkj.k ,oa fu;a=.k] oSf'od riu]vEyh; o"kkZ tyok;q ifjorZu]vkstu ijr ,oa vkstksu fNnzA ikni lwpd] i;kZoj.k laj{k.k vf/kfu;e] d`"kd vf/kdkj ,oa ckSf)d laink dk vf/kdkjA	
Unit-V	(English)	**Phytogeography :** Phytogeographical regions of India. Vegetation types of Madhya Pradesh. Natural resources: definition and classification. Conservation and management of natural resources, Land resource management, Water and wet land resource management. Economic and Ethobotany.	09
	¼fgUnh½	**Ikkni HkkSxksfydh %**Hkkkjr ds ikni HkkSxksfyd {ks=A e0iz0 ds okuLifrd izdkjA izkÑfrd L=ksr& ifjHkk"kk ,oa oxhZdj.k] lj{k.k ,oa izca/kuA Hkw&Lkzksr izca/kuA ty ,oa vknzZHkwfe L=ksr izca/kuA vkfFkZd ,oa yksdokufLifrdhA	

Practical work based on theory

Suggested Books:

- Odum, E.J. 2004.5th ed. Fundamentals of Ecology, Natraj Pub.
- Odum, E.J. 1983 Basic ecology, Saunders, Philadeliphia.
- Kormondy, 1996 Ecology.
- Ambast R.S. plant Ecology.
- Doubenmre: Plant and Environment.
- Puri G.S. 1960. Indian Forest Ecology.
- Sagarcya K.P. Forest and Forestry.
- pandhi-Indian Foresty.
- R.S. Shukla & P.S. Chandel,2006. A Text book of plant Ecology.
- Kumar, U.K. 2006.Biodiversity principles and conservation -Agrobios, Jodhpur.
- Banargee S.1998, Bio diversity conservations- Agrobotamica, Bikaner
- Tandan R.K .,Biodiversity taxonomy & ecology- Scientific pub-Jodhpur.
- Sharma, P.D. 7th ed. 1998 Ecology and Environment, Rastogi Pub.,Meerut,250002

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Under Graduate ANNUAL Pattern Syllabus of Botany
(As Recommended by the Board of Studies)
2020-21
Theory / Practical

Session		**2020-21**
Class		B.Sc. III Year
Subject	(English)	Botany
	¼fgUnh½	**ouLifr 'kkL=**
Paper		I
Title of the Paper	(English)	**Plant Physiology and Biochemistry**
	¼fgUnh½	**ikni dkf;Zdh vkSj tSo jlk;u**
Medium of Instructions (Teaching)		English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language		English/**fgUnh**/Both **¼nksuksa½**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Plant water relations**: Properties of water, Importance of water in plant life, Diffusion, osmosis and osmotic relation of plant cell, water absorption, Ascent of sap. **Transpiration**: Structure & physiology of stomata, mechanism of transpriation, factors affecting rate of transpiration.	09
	¼fgUnh½	**ikni ty laca/**k % ty ds xq.k] ikni thou esa ty dk egRo] folj.k ijklj.k rFkk ikni dksf'kdk ds ijklj.k laca/k] ty vo'kks"k.k] jlkjksg.kA **ok"iksRltZu** % ja/kz dh lajpuk ,oa dkf;dh] ok"iksltZu dh fØ;kfof/k] ok"iksRltZu dks izHkkfor djus okys dkjdA	
Unit-II	(English)	**Plant Nutrition & Biomolecules:** Mineral nutrition, essential macro & micro nutrients and their role. Absorption of mineral nutrients& hydroponics, translocation of organic solutes. **Biomolecules:** Sructure, classification and functions of Carbohydrates, Amino acids, Proteins and Lipids.	09
	¼fgUnh½	**ikni iks"k.**k ,oa **tSfod v.kq%** [kfut iks"k.k] vko';d nh?kZ ,oa y?kq iks"kd rRo ,oa mudh Hkwfedk] [kfut yo.kksa dk vo'kks"k.k] ty lao/kZu] dkcZfud foys; dk LFkkukarj.kA **tSfod v.kq%** dkckZsgkbMªsV] ,sfeuks vEy] izksVhu ,oa	

		fyfiM dh lajpuk] oxhZdj.k vkSj dk;ZA	
Unit-III	(English)	**Photosynthesis**: Chloroplast, Photosynthetic pigments, Concept of two photosystems, Light reaction, Red drop and Emerson's effect, Dark reaction – Calvin cycle, Hatch & Slack cycle, CAM cycle, factors affecting rate of Photosynthesis and Photorespiration.	09
	¼fgUnh½	**izdk'k la'ys"k.k** % DyksjkslykLV] izdk'k la'ys"kh; o.kZd] nks izdk'k ra= dh vo/kkj.kk] izdk'k vfHkfØ;k] jsM Mªki rFkk bejlu izHkko] va/kdkj vfHkfØ;k] dsyfou pØ] gsp ,oa Ltsd pØ] lh-,-,e- pØ] izdk'k la'ys"k.k dks izHkkfor djus okys dkjd ,oa izdk'kh; 'oluA	
Unit-IV	(English)	**Respiration**: Mitochondria, aerobic and anaerobic respiration, fermentation, Respiratory coefficient. Mechanism of respiration-Glycolysis, Kreb's cycle, Pentose phosphate pathway, Electron transport system, Factors affecting rate of respiration, Redox Potential and theories of ATP synthesis.	09
	¼fgUnh½	**'olu** % ekbVksdkWfUMª;k] vkDlh ,oa vukDlh 'olu] fd.ou] 'olu xq.kkad] 'olu dh fØ;kfof/k & Xykbdksfyfll] Øsc pØ] isUVksl QkLQsV ekxZ] bysDVªku vfHkxeu ra=] 'olu dh nj dks izHkkfor djus okys dkjd] vkDlhdj.k & vip;u foHko] ,-Vh-ih-la'ys"k.k ds fofHkUu fl}karA	
Unit-V	(English)	**Enzymology and Plant Hormones :** Classification, nomenclature and characteristics of enzymes, concept of holoenzyme, apoenzyme, co-enzymes and co-factors, Mode and mechanism of enzyme action, Factors affecting enzyme activity. **Plant harmones**: Discovery , structure, mode of action and role of Auxins, Gibberellins, Cytokinin, Abscissic acid and Ethylene.	09
	¼fgUnh½	**,satk;eksykWth rFkk ikni gkekZsu** %& fodjkas dk oxhZdj.k] ukedj.k ,oa vfHkyk{kf.kd xq.k] gksyk,UtkbZe] ,iks,UtkbZe] dks,UtkbZe ,oa dksQsDVlZ dh vo/kkj.kk] fodj dh dk;Ziz.kkyh ,oa fØ;kfof/k] fodj izfrfØ;k dks izHkkfor djus okys dkjd **ikni gkeksZu**] vkfDlu] ftCcjsfyu] lk;Vksdk;fuu rFkk ,Clhfld vEy ,oa bFkhfyu dh [kkst] lajpuk] dk;Ziz.kkyh ,oa HkwfedkA	

Pratical work based on theory paper

Suggested Books:

- Hopkins W.G. 1995 Introduction of plant physiology Pub. John wiley and sons New York.
- Salisbury F.D., and Ross C.W. 1992 Plant physiology, Wadsworth pub. Co. California, USA
- Taiz & Zeiger, E. 1998, Plant physiology, Sinauer associates, inc. pub. Massachusetts,U.S.A.
- Jain V.K.1974. Fundamentals of plant physiology, S. Chand & company.
- Verma S.K. & Verma M.A. 1995.Text book of plant physiology & Biotechnology, S.Chand & company.
- Verma V. 1995.Plant physiology Emkey pub.
- Devid, L.N. and Michael,M.C.2000. Leninger Principle of Biochemistry, Macmillan Worth Pub. New York,USA.
- Gangulee, H.C.,Das,K.S.,Dutta,C.and Sen, S.2007.College Botany Vol. II.New Centre Book Agency (P)Ltd. Kolkotta,700009

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Shivaji Nagar, Bhopal
Under Graduate ANNUAL Pattern Syllabus of Botany
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2020-21
Theory / Practical

Session		**2020-21**
Class		B.Sc. IIIrd yr.
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		II
Title of the Paper	(English)	**Cell Biology , Genetics and Biotechnology**
	(हिन्दी)	कोशिका विज्ञान, आनुवांषिकी एवं जैवप्रौद्योगिकी
Medium of Instructions (Teaching)		English/**fgUnh**/Both **¼nksuksa½**
Question Paper Language		English/**fgUnh**/Both **¼nksuksa½**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**The cell envelops and cell organelles:** plasma membrane, bilayer lipid structure, function of the cell wall. Structure and function of cell organells: Nucleus, Chloroplast and Mitochondrion, Golgibodies, ER, Peroxisome and Vacuole.	09
	(हिन्दी)	**कोषिका आवरण एवं कोषिकांग** : प्लाज्माझिल्ली, द्विस्तरीय लिपिड संरचना कोषिका भित्ति के कार्य। कोषिका अंगकों की संरचना एवं कार्यः केन्द्रक, हरित लवक, माइटोकॉण्ड्रिया गॉल्जीकाय, अंतःद्रव्यी जालिका, परऑक्सीसोम्स, रिक्तिकाएँ ।	
Unit-II	(English)	**Chomosomal organization:** Structure and functions of chromosome, centromere and telomere, Nucleosome model special types of chromosomes. Mitosis and Meosis. **Variations in chromosome structure**: Deletion, duplication,	09

		translocation and inversion, variation in chromosome number, euploidy, aneuploidy. DNA the genetic material, DNA structure and replication.	
	(हिन्दी)	**गुणसूत्र संगठन :** गुणसूत्र की आकारिकी एवं कार्य, सेंट्रोमीर्धसूत्रीय विभाजन।यर एवं टिलोमीयर न्यूक्लियोसोम मॉडल, विषेष प्रकार के क्रोमोसोम्स, समसूत्र एवं अर्धसूत्री विभाजन। **गुणसूत्र संरचना में विभिन्नताएँ** : विलोपन, द्विगुणन, स्थानान्तरण, प्रतिलोमीकरण। गुणसूत्र संख्या में विभिन्नताएँ । यूप्लॉयडी एव एन्यूप्लॉयडी । डी.एन.ए. : आनुवाषिक पदार्थ, डी.एन.ए. की संरचना एवं पुनरावृत्ति।	
Unit-III	(English)	Genetic inheritance: Mendelism; segregation and independent assortment; linkage analysis; interactions of genes. Cytoplasmic inheritance, mutations- spontaneous and induced; transposable elements; DNA damage and repair.	09
	(हिन्दी)	आनुवाषिक वषांगतिरू मेण्डलवाद, पृथक्करण एव स्वतंत्र अपव्यूहन के नियम, सहलग्नता विष्लेषण, जीन की अन्योन्य क्रियाएँ। कोषिकाद्रव्यी वंषागति, उत्परिवर्तन, प्राकृतिक एवं प्रेरित उत्परिवर्तन, स्थानांतरणषील अवयव, डी.एन.ए. क्षति एवं सुधार।	
Unit-IV	(English)	Gene: Structure of gene, genetic code, transfer of genetic information; trascription, translation, protein synthesis, tRNA, and ribosomes. Regulation of gene expression in prokaryotes and eukaryotes.	09
	(हिन्दी)	जीन – जीन की सरंचना, आनुवांषिक कोड , आनुवांषिक सूचना का स्थानान्तरण, अनुलेखन, अनुवाद, प्रोटीन सष्लेषण, ट्रासंफर आर.एन.ए., राइबोसोम्स, प्रोकेरियाट्स एवं यूकैरियाट्स में जीन अभिव्यक्ति का नियमन।	
Unit-V	(English)	**Biotechnology:** Functional definition; basic aspects of plant tissue culture; cellular totipotancy, differentiation and morphogenesis, important achievements in crop biotechnology. **Genetic Engineering:** Tools and techniques of recombinant DNA technology; cloning vectors, Biology of Agrobacterium, vector for gene delivery and marker gene. Genomic and cDNA library; gene mapping and chromosome walking.	09
	(हिन्दी)	जैव प्रौद्योगिकी ': कार्यात्मक परिभाषा, पादप ऊतक संवर्धन के आधारभूत तत्व, कोषीय टोटीपोंटेंषी, विभिन्नीकरण एवं मार्फोजेनेषिसए कृषि क्षेत्र में जैव प्रौद्योगिकी की प्रमुख उपलब्धियाँ। आनुवांषिक अभियांत्रिकी : पुनर्योजक डी.एन.ए. तकनीकी के संयंत्र एवं तकनीक, क्लोन वाहक, एग्रोवैक्टीरियम की जैविकी, जीन डिलिवरी के वाहक एवं मार्कर जीन, जीनोमिक तथा ब क्छ। लाईब्रेरी, जीन मैंपिंग तथा गुणसूत्र वाकिंग।	

Pratical work based on theory paper

Suggested Books:

- P.K.Gupta, 1999 A text book of Cell and Molecular biology, Rastogi pracation Meerut. India
- P.K.Gupta, 1999 Genetics, , Rastogi pracation Meerut. India
- Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
- Rost, T. et: aI. 1998.PIant Biology, Wadsworth Publishing Co., California, U.S.A
- Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A
- Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Semester Wise Syllabus of M.Sc. Botany
(As Recommended by the Board of Studies)
2020-21
Theory / Practical
M.Sc. Botany

First Semester

Course No.	Name of the Course	Total
PG 101	Biology& Diversity of Virus,Bacteria & Fungi	70 + CCE 30 = 100
PG 102	Biology and Diversity of Algae	70+ CCE 30 = 100
PG 103	Biology & Diversity of Bryophyta and Pteridophyta	70 + CCE 30= 100
PG 104	Biology and Diversity of Gymnosperms	70+ CCE 30 = 100
PG 105	Practical I – based on Course PG 101 & 102	100
PG 106	Practical II – based on Course PG 103 & 104	100
	Project work related to course Paper	50
	Total	**650**

Second Semester

Course No.	Name of the Course	Total
PG 201	Cell Biology and Genetics	70 + CCE 30 = 100
PG 202	Plant Development & Reproduction	70 + CCE 30 = 100

PG 203	Plant Physiology-I	70 + CCE 30 = 100
PG 204	Plant Ecology-I	70 + CCE 30 = 100
PG 205	Practical I – based on Course PG 201 & 202	100
PG 206	Practical II – based on Course PG 203 & 204	100
	Project work related to course Paper	50
	Total	**650**

M.Sc. Botany

Third Semester

Course No.	Name of the Course	Total
PG 301	Systematic of Angiosperms	70 + CCE 30 = 100
PG 302	Molecular Biology and Plant Breeding	70 + CCE 30 = 100
PG 303	Plant Physiology, Biochemistry and Metabolism	70 + CCE 30 =100
PG 304	Plant Ecology-II (Conservation & Utilization of Plant Resources)	70 + CCE 30 =100
PG 305	Practical I – based on Course PG 301 & 302	100
PG 306	Practical II – based on Course PG 303 & 304	100
	Project work related to course Paper	50
	Total	**650**

Fourth Semester

Course No.	Name of the Course	Total
PG 401	Biotechnology and Tissue Culture	70 + CCE 30 = 100
PG 402	Applied Botany & Instrumentation	70 + CCE 30 = 100
PG 403	Elective Paper- I*	70 + CCE 30 =100
PG 404	Elective Paper- II*	70 + CCE 30 =100

PG 405	Practical I – based on Course PG 401 & 402	100
PG 406	Practical II – based on Course PG 403 & 404	100
	Internship Training	**100**
	Total	**700**

Note: Excursion is compulsory for all students (local) in Previous and Final year.

* List of Elective Papers are enclosed . Students can opt any two elective papers.

Signature with date

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Session		**2020-21**
Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
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Paper		PG - 101
		Paper-I
Title of the Paper	(English)	**Biology & Diversity of Viruses, Bacteria and Fungi**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit	**Syllabus**	**Period**
Unit-I	Virus: characteristics, classification and ultrastructure, Isolation and Purification of viruses; chemical nature, replication, transmission of viruses, economic importance of viruses.	9
Unit-II	General characteristics, ultrastructure, nutrition and reproduction, biology and economic importance of Archaebacteria and Eubacteria. General characteristics of Cyanobacteria, Actinomycetes Mycoplasma, Rickettsiae, Chlamydiae.	9
Unit-III	General characteristics, classification of fungi substrate relationship in	9

	fungi, reproduction, heterothallism, parasexuality, Economic Importance of fungi (fungi in industries, medicine, as food, symptoms & signs of Fungal Diseases in Plants and fungal diseases in Humans - Dermatophytes), fungus as biocontrol agent, mycorrhiza.	
Unit-IV	General characteristics of Mastigomycotina-Synchytrium, Saprolegnia, Pythium, Phytophthora, Peronospora, Sclerospora. General characteristics of Zygomycotina –Rhizopus, Pilobolus. General characteristics of Ascomycotina-Yeast, Taphrina, Penicillium, Erysiphe, Phyllactinia, Uncinula, Chaetomium, Peziza, Morchella.	9
Unit-V	General characteristics of Basidiomycotina- Puccinia, Melampsora, Ustilago, Agaricus, Geastrum. General characteristics of Deuteromycotina- Alternaria, Curvularia Cercospora, Colletotrichum	9

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of reproductive members of fungi and cynobacteria : Peronospora, Albugo, Mucor, Pilobolus, Yeast, Chaetomium, Morchella, Agaricus, Melampsora curvularia, Polyporus, Phoma, Penicillium, Fusarium, Rhizopus, Asprgillus, Colletotrichum, Nostoc, Anabaena, Gleotrichia, Rivularia, Microcystis, Oscillatoria, Lyngbya.**
2. **Symptomatology of some diseased specimens: White rust, Downy mildew, Powdery mildew, Rusts, Smut, Ergot, Groundnut leaf spot , Red rot of sugarcane, Wilts, Paddy Blast, Citrus canker, Bacterial blight of paddy, Angular leaf spot of cotton, Tobacco mosaic, Little leaf of brinjal, Mango malformation, Leaf curl of papaya.**
3. **Gram staining of Bacteria.**
4. **Sterilization methods, preparation of media and stains.**
5. **Isolation of microbes from soil, water and air.**

SUGGESTED READINGS

- Alexopoulus, C.J. Mims, C. W. and Blackwel, M; 1996: Introductory coO' Mycology, Jbon Wjley & Sons Inc.
- Clifton, A; 1958: Introduction to Bacteria, Mcgraw- Hills Book Co.New Delhi.
- Madigan, M T. Martinko, J. M and Parker Jack; I 997: Brock Biology Of Microorganisms, (8th edition) Prentice Hall, N,J. U.S.A
- Mandahar, C. L.; 1978: Introduction to Plant Viruses. Chand & Co.Ltd. Delhi.
- Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate Press.

- Rangaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in Indja (4th edjtjon).PrentjceHaJl ofInilia Ltd. New Delbj.
- Webster, J.; 1985: Introduction to Fungi Cambridge University Press. Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbjology, S. Chand Publisher, New Delh

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Semester		**I**
Subject	(English)	**Botany**
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Paper		PG – 102
		Paper-II
Title of the Paper	(English)	**Biology & Diversity of Algae**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General characteristics of Algae; Classification of algae, diversified habitats, thallus organization, cell ultrastructure, reproduction, pigments, reserve foods, types of flagella, Economic importance of Algae.	9
Unit-II	General characteristics of Chlorophyta and Charophyta-Chlamydomonas, Pandorina, Eudorina, Chlorella, Hydrodictyon, Pediastrum, Ulothrix, Cladophora, Draparnaldiopsis, Spirogyra, Zygnema, Bryopsis and Nitella	9
Unit-III	General characteristics of Xanthophyta: Botrydium, Vaucheria. General characteristics of Bacillariophyta: Diatoms (Pennularia). General characteristics of Euglenophyta: Euglena.	9
Unit-IV	General characteristics of Phaeophyta : Ectocarpus, Dictyota, Laminaria, Fucus, Sargassum	9
Unit-V	General characteristics of Rhodophyta: Porphyra, Batrachospermum,	9

	Gelidium, Cryptonemia, Rhodymenia, Polysiphonia.	

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of representative members of Algae**
2. **Algae :- Volvox, Pandorina, Chara, Nitella, Oedogoneum, Spirogyra, Zygnema, Coleochaete, Chaetophora, Hydrodictyon, Ulva, Pithophora , Stigloclonium , Draparnaldiopsis , Clostridium , Cosmarium , Valonia , Vaucharia , Botydium, Dictyota , Padina , Laminaria , Saragassum, Fucus , Cutleria , Porphyra , Batrachospermum , Gracillaria, Polysiphonia**
3. **Study of algae as Biofertilizers, algal bloom.**
4. **Study the role of algae in Eutrophication.**
5. **Culture technique of Algae**

SUGGESTED READINGS

- Smith G. M. Cryptogamic Botany VoL I(1st edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Kumar H. D. 1988: Introduction to Phycology. Affiliated East-West Press Ltd.
- Prescott,G.W.,1969. The Algae:A review . Butler &Tanner Ltd., From & London
- Chapmam & Chapman, The Algae
- Sharma O.P.,The Algae
- Gangulee, H.C. &Car, A.K. Vol. I&II ,1989, College Botany, Books & allied(P Ltd. , Calcutta
- Fritsch, F.E. , Vol.I, 1965, The Structure and Reproduction of the Algae,The Syndics of Cambridge university Press

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Semester		**I**
Subject	(English)	**Botany**
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Paper		PG – 103
		Paper-III
Title of the Paper	(English)	**Biology & Diversity of Bryophyta& Pteridophyta**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit-I	General Characteristics, classification , Morphology, reproduction and life history, distribution, Origin, Evolution& Affinities, Ecology and Economic importance of Bryophytes. Contribution to Bryophyta in India	9
Unit-II	General Characteristics of Hepaticopsida-Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Sphaerocarpus, Pellia, Porella. General Characteristics of Anthocerotopsida-Anthoceros, Notothylas. General Characteristics of Bryopsida-Sphagnum, Polytrichum.	9
Unit-III	General characteristics of Pteridophyta; Classification, origin, telome theory, stelar organization, Homospory, Heterospory and Seed Habits, Reproduction , Indian contribution to Pteridophyta, Paleobotany and	9

	Geological Time-Scale, types of fossils.	
Unit-IV	General characteristics of Psilophyta-Rhynia, Horneophyton, Zosterophyllum, Psilophyton, Asteroxylon, Psilotum, Tmesipteris. General characteristics of Lycophyta- Lycopodium, Protolepidodendron, Lepidodendron, Isoetes, Selaginella.	9
Unit-V	General characteristics of Sphenophyta-Eqisetum, Hyenia, Calamites, Paleostachys, Calamostachys, Sphenophyllum. General characteristics of Pterophyta-Ophioglassum, Osmunda, Gleichenia, Pteris, Lygodium, Marsilia, Salvinia, Azolla.	9

SUGGESTED READINGS

- Smith G. M. Cryptogamic Botany VoLII I(2nd edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Brower- 1926: Primitive Land Plants~ Cambridge At the University Press.
- Kashyap- 1972 LiveIWorts of Western Himalayas and Punjab. Researchco Publication.
- Puri P. 1980~ Bryophyta -Morphology, Growth & Differentiation. Atma Ram & Sons, Delhi.
- Chopra & Kumara- 1988: Biology of Bryophyta; Wiley Eastern Ltd.
- Ram Udar; 1970: An Introduction to Bryophyta; Shashidhar Malviya Prakashan.
- Watson; 1968: Structure and life of Bryophyta; Hutchinson & Co. Ltd.
- Campbell; 1939: The evolution of land plants; Stanford University.
- Sporne, K.R. 1991. The Morphology of Pteridophyta
- Parihar N.S. 1996 Biology and Morphology of Pteridophytes, CentralBook Depot. Allahabad.
- Arnold C. A; An Introduction to Paleobotany; Tata Mc Graw –Hill Publishing Co. New Delhi.
- Stewart, W. N. and RathweIL G. W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.
- Eames A J.; Morphology of Vascular Plants-Lower Groups.Tata Mc Graw -Hill Publishing Co. New Delhi
- Rashid A. 1999; An introduction to Pteridophytes; Vikas Publishing House Pvt. Ltd..
- Gangulee & Kar College Botany Vol II

SUGGESTED LABORATORY EXERCISES

1. **Morphological & Anatomical study of representative members of the Bryophyta:** Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Pellia, Porella, Anthoceros, Notothylas, Sphagnum, and Polytrichum.
2. **Morphological & Anatomical study of representative members of the Pteridophyta** :- Psilotum , Isoetes , Lycopodium , Sellagena , Ophioglossum , Osmunda , Lyathia , Marsilea , Salvinia , Azolla , Gleichenia, Dryopteris, Alsophilla, Study of fossil members.

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Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
Paper		PG – 104
		Paper-IV
Title of the Paper	(English)	**Biology & Diversity of Gymnosperms**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General Characteristics and Classification of Gymnosperms, Distribution of Gymnosperms in India, Economic Importance, Evolutionary tendencies in Gymnosperms. Indian contribution to Gymnosperms – Dr. Birbal Sahni, Dr. P. Maheshwari & Dr. M.S. Swaminathan.	9
Unit-II	General Characteristics of Fossil Gymnosperms (Pteridospermales) - Lyginopteris, Medullosa, Glossopteris, Pentoxylon, Caytonia.	9
Unit-III	General Characteristics of Cycadeoidales, Cycadales, Bennettitales-	9

	Williamsonia, Cycadeoidea: Cycas, Zamia, Nilssonia.	
Unit-IV	General Characteristics of Ginkgoales, Cordaitales & Coniferales- Ginkgo biloba, Cordaites, Cedrus, Pinus, Araucaria, Cryptomeria, Thuja, Cupressus Podocarpus, Taxus.	9
Unit-V	General Characteristics of Ephedrales- Ephedra. General Characteristics of Welwitschiales- Welwitschia. General Characteristics of Gnetales- Gnetum.	9

SUGGESTED LABORATORY EXERCISES

1. Monographic study of following :- Cycas , Ginkgo , Cedrus , Abies , Picea , Cupressus , Araucaria , Cryptomeria , Taxodium , Podocarpus , Agathis , Taxus , Ephedra and Gnetum.
2. Study of important fossil gymnosperm from prepared slides and specimens.

SUGGESTED READINGS

- Bhatnagar, S.P. and Moitra, A; 1996: Gymnosperms. New Age International Pvt. Ltd., New Delhi.
- Singh H.; 1978: Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
- Spome K R; 1991: The Morphology of Gymnosperms; Hutchinson Univ. Library; London.
- Foster A S. & Gifford E. M; Comparative morphology of vascular Plants; Vakils, Feffer, & Simons Private Ltd. Bombay. Chamberlain; Gymnosperms -Structure & Evolution; CBS Publishers & Distributors Delhi.
- Shukla A C. & Mishra S. P.; Essentials of Paleobotany; Vikas Publishing House Pvt. Ltd. Delhi-Bombay-:6angalore-Calcutta-Kanpur .

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Semester		**II**
Subject	(English)	**Botany**
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Paper		PG – 201
		Paper-I
Title of the Paper	(English)	**Cell Biology and Genetics**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Structure and organization of plant cell, Structure and functions of cell wall, Plasma membrane, Ion carriers, channels and pumps, Receptors, Plasmodesmata, Sites for ATPases.	9
Unit-II	Structure and function of Cell organelles: Chloroplast, Mitochondria, Vacuole, Endoplasmic Reticulum, Lysosomes, Ribosome, Golgi body.	9
Unit-III	Structure and Function of Nucleus ,Nucleosome, Chromosome structure and packaging of DNA, Euchromatin and heterochromatin, karyotype , banding patterns, specialized types of chromosomes.	9
Unit-IV	Cell division, Cell cycle, Programmed cell death, Structural changes in Chromosomes(Duplication, Deficiency Inversion and Translocation), Numerical changes in chromosomes(Aneuploids and Euploids, haploids)	9
Unit-V	Mendel's Laws, Genetics of Mitochondria and Chloroplast polygenetic inheritance, crossing over and linkage, Transposable elements.	9

SUGGESTED LABORATORY EXERCISES

1. Isolation of plant DNA and its quantitaion by a spectrophotometric method.
2. Isolation of RNA and quantitaion by a spectrophotometric method.
3. Demonstration of SEM and TEM.
4. Isolation of Mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDH).
5. Isolation of chloroplasts and SDS-PAGE. Profile of proteins to demarcate the two submits of Rubisco.
6. Demonstration of Mitosis.
7. To determine Mitotic Index in onion root tip cells.
8. Demonstration of Meiosis (normal) in Tradeshcantia.
9. Demonstration of abnormal meiosis.
10. Demonstration of special types of chromosomes.
11. Preparation of karyotype and Idiogram.
12. Calculation of Nucleo Cytoplasmic Index of onion/garlic root tip with the help of micrometric method.

Section the following Review Journals:-

1. **Annual Review of plant physiology and Molecular Biology.**
2. **Current Advances in Plant Sciences.**
3. **Nature Reviews: Molecular and Cell Biology.**

SUGGESTED READINGS

Lewin, B. 2000, Genes VIL Oxford University Press, New York.

Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.

Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Rost, T. et: aI. 1998.PIant Biology, Wadsworth Publishing Co., California, U.S.A

Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A

Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA

De, D.N. 2000: Plant Cell Vacuoles: An Introduction. CSIRO Publication, ColliJ18W~ Australia.

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Semester		**II**
Subject	(English)	**Botany**
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Paper		PG – 202
		Paper-II
Title of the Paper	(English)	**Plant Development & Reproduction**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Organization of the higher plant body: shoot and reproductive meristem, Tissue system, Shoot apical meristem (SAM), Root apical meristem, Lateral meristem. Control of tissue differentiation especially xylem and phloem, Lateral root and root hair.	9
Unit-II	Development of Shoot, Secondary growth in stem, primary and secondary anomaolus structure of stem. Origin, development, differentiation, arrangement, diversity, venation, modification and anatomy of leaves.	9
Unit-III	Flower development, floral organ differentiation, homeotic mutants in *Arabidiopsis* and *Antirrhinum*, Androecium, Microsporangium, Microsporogenesis, role of tapetum, Male gametophytes and their development, Pollen storage,Pollen allergy and Pollen enbryos, Male sterility.	9
Unit-IV	Gynoecium: structure of Megasporangium, Ovule development, Types and development, Megasporogenesis, organization of Embryo sacs, Pollination Mechanisms and vectors, Self incompatibility.	9
Unit-V	Double fertilization: Endosperm development, embryogenesis, storage proteins of endosperms and embryo. Fruit growth: biochemistry and molecular biology of fruit maturation. Seed growth and their dispersal, Polyembryony, apogamy and apomixes.	9

SUGGESTED LABORATORY / FIELD EXERCISES

1. **Effect of gravity, unilateral light and plant growth regulators (PGRs) on the growth of young seedlings.**
2. **Role of dark and light on the expansion of cotyledons and epicotylar hook opening in pea.**
3. **Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double strained permanent slides of suitable plant such as Coleus , Tobacco.**
4. **Study of shoot apices in a monocotyledon in both TS and LS to show the origin and arrangement of leaf Primordia.**
5. **Study of phyllotaxy of various plant species.**
6. **Anatomy of leaf available locally.**
7. **Study of trichomes, glands in few species Osimum , Azadirecta Indica , Plumbago , Eucalyptus etc.**
8. **Study of morphology pollengrains of different species.**
9. **Study of pollen germinations and test for pollen viability using strains**
10. **Study of microsporogenesis and gametogenesis in section of Anthers.**
11. **Pollen storage, pollen pistil interaction, self incompatibility In- vitro pollination.**
12. **Study of monosporic, bisporic and tetra sporic type of embryosac.**
13. **Emasculation , bagging and hand pollination to study pollen germination seed set and fruit development using self compatible and obligate outcrossing systems.**
14. **Suitable seeds and polyembryony in Citrus , Jamun , etc by dissection.**

SUGGESTED READINGS

- Bhojwani,S.S.and Bhatnagar,S.P.2000. The Embryology of Angiosperms(4th revised and enlarged edition). Vikas Publishing House,New Delhi.
- Burgess.J.1985.An introduction to Plant Cell Development.Cambridge University Press, Cambridge.
- Fageri,K.and Van der Pijl,L1979. The Principles of Pollination Ecology .Pergamon Press, Oxford.
- Fahn, A 1 982.Plant Anatomy.(3rd edition).Pergamon Press,Oxford.
- F osket, D .E.1994 .Plant Growth and Development. A Molecular Approach.Academic Press, San Diego.
- Howell, S.H.1998. Molecular Genetics of Plant Development, Cambridge University Press, Cambridge.
- Leins,P., Tucker,S.C.and Endress,P .K.1988.Aspects of Floral Development. J. Cramer, Germany.
- Lyndon, R.F.1990.Plant Development. The Cellular Basis. Unin Hyman .London.
- Murphy, T. M. and Thompson, W. E. 1988 Molecular Plant Development. Prentice Hall, New Jersey.
- Proctor, M. and Yeo,P.1973.The Pollination of Flowers. William Collins Sons, London.
- Raghvan, V .1997 .Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
- RaghVan, V. 1999. Development Biology of Flowering P Jants. Springer-verlag.
- Atwell, B. J., Kriedermann, P.E. and Jurnbull, C.G.N.(eds)1999.PIants in Action: Adaptation in Nature, Perfonnance in Cultivation, MacMillan Education, Sydney, Austr

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Class		M.Sc.
Semester		**II**
Subject	(English)	**Botany**
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Paper		PG - 203
		Paper-III
Title of the Paper	(English)	**Plant Physiology-I**
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Principles of thermodynamics, Free energy and redox potential, Plant water relation, mechanisms of water absorption, water transport through xylem, Transpiration, root-microbe interactions in facilitating nutrient uptake, Mineral nutrition, Membrane transport protein.	9
Unit-II	Phloem transport, Signal transduction, receptors and G-proteins, phospholipids signaling, Role of cyclic nucleotide, calcium-calmodulin cascade.	9
Unit-III	Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, bracinosteroids, polyamines, jasmonic acid, and salicylic acid, Hormone receptors.	9
Unit-IV	Flowering process: Floral induction and development, photoperiodism and its significance, endogenous clock and its regulation, Movement, Phytochrome and cryptochrome, their photochemical and biochemical properties, Molecular mechanism of action of photomorphogenic receptors, Vernalization.	9
Unit-V	Stress physiology: Plant response to biotic and abiotic stress, Water deficit and drought resistance, Salinity stress and resistance, Concepts of freezing, heat stress and oxidative stress.	9

SUGGESTED LABORATORY EXERCISES

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry, Spectrophotometry and florimetry.
3. Study of physiological stress in terms of Water, light and tempreture.
4. Determine rate of transpiration by Ganong's potometer.
5. Determine rate of transpiration by Gravimetric Method.
6. Demonstration of the effect of light intensity and wind velocity on the rate of transpiration by Ganong's potometer.
7. To Study the comparision between stomatal and cuticular transpiration by Cobalt Chloride Method and Four Leaf Method.
8. To Study the comparision between evaporation and transpiration and find out T/E ratio.
9. Bioassay of plant hormones- auxins, ethylene, GA, ABA and Cytokinin.
10. To study the effect of auxins (IAA/IBA/BAP/NAA) on plant tissue culture.
11. To study the effect of auxins (IAA/IBA/BAP/NAA) on seed germination.
12. To determine stomatal index (SI), stomatal frequency.
13. To demonstrate the presence of Phosphate in plant tissue.
14. To study the effect of Auxin on Shoot /root growth.
15. To study the effect of cytokinin Shoot /root growth.
16. Hydroponic study
17. To compare the rate of transpiration in an ABA treated leaf normal leaf.

Suggested readings

- **Hopkins, W.G. 1995**. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- **Moore, T.C. 1989**. Biochemistry and Physiology of Plant Hormones (second edition). Springer -Verlag, New York. USA.
- **Nobel, P.S. 1999**. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz l and Zeiger E1998** Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Subject	(English)	**Botany**
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Paper		PG – 204
		Paper-IV
Title of the Paper	(English)	**Plant Ecology-I**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Introduction, division of plant Ecology, Ecosystem component (abiotic and biotic), Factors(light, temperature, water), Population Ecology, Inter and intra specific competition and self regulation. **Biostatistic**s: mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test)	9
Unit-II	Community organization: Concepts of community and continuum, analysis of community (analytical and synthetic characters), Community coefficients, Association (negative and positive associations), Concept of ecological niche, Concept of Biodiversity evolution and differentiation of species , allopatric and sympatric speciation, Ecads and Ecotypes.	9
Unit-III	Ecosystem development and stability: Temporal changes(cyclic and non cyclic), Succession processes & types, Mechanism of succession, facilitation, tolerance and inhibition models, Concept of climax, persistence , Ecological stability concept(resilience and resistance), Ecological perturbation natural and anthropogenic and their impact on plants and ecosystem,Ecosystem restoration.	9
Unit-IV	Fate of energy and matter in Ecosystems: Trophic organization(ecological pyramids) and structure, Food chains & food webs, Ecological energetics, energy flow pathways, Ecological efficiencies, consumption, assimilation and production at trophic level, Primary production measurement methods, Limiting factors, litter fall and decomposition , Recycling pathway relation between energy flow and nutrient cycling ,Global Biogeochemical cycle of C,N,P,S.	9
Unit-V	Major Biomes of the World, Major Vegetation types- Tropical rain forests, Temperate forests, Seasonal forests, Boreal forest, Grasslands, Deserts, Aquatic ecosystems and Wetlands.	9

SUGGESTED LABORATORY EXERCISES

1. To determine minimum size and number of quadrat required for study of vegetation by species area curve method.
2. To determine percentage frequency and frequency classes of various species by quadrate and line transect method using Raunkiaer's Law.
3. To study density and abundance of species.
4. To calculate relative frequency , relative density and relative dominance (or basal area) and determine importance value Index (IVI) of the species.
5. To determine diversity Index or community coefficient for two different vegetation / protected and unprotected grassland.
6. To determine gross and net phytoplankton productivity by light and dark bottle method.
7. To calculate Basal area of tree species found locally.
8. To find out reproductive capacity of the seeds.
9. To study the foliar injuries of plants which are exposed by SO_2.
10. To determine dust deposition on leaves of polluted and non polluted area.
11. To estimate the dissolved oxygen (DO) content in entrophic and oligotrophic water sample by azide modification of Winkler's method.
12. Physical and Chemical analysis of soil.
13. To study water holding capacity, porocity, bulk density of soil.
14. Ecological adaptations: Hydrophyte, Xerophyte, Epiphyte, Parasite etc.
15. To study- Hygrometer , Minimum Maximum Thermometer ,sling Psychrometer , Saci disc , pH meter , Spectrophotometer, Soxhlet apparatus , Kjehldal's apparatus.
16. Biostatistics**:** mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test).
17. To study various Biotic and abiotic components of pond and forest ecosystem.
18. Mapping of Biomes on world map**.**

SUGGESTED READINGS

- Smith. R.L. 1996. Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- Begon. M.. Harper, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science. Cambridge.
- Ludwig. J. and Reynolds. J.F. 1988. Statistical Ecology. John Wiley & Sons.
- Odum. E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
- Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. Cambridge University Press, Cambridge, U.K.
- Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.
- Treshow. M. 1985. Air Pollution and Plant Life. Wiley Interscience.
- Heywood, V.H. and Watson. R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
- Mason, C.F. 1991. Biology of Freshwater Pollution. Longman. 'Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .
- Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.

M. Sc. Botany (Semester System)

List of suggested Project work/Dissertation work

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Inventroization of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR

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2020-21
Theory / Practical

Session		**2020-21**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
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Paper		PG - 301
		Paper-I
Title of the Paper	(English)	**Systemetics ofAngiosperms**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Morphology of flower, floral induction and development, morphology of stamens and carpals, carpels evolution, morphology of inferior ovary, placentation: their origin and types.	9
Unit-II	The species concept Taxonomic hierarchy, International Code of Botanical Nomenclature, Taxonomic evidences (morphology, anatomy, palynology, embryology, cytology, phytochemistary). Taxonomic tools(Herbarium, Botanical garden, Taxonomic keys, Taxonomic literature, floras.) Histological, biochemical, cytological phytochemical, serological, and molecular technique.	9
Unit-III	Systems of Angiosperm classification: Origin of angiosperms Phenetic versus phylogenetic system, Cladistics in taxonomy, relative merits and demerits of major system of classification, Plant exploration , invasions and introduction and, World centres of primary and Secondary centers diversity of domesticated plant.	9
Unit-IV	Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae.	9
Unit-V	Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae , Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales, Santanales, Centrospermales, and Hellobiales.	9

SUGGESTED LABORATORY EXERCISES

1. Study of stamens and carpals in various species.
2. Different kinds of placentations
3. Description of various species of a genus, location of Key characters and preparation of Key at generic level.
4. Location of key characters and use of keys at family level.
5. Training for herbarium preparation.
6. Preparation of Herbarium sheet of such plants, wild cultivated medicinal as are available locally.
7. Locally available Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae
8. Locally available Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales Santanales, Centrospermales, and Hellobiales.

Suggested Reading

Heywood & Moore, D.M; 1984: CWTent concept in Plant Taxonomy Academic Press.

Banson, L.B.;1957; Plant Classification, Health & Co. Boston.

Davis, P.R & Heywood, V.H 1973; Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. Co. New York USA.

Eames, AL.; 1961; Morphology of Angiosperms, McGraw Hill, New York.

Lawerence, G.H.M,;1951: Taxonomy of Vascular Plants Macmillan, New York

Naik V.N,:1984: Taxonomy of Angiosperms. Tata McGraw Pub Co. Ltd New Delhi.

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Session		**2020-21**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	¼fgUnh½	**ouLifr 'kkL=**
Paper		PG-302
		II
Title of the Paper	(English)	**Molecular Biology and Plant Breeding**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Nuclear DNA content DNA structure and forms, DNA replication, mutation, C value paradox, cot curve, and its significance, damage and repair, Restriction Mapping, Multigene families and their evolution.	9
Unit-II	Gene structure and expression, Gene fine structure, cis and trans test of recombination, introns and exons, their significance, Genetics of Bacteria and Virus (genetic transformation, conjugation, transduction, Recombination in Phage), Regulation of gene expression in Prokaryotes and Eukaryotes.	10
Unit-III	RNA synthesis and processing-adding, splicing, polyadenilation, structure and function of different types of RNA, RNA transport.	9
Unit-IV	Genetic code, Protein synthesis–Ribosome structure and site of protein synthesis, initiation complex, factors, elongation, and termination. Post translation modification of protein, protein sorting. Targeting of protein to organelles.	9
Unit-V	Plant breeding,: In situ Hybridization-Concept and techniques. Genetic basis of inbreeding and heterosis, exploitation of hybrid vigor, Cancer oncogene, Apoptosis, Immune innate and adaptive immune system	8

SUGGESTED LABORATORY EXERCISES

1. Isolation of genomic DNA from plant tissue using CTAB (cetyetri methyl ammonium bromide) or any animal tissue.
2. Isolation of DNA & its quantitation by a spectrophometric method.
3. Restriction digestion of plant DNA, its seperation by Agrose gel electrophoresis and visualization by ethidium bromide staining.
4. Isolation of RNA and quantitation by a spectrophotometric method.
5. Separation of RNA by Agrose gel electrophoresis and visualization by Et. Br. staining.
6. Immunological techniques : Ouchterlony method, ELISA & western blotting.
7. Isolation of chloroplats and SDS-PAGE. profile of proteins to demarcate the two subunits of Rubisco.
8. Emasculation technique.

Other experiments based on theory paper

Suggested Readings:

- Alberts, B. Bray, D. Lewis, J. Raff: M. Roberts, K. and Watson,J. D. 1989 Molecular Biology of the Cell (2nd edition). Garland Publishing Inc., New York. U. S. A.
- Karp, G. 1999 Cells and Molecular Biology: Concepts and Experiments John Wiley & Sons, Inc. U. S.A
- Malacinski, G. M. and Freifelder, D. 1998. Essentials of Molecular Biology *(3M* edition). Jones and Barlett Publishers, Inc. London.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, WadsworthPublishing Co., California, USA.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, *K.,* and Watson, J.D. 1999.Molecular Biology of the Cell. Garland Publishing:Inc., New York.
- Rost, T. et al. 1 998.Plant Biology, Wadsworth Publishing Co.,California, U.S.A
- Krishanmurthy K. V. 2000 Methods in Cell Wall Cytochemistry, CRCPress, Boca Raton, Florida U.S.A
- Buchanan, B.B. Gruissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA
- De, D.N. 2000 Plant Cell Vacuoles: An Introduction.CSIRO Publication, Collingwood, Australia.
- Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA
- Lodish H. Bert, A,zipursky, S.L.,Matsudaira, p.,Baltimore, D. and Darnell, J. 2000.Molecular Cell Biology, W.H.Freeman and Co., NewYork, U.S.A
- Twyman, R. M. 2003. Advanced Molecular Biology. Viva Books Private Ltd. New Delhi. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer - Verlag, New York. USA.
- Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- Salisbury FB and Ross CW 1991 Plant Physiology IV edition Wdsworth Publishing co. California USA.
- Taiz l and Zeiger E1998 Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997 Plant Metabolism II Ed. Longman England.
- Buchanan, B.B.Gruissem, W. and Jones R.L. 2000. Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Theory / Practical

Session		**2020-21**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	¼fgUnh½	**ouLifr 'kkL=**
Paper		PG-303
		III
Title of the Paper	(English)	Plant Physiology, Biochemistry and Metabolism
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Fundamentals of Enzymology: General aspects, Allosteric mechanism, regulatory and sites, Isoenzyme, Kinetics of enzymatic catalysis, Michaelis-Menten equation and its significance, Mechanism of enzyme action.	9
Unit-II	Photochemistry and Photosynthesis: General concept and Historical back ground, evolution of photosynthetic apparatus, photosynthetic pigment and light harvesting complexes, Photo oxidation of water, mechanism of electron and proton transport, Carbon assimilation, Calvin cycle, Photorespiration and its significance, C-4 cycle, CAM path way, physiological and ecological consideration.	9
Unit-III	Respiration: Overview of plant respiration, Glycolysis, TCA cycle, Electron Transport, Structure, function & synthesis of ATP, oxidative pentose phosphate pathway.	9
Unit-IV	Structure, classification and function of carbohydrates, biosynthesis of sucrose and starch, Structure and function of Lipids, Fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids, , and their catabolism, Glyoxilate cycle and alternative oxidases system.	9
Unit-V	Nitrogen fixation, (chemical and biological), Nodule formation, Mechanism of Nitrate uptake and reduction, ammonium assimilation, Sulphate uptake, transport and assimilation. Sulphur metabolism, Vitamins (structure and role).	9

Suggested Laboratory Exercise based on P.G 301 :

1. Principles of colorimetry and Spectrophotometry.
2. Determine rate of respiration in germinating seeds/young buds by Ganong's respirometer.
3. Determine rate of respiration in terms of oxygen utilized by plant material by volume method/ weight method.
4. Determine effect of light intensity / wave length on rate of photosynthesis.
5. Determine effect of Co2 concentration on rate of photosynthesis
6. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids by spectrophotometer.
7. To seperate chloroplast pigments by strip paper chromatography/circular paper chromatography.
8. To determine the chlorophyll-a / chlorophyll b ratio in C_3 and C_4 plants by spectrophotometer.
9. Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.
10. To demonstrate photophosphorylation in intact chloroplasts, resolve the phosphoproteins by SDS-PAGE and perform autoradiography desalting of proteins by gel filtration chromatography embaying Sephadex G-25.
11. Biochemistry of carbohydrates and lipids.
12. Study of structure and formation of Root nodule in leguminous plants
13. Effect of enzyme concentration on enzyme activity e.g. catalase, amylase, acid Phosphatase, nitrate reductase.
14. Effect of substrate concentration on enzyme activity eg. catalase, amylase
15. Demonstration of the substrate inducibility of the enzyme nitrate reductase.
16. Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.
17. Separation of isoenzymes of esterase, Peroxidases by native polyacrylamide gel electrophoresis

Suggested readings

- **Hopkins, W.G. 1995**. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- **Moore, T.C. 1989**. Biochemistry and Physiology of Plant Hormones (second edition). Springer - Verlag, New York. USA.
- **Nobel, P.S. 1999**. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz l and Zeiger E1998** Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Session		**2020-21**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
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Paper		PG-304
		IV
Title of the Paper	(English)	**Plant Ecology-II (Conservation & Utilization of Plant Resources)**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant biodiversity concept, status in India, and world. World centres of primary diversity of domesticated plants with special reference to Indoburmiese centre and secondary centres.	9
Unit-II	Sustainable development, utilization, of resources from forest, grassland, aquatic habitats, food, fodder, forage, timber and non wood forest products. Threats to quality and quantity of resources due to over exploitation. Speciation and Extinction, IUCN categories of threat. Distribution and global pattern of terrestrial biodiversity, Hot spots and inventory.	9
Unit-III	Strategies for conservation of resources: Social forestry, Principle of conservation, In situ conservation (Sanctuaries, National Parks, Biosphere reserves for wild life conservation), Ex situ conservation(Botanical Garden, Field gene bank, Seed bank, in vitro repositories, Cryo banks).	9
Unit-IV	Pollution and Climate change : Air, Water and Soil pollution(Kinds, sources, quality parameters) and their effects on plants and ecosystem. Green house gases- CO2 , CH4, N2O, CFCs (source, trend and role). Ozone layer and Ozone Hole, Consequences of climate change, (Co2 as fertilizer, Global warming, sea level rise, UV radiation). Bioremediation (Management of Pollution).	9
Unit-V	Resource Monitoring Remote sensing Concepts and tools, Satellite remote sensing ,basics, sensors, Visual and digital interpretation) EMR bands and their application , Indian remote sensing Program Thematic mapping of resources Application of Remote sensing.	9

Suggested Laboratory Exercise -

1. Study of locally available plants.
2. Food crops – Wheat, rise, maize, chickpea, potato tapioca, sweet potato, sugarcane , morphology , anatomy , economic importance.
3. Forage / fodder plants – study of any five important crops of locally available.
4. Textile fibres – cotton, jute, linen, sun hump, cannabis.
5. Maceration technique and staining technique of fibres.
6. Fibres for stuffing – silk cotton or Kapok.
7. Medicinal and aromatic plants:- morphology and importance of Papaver somnifera , Atropa balladona , Catharanthus roseus , Adhathoda vasaca , Rauwolfia serpentina , Withania somnifera , Phyllanthus nurori , Andrographis paniculata , Aloe barbedensis , Mentha arvensis , Rosa , Pogostemon cablin , Viteveris zizanioides , Jasminum grandiflorum , cymbopogon sp. , Rosa , Pandanus odoratissimus .
8. Fire wood and timber yielding plants and Non wood forest products (NWFPs).
9. Morphology and Anatomy of oil yielding tissue and their test (Biochemical or by staining).
10. Prepare an inventory of medicinal and aromatic plants, bamboos and timber yielding plants of your area giving their scientific and local name their important uses appropriate illustrations.
    - Study of live or herbarium specimens or other visual materials to become familiar with these resource.
11. Remote sensing image interpretation.
12. Mapping of natural resourses (water and forest) of M.P.
13. Enlist wild and cultivated varieties of cereal crops of M.P.
14. Study of pollination indicator plants.
15. Water and soil analysis.
16. Study of leaf injury.
17. Cellulose test for natural fibers.

Study of live or herbarium specimens or other visual materials to become familiar with these resource

The student should be taken to one of the following-

1. A protected areas (biosphere reserve- Pachmari, national park or a sanctuary).
2. A wet land.
3. Botanical survey of India (BSI).
4. CSIR Laboratory doing research on plants and their utilization.
5. Botanical Gardens or Museum.
6. FRI Forest Research Centre, Dehradun.

Note **– The students are expected to prepare a brief illustrated narrative of the field survey and scientific visits. After evaluation the grades awarded to students by teachers and should be added to the final assessment of practical examination**.

Suggested Reading

Brady,N.C.1990 The Nature and Properties of Soil MacMillan.
Heywood, V.H. and Watson, R.T. 1995 Global Biodiversity Assessment. Cambridge University Press.
Hill, M.K. 1997 Understanding Environmental Pollution,. Cambridge University, Press.
Kohli, R. Arya, K.S., Singh, P.H. and Dhillon, H.S,. 1994 Tree Directory of Chandigarh, Lovedale Educational, New Delhi.
Kothari A. 1997 Understanding Biodiversity Life Sustainability and Equity.
Orient Longman.Mason, C.F. 1991. Biology of fresh water Pollution Longman.
Nair, M.N.B.et.al.1998Sustainable Management of Non Wood Forest Products.
Faculty of Forestry, University Putra Malasia 434004 PM Serdong Selangor Malaysia

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Session		**2020-21**
Class		M.Sc.
Semester		IV
Subject	(English)	Botany
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Paper		PG-401
Title of the Paper	(English)	Biotechnology and Tissue Culture
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant cell and tissue culture: General introduction, history, scope, concept of cellular differentiation and Totipotancy. Establishment of lab, aseptic technique and sterilization of glassware. Different types and preparation of media. Ex plant technique of tissue culture, meristem, anther, embryo culture and organogenesis.	9
Unit-II	Somatic Hybridization, Protoplast isolation, Fusion and culture, Somatic cell genetics, application of tissue culture, Artificial seed, Somaclonal variation, Production of Secondary metabolites, cryopreservation, and germplasm storage.	9
Unit-III	Biotechnology Principles and Application of biotechnology in agriculture, horticulture, forestry, food, and industries, health care and immunology, environment biotechnology, and ethics. Intellectual Property Right. Genetic engineering of plants, aims, strategies of Transgenic Agrobcterium, T-DNA, Gene tagging microbial genetic manipulation, genetic improvement of industrial microbes, fermentation technology.	9
Unit-IV	Recombinant DNA technology: gene cloning, principle and technique, construction of genomic and c-DNA library, Vector, Plasmid, DNA synthesis, Polymerase Chain Reaction (PCR), DNA fingerprinting.	9
Unit-V	Genomics and proteomics, molecular markers, Artificial chromosomes, High through put sequencing, genome projects, bioinformatics, microarrays, protein profiling and its significance.	9

Suggested Laboratory Exercise: -

1. To prepare biotechnology lab.
2. Sterilization techniques.
3. Preparation of culture medium.
4. Sterilization of medium.
5. To demonstrate growth characteristics of E.coli using plating method.
6. To demonstrate growth characteristics of E.coli by turbidiometric method.
7. To study the effect of antibiotics on growth of microorganism.
8. To study fermentation techniques.
9. Study of nitrogen fixer & its applications.
10. To prepare tissue culture lab.
11. Stertization techniques.
12. Sterilization of glassware.
13. Preparation of tissue culture medium.
14. Stertization of Explants.
15. Study effect of plant growth hormones (PGR) on tissue culture.
16. To perform the techniques of micro propagation/ somatic embryogenesis /anandroganesis.
17. To perform the techniques of organogenesis.
18. Study of applications of tissue culture.
19. Raising of callus by isolation of an explants from Daucus carota on MS medium
20. Preparation of artificial seeds.

Suggested Reading

Butenko, R.G. 2000 Plant Cell Culture. University Press Of pacific.
Collin, H.A. and Edwards, s. 1998 Plant Cell culture. Bios scientific publishers Oxford. UK.
Callow, J.A. Ford-Lioyd, B.V. and Newbury, H.J.1997 Biotechnology and plant genetic Resources, Conservation and Use.CAB, International Oxon, UK.
Dixon, R.A. 1987 Plant Cell Culture; a Practical Approach. IRL press, Oxford. George, E.F.1993 Plant Propagation by Tissue culture part- 1&2 Exegetics Ltd Edington. UK.
Glick, B.R. and Thompson, J.E. 1993 methods in Plant molecular Biology and Biotechnology Grc Press Boca Raton. Florida.
Primrose, S.B. 1995 Principles of Genome Analysis, Blackwell Science ltd., Oxford,

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Session		**2020-21**
Class		M.Sc.
Semester		IV
Subject	(English)	Botany
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Paper		**PG 402**
		II
Title of the Paper	(English)	**Applied Botany and Instrumentation**
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plants used in daily life: plants used in cosmetics, herbal cosmetic products and applications. Plants used in hair care and skin care. Herbal dyes and their uses **.** Herbal beverages. Small scale industries.	6
Unit-II	Aromatherapy: Introduction, History, modern concept of Aromatherapy. Essential oils, Extraction technique by Sohxlate method. Applied aspects of Aromatherapy.	9
Unit-III	Organic Farming and applications, Bio-fertilizers, Vermiculture, Floriculture, Mushroom cultivation technique, Nursery management and applications, marketing strategies, possibilities and loan schemes. Entrepreneurial Development.	10
Unit-IV	Microscopy: Principle and applications. Types of microscopes. Basic knowledge of spectrophotometer, Electrophoresis, Colorimeter, pH meter and Centrifuge.	10
Unit-V	Introduction to computer: fundamentals, MS ,DOS,MS WORD , MS EXCEL usage of Computer in Biology, Sample graph plotting, Net working of Computer, basic need and applications , modern strategies of literature search.Record and presentation of Data and scope.	10

Suggested Practical Exercises-

1. Extraction technique by sohxalate method of essential oils
2. methods of processing of crude plants and their storage.
3. Traditional method of beautification of skin and their application-
   - Cleansing-Alove,Papaya,Lemon etc.
   - Nutritive-Ashwagandha,Ginsing,Nagarmotha etc
   - Bleaching-Amba haldi,Raktachuran,kachur,suganthi etc
   - Anti wrinkle-Manjistha,papaya,suganthiets,Kumari etc

4. Hair care- amla, shikakai, Aritha, Nagarmotha etc.
5. Aromaterapy by –Chameli, Rose, Eucaliptus, Tulsi etc.
6. **Enlist herbal pesticides and herbicides.**
7. Techniques of vermiculture, Mushroom culture, nursery management
8. Perfoma preparation of proposal of marketing of plants
9. Herbal dyes and their uses.
10. Working principle and Practical based on pH meter, Electrophoresis, Spectrophotometer, Centrifuge etc
11. MS office,DOS,MS WORD , MS EXCEL .Usage of Computer in Botany.

Suggested Reading

- Biotechnology-R.C. Dubey
- Biostatistics and Computer Application- Dr. R Goswami
- Mushroom Cultivation-
- Vermiculture-
- Floriculture-
- Aromatherapy -a Complete Guide to the Healing Art- Kathi Kerthi and Mendy Green
- Essential oils for Radiant Health- Susanne Fischer Rizzi 1998
- Beauty through Herbs- Dr. Urjita Jain, Institute of Herbal Science, Mumbai,1997
- Text book of Cosmetology-Harry
- Cosmetic Science and technology-Sagarin C.B.
- The Skin care Book: Simple Herbal Recipes-Kathryn wartrochi, Ist Edition 1996,Paper Gooseberry Hill Publication.
- Natural organic Hair & Skin care :Including A to z Guide to natural & Synthetic Chemicals in cosmetics- ISBN-1990,Aubrey Hampton organic press
- Instrumentation-
- Wealth of India-CSIR New Delhi Publication
- Entrepreneurial Development concept and practices-Dilip Sarwate, Everest Himalaya Publication
- Entrepreneurial Development –S.S.Khan ,S Chand Publication
- Entrepreneurial Development in India- Dr. C. B. Gupta & Dr. N. P. Shrinivasan, S Chand Publication ,4th Edition

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2020-21
Theory / Practical

Session		**2020-21**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	¼fgUnh½	**ouLifr 'kkL=**
Paper		**PG-403: Elective Paper-I**
		III
Title of the Paper	(English)	
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers I

1. Environmental science
2. Limnology
3. Industrial microbiology
4. Taxonomy of Angiosperms
5. Applied Mycology
6. Forest Biology, Forest vegetation of India and Management of Forest Resources
7. Plants and Society

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2020-21
Theory / Practical

Session		**2020-21**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	¼fgUnh½	**ouLifr 'kkL=**
Paper		**Elective Paper-I**
		III
Title of the Paper	(English)	**PG-403: Environmental Science**
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Global distribution and Classification of climate (Koppen's classification); Climatic types and their distribution. Climate of India**.**Climatic Factors (Light, Temperature, Water) Soil types of India and Soil type of World	9
Unit-II	**Global warming and climate change**: Green house effect; consequences; responsible factors. Environmental Impact Assessment. Environmental management.	9
Unit-III	**Toxicology** : Radiation toxicants - Kinds, sources & biological effects. Chemical toxicants - Sources & biological effects of Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides. Bioremediation : Need , scope & technology .	9
Unit-IV	**Environmental Laws** : Goal, objectives and guiding principles of Environmental Laws; Indian Environmental Laws; National Environmental Policies ; Environmental priorities in India and sustainable development.	9
Unit-V	**Environmental Education and Organization** : Goal, objectives and guiding principles of Environmental Education ; Environmental Education in educational Institutes; Environmental organizations and agencies; Man and Biosphere Programme (MAB).	9

Suggested Practical exercises-

1. **Meteorological recording-**
   Determination of air temperature by Min.-Max. thermometer& humidity by hygrometer,Sling pschrometer .
   Determination of light intensity.
   Determination of clouds by Okta scale.
   Determination of wind velocity.
   Determination of precipitation by Rain Gauge.
   Determination of light penetration by Sachi disc.

2. **Non-conventional Bio-management of waste-**
   1. Planning of Root Zone treatment.
   2. Vermicomposting.

3. **Sampling for physico-chemical properties of water-**
   1. To measure temperature by thermometer.
   2. To measure pH by pH meter/pH indicator.
   3. To determine turbidity by turbidometer.
   4. To determine light intensity by photometer.
   5. To determine DO(dissolved oxygen) in eutrophic & oligotrophic water.
   6. To determine BOD(biological oxygen demand) of pond water.
   7. Determinetion of chloride/fluoride/nitrate/phosphate/hardness.

4. **Sampling for soil analysis-**
   1. To determine Nitrate, Phosphate, Carbonate,Potessium .
   2. To determine water holding capacity of soil.
   3. To determine organic matter content of soil.
   4. To determine bulk density and porosity of soil.

5.Exercises based on pollution-

- To study the foliar injuries of plants which are exposed to SO_2..
- To determine dust deposition on leaves of polluted and non polluted areas.
- To determine pH of plants growing in under polluted and non-polluted areas.
- To study environmental impact of a given developmental activity using checklist as AIE method.

The purpose of above practical exercises is to make the students aware of the issues related to environmental science specially global warming, climate change and impact on nature and for ecological services.

7. Study of Toxicants- Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides.
8. Study of Bioremidiation
9. Study of bioindicators

<u>SUGGESTED READINGS</u>

- **Smith. R.L. 1996.** Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- **Begon. M.. Harper, J.L. and Townsend, C.R. 1996**. Ecology. Blackwell Science. Cambridge.
- **Ludwig. J. and Reynolds. J.F. 1988**. Statistical Ecology. John Wiley & Sons.
- **Odum. E.P. 1971**. Fundamentals of Ecology. Saunders, Philadelphia.
- **Odum, E.P. 1983**. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- **Kormondy, E.J. 1996**. Concepts of **Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.**
- **Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. t::ambridge University Press, Cambridge, U.K.**
- **Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.**
- **Treshow. M. 1985. Air Pollution and Plant Life. Wiley Interscience**.
- **Heywood, V.H. and Watson. R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.**

- **Mason, C.F. 1991. Biology of Freshwater Pollution. Longman. 'Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .**
- **Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.**
- **Mason, C.F. 1991. Biology of Freshwater Pollution. Longman. '**
- **Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .**
- **Kothari, A 1997. Understanding Biodiversity: Life'Sustainability and Equity. Orient Longman.**
- **Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994. Tree Directory of Chandigarh. Lovedale Educational, New Delhi.**
- **Nair, M.N.B. et. al (Eds) 1998. Sustainable Management of Non-wood Forest Products. Faculty of Forestry, Universiti Putra Malaysia. 434004 PM Serdong, Selangor, Malaysia.**
- **Rodgers, N.A. and Panwar, H.S. 1988. Planning a Wildlife Protected Area Network in India. Vol. 1. The Report. Wildlife Institute of India, Dehradun.**
- **Walter, K.S. and Gillett, H.J. 1998. 1997 IUCN Red List of Threatened Plants. IUCN, the World Conservation Union. IUCN, Gland, Switzerland, and Cambridge**,

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(As Recommended by the Board of Studies)
2020-21
Theory / Practical

Session		**2020-21**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	¼fgUnh½	**ouLifr 'kkL=**
Paper		**PG 404: Elective Paper-II**
		IV
Title of the Paper	(English)	
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers II

1. Ethnobotany
2. Plant protection
3. Bioinformatics and computer applications and Biostatistics
4. Molecular biology and biotechnology
5. Pollution Ecology

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2020-21
Theory / Practical

Session		**2020-21**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	¼fgUnh½	**ouLifr 'kkL=**
Paper		**Elective Paper- 404**
		IV
Title of the Paper	(English)	**Ethnobotany**
	¼fgUnh½	
Medium of Instructions (Teaching)		English/fgUnh/Both ¼nksuksa½
Question Paper Language		English
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Definition and scope of Ethnobotany Historical review and outline idea of archaeoethnobotany. Ethnoecology, Ethnomedicines, Ethnonarcotics, Ethnopharmacology, Ethnotaxonomy, Ethnocosmetics, Ethnolinguistics, Ethnoorthopaedics, Ethnopaediatrics.	9
Unit-II	Preservation of Genetic diversity, plants used in various systems of medicines, Ayurvedic, Unani, Homoeopathic and Allopathic systems. Plants used by villagers and tribal people. Role of ethnobotany in the development of Society.	9
Unit-III	**Ethnobotanical importance of :***Aconitum napellus, Allium cepa, Mentha arvensis, Allium sativum, Nux-vomica, Aloe vera, Ocimum sanctum, Atropa belladona, Azadirchta indica, Piper nigrum, Butea monospera, Pterocarpus marsupium, Terminalia bellerica, Terminalia arjuna, Terminalia chebula , Eugenia aromatica, Eugenia jambolana, Hollarrhena antidysenterica, Withania somnifera, Lawsonia inermis.*	9
Unit-IV	**Ethnobotanical importance of**: Cassia *fistula, Cannabis sativa, Ricinus communis, Emblica officinalis, Santalum album.* Plants in mythology, Taboos and Totems in relation to plants, folklore and folk tales, Wild life protection by tribal, plants domestication by the tribals. Plants in similes and metaphors.	9
Unit-V	Detailed study of the common plants and their parts used in the treatment of following diseases:Expulsion of worms, Skin diseases, Bronchial inflammation and Asthma, Tuberculosis, Urino - genital problems, Amoebic dysentery, Malaria, Rheumatism, Leprosy, Jaundice, Heart diseases, Piles, Leukoderma.	9

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Investigation of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR
28. Somatic Hybridization
29. Biofertilizers and Bioinoculants
30. Transgenics
31. Exploitation of Rhizospheric microbes including mycorrhizae
32. Recycling of domestic, municipal and industrial wastes
33. Vermicomposting and Biomethanation
34. Environmental Monitoring
35. Assessment of Pollution in different habitats

List of Journals-

1. Indian journal of Multidisciplinary Research-CMRA Kerala.
2. National journal of Life Science.
3. International Journal of Biotechnology.
4. Journal of Biotechnology
5. Pollution Research.
6. Science Reporter.
7. University New- UGC.
8. Acta Botanica.
9. Acta Ecologica.
10. Tropical Ecology.
11. Annual Review of Plant Physiology and Molecular Biology.
12. Current Advance in Plant Science.
13. Nature Review: Molecular and Cell Biology.
14. Indian journal of Biotechnology (NISCAIR New Delhi).

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Shivaji Nagar, Bhopal
Under Graduate ANNUAL Pattern of Syllabus of Botany
Syllabus of Botany
(As Recommended by the Board of Studies)
Practical scheme 2020-21
(based on Paper I&II)

B.Sc. I Year

M.Marks-50

B.Sc. I Year- Scheme of practical examination based on paper I&II

Time: 4 hrs Marks: 50

Q.1 Algae/Fungi ---------- 05

Q.2 Bryophyta/Pteridophyta---------- 05

Q.3 Gymnosperms---------- 10

Q. 4 Anatomy & Morphology ---------- 10

Q. 5 Spotting (1 to 5) ----------10

Q. 6 Viva----------05

Q. 7 Sessional ---------- 05

Total 50

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Under Graduate ANNUAL Pattern of Syllabus of Botany
(As Recommended by the Board of Studies)
2020-21
Practical Scheme 2020-21

B.Sc. II Year
Practical Exercises + Scheme based on paper I&II

Time: 4 hrs **Marks: 50**

1.	Taxonomy	-	10
2.	Embryology – Anther/Ovule/Placentation	-	05
3.	Exercise based on Ecology	-	10
4.	Exercise based on Phytogeography/National Parks	-	05
5.	Spotting (01-05)	-	10
6.	Viva voce	-	05
7.	Sessionals	-	05

Total-50

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2020-21

BOTANY PRACTICAL EXERCISES + SCHEME BASED ON PAPER I & II

B.Sc. III Year

Maximum 50 Marks

Question 1. Exercise based on Physiology.	10
Question 2. Biochemical Test	05
Question 3. Exercise based on Cytology (Smear preparation identification of stages)	10
Question 4. Exercise based on Genetic Problem	05
Question 5. Spotting (1 to 5)	10
Question 6 . Viva-Voce	05
Question 7. Sessional	05

Total	**50**

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Shivaji Nagar, Bhopal
Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2020-21
M.Sc Botany (Semester system)
SEMESTER-I
Practical scheme for Part-I
(Based on Course PG 101 and 102)

M.M-100 **Time 4 Hrs**

Exercise –

1. **Prepare a slide of given material A (fungi). Draw well labelled diagrams. Identify giving reasons……. 16**
2. **Bacterial Staining …..... . 10**
3. **Prepare slide of given material B (Algae) , Draw well labelled diagrams. Identify three algae with giving reasons…… 24**
4. **1 to 10 spot……. 20**
5. **Viva Voce…… 10**
6. **Sessional……. .. 20**

Total 100

M.Sc Botany SEMESTER –I
Practical scheme for Part-II
(Based on Course PG 103 and 104)

M.M-100 **Time 4 Hrs**

Exercise –

1. **Prepare a slide of given material A (Bryophyte). Draw well labelled diagrams. Identify giving reasons……. 15**
2. **Prepare a slide of given material B (Pteridophyte). Draw well labelled diagrams. Identify giving reasons 15**
3. **Monographic study of given material C (Gymnosperm). Draw well labelled diagrams. Identify giving reasons 20**
4. **1 to 10 spot……. 20**
5. **Viva Voce……. 10**
6. **Sessional……. 20**

TotalS **100**

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2020-21
M.Sc (Previous) Botany
SEMESTER-II
Practical scheme for Part-I (Based on PG 201 and 202)

M.M-100 **Time 4 Hrs**

1. **Exercise based on Cell Biology……..….. 15**
2. **Exercise based on Cytogenetics…… 10**
3. **Study of Anther / Ovule / Seed…… 15**
4. **Demonstration of Emasculation Tech…… 10**
5. **Spot 1 to 10…….. 20**
6. **Viva-Voce……..... 10**
7. **Sessional and Records……. 20**

Total 100

M.Sc (Previous) Botany

SEMESTER-II

Practical scheme for Part-II (Based on PG 203 and 204)

M.M-100 **Time 4 Hrs**

Exercise –

1 .Exercise based on Physiology (major)…….…… 15
2 .Exercise based on Physiology (minor)……..…… 10
3. Exercise based on ecology (community study)……..... 10
4**. Exercise based on ecological adaptation…… …..……. 15**
5**. Spotting 1 to 10…….…..…….... 20**
6. Viva-Voce……..…... 10
7. Sessional and Records…….……. 20

……..
Total 100

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
As Recommended by the Board of Studies
2020-21
M.Sc. SEMESTER- III
Botany Practical Part-I
Practical Scheme
(Practical based on PG 301 & 302)

MM – 100 ***Time :- 4 hrs***

Execises :-

1. Exercise based on Taxonomy
   (Study of given plant up to genus level)----------15
2. Exercise based on Morphology
   (Study of stamens/ carpels/ placentation) ---------- 10
3. Exercise based on Molecular Biology ---------- 15
4. Exercise based on Plant Breeding ---------- 10
5. Spot 1 to 10---------- ---------- 20
6. Viva-Voce ---------- 10
7. Sessional & Record ---------- 20

TOTAL 100

M. Sc. Botany (Semester System)
Third Semester
Practical scheme for Part - II
(Based on course PG 303 & 304)

Time :- 5 hrs. ***MM - 50***

Exercises :-

1. Exercise based on Physiology---------- 15
2. Exercise based on Biochemistry and Metabolism---------- 10
3. Exercise based on Ecology of
   Food/Forage/Fodder/Medicinal Plants ---------- 15
4. Report on field survey ---------- 10
5. Spot 1 to 10 ---------- ---------- 20
6. Viva-Voce ---------- 10
7. Sessional & Record ---------- 20

TOTAL 100

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

2020-21

M.Sc Botany SEMESTER-IV

Botany Practical Part -I

Practical Scheme

(Practical based on PG 401 & 402)

Time : 4 hrs **Botany Practical-I Scheme (Practical based on PG 401 & 402)**

MM 100 **Time : 4 hrs**

Exercises

1. Exercise based on Biotechnology…… 15
2. Exercise based on Tissue culture …… … 10
3. Exercise based on Applied Botany…… 15
4. Exercise based on Instrumentation …… … 10
5. Spot 1 to 10 …… 20
6. Viva-Voce …… 10
7. Sessionals and Record …….. 20

……

100

Practical Base on the Course Code 403: Elective-I Course Code 404: Elective-II

2020-21

M.Sc Botany SEMESTER-IV

Botany Practical Part -II

Botany Practical Scheme (Practical based on PG 403 & 404)

MM 100 Time : 4 hrs

Exercises

1. Major Exercise based on Elective - I …….. 15
2. Minor Exercise based on Elective - I……... 10
3. Major Exercise based on Elective - II …….. 15
4. Minor Exercise based on Elective - II……... 10
5. Spot 1 to 10 …… 20
6. Viva-Voce …….…. 10
7. Sessionals and Record ……..…... 20

……

100

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE
SHIVAJI NAGAR, BHOPAL

Syllabus of Botany

As Recommended by the Board of Studies
2017-18

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College

Shivaji Nagar, Bhopal – 462016

Syllabus

2017-2018

Subject:BOTANY

Details			Page No.
Under Graduate Level			
	Theory	**B.Sc.I Paper- I**	…5-6
	„ „	**B.Sc.I Paper- II**	…7-8
	„ „	**Semester III**	…9-11
	„ „	**Semester IV**	…12-14
	„ „	**Semester V**	…15-16
	„ „	**Semester VI**	…17-18
	Practical	**B.Sc.I**	…61
	„ „	**Semester III**	…62
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	„ „	**Semester V**	…64
	„ „	**Semester VI**	…65
Post Graduate Level			
	Theory	**Semester I**	…21-28
	„ „	**Semester II**	…29-38
	„ „	**Semester III**	…39-47
	„ „	**Semester IV**	…48-60
	Practical	**Semester I**	…66
	„ „	**Semester II**	…67
	„ „	**Semester III**	…68
	„ „	**Semester IV**	…69

Date of submission in Autonomous Examination cell:

Signature H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College
Shivaji Nagar, Bhopal – 462016

Syllabus of Botany: As Recommended by the Board of Studies
2017-18
Scheme of examination

Course:Botany **B.Sc. (3 Years Degree Course)**

Theory Papers/practical	Title of paper	Compulsory/ Optional	Marks
B.Sc. I Year **ANNUAL SYSTEM**			
Paper I	Diversity of Lower Plants	Compulsory	40+10CCE=50
Paper II	Diversity of Higher Plants	Compulsory	40+10CCE=50
Practical	Botany Practical(based on paper I&II)	Compulsory	50
Total Marks			**150**
SEMESTER III			
Paper	Structure, Development and Reproduction in flowering plants	Compulsory	70+30CCE=100
Practical	Botany Practical	Compulsory	50
Total Marks			**150**
SEMESTER IV			
Paper	Plant Ecology, Biodiversity and Phytogeography	Compulsory	70+30CCE=100
Practical	Botany Practical	Compulsory	50
Total Marks			**150**
SEMESTER V			
Paper	Plant Physiology and Biochemistry	Compulsory	70+30CCE=100
Practical	Botany Practical	Compulsory	50
Total Marks			**150**
SEMESTER VI			
Paper	Cell Biology, Genetics and Biotechnology	Compulsory	70+30CCE=100
Practical	Botany Practical	Compulsory	50
Internship Training	Job oriented Project/ Internship will be carried out in VI Semester for 60 hrs as per policy of Department of Higher Education	Compulsory	100

Total Marks			**250**
GRAND TOTAL			**1000**

Signature with date

Member Board of Studies:

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Under Graduate ANNUAL Pattern of Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		**2017-18**
Class		**B.Sc.. Ist Year**
Subject	**(English)**	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**I**
Title of the Paper	(English)	**Diversity of Lower plants**
	(हिन्दी)	**निम्न श्रेणी के पादपो की विविधता**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		40+10CCE=50

Unit		Syllabus	Periods
Unit-I	(English)	**Viruses and Prokaryots:** characteristics of Virues, general account of TMV and T4 bacteriophage. Bacterial structure, nutrition, reproduction and economic importance; General account of Mycoplasma Cynobacteria and Actinomycetes.	09
	(हिन्दी)	**वाइरस एवं प्रोकेरियोट :** विषाणुओं के सामान्य लक्षण, टी एम.वी एवं टी फोर बेक्टीरियोफेज का सामान्य विवरण। जीवाणु की संरचना, पोषण, प्रजनन एवं आर्थिक महत्व, मायकोप्लाज्मा सायनो–बेक्टीरिया एवं एक्टीनोमाइसीटीज का सामान्य विवरण।	
Unit-II	(English)	**Algae** : General characters, classification and economic importance. Important features and life history of Chlorophyceae- *Volvox, Oedogonium*, Charophyceae- *Chara*, Xanthophyceae - *Vaucheria*, Phaeophyceae - *Ectocarpus*, Rhodophyceae -*Polysiphonia.*	09
	(हिन्दी)	**शैवाल** : शैवालों के सामान्य लक्षण, वर्गीकरण एव ं आर्थिक महत्व, मुख्य लक्षण, एवं जीवन चक्र क्लोरोफायसी–वॉल्वॉक्स, ऊडोगोनियम, कैरोफायसी–कारा, जैन्थोफायसी– वाउचेरिया फियोफायसी–एक्टोकार्पस, रोडोफायसी– पोलीसाइफोनिया।	
Unit-III	(English)	**Fungi**: General characters, classification and economic importance, Important features and life history of Oomycetes- Albugo, Zygomycetes -*Mucor*, Asco mycetes –*Yeast* , *Peziza*, Basidomycetes - *Puccinia*, Deurteromycetes –*Alternaria* ,,General account of lichens.	09
	(हिन्दी)	**कवक** : कवकों के सामान्य लक्षण एवं वर्गीकरण एवं आर्थिक महत्व। प्रमुख लक्षणों एवं जीवन इतिहास का अध्ययन , उमाइसीटीज़ - अल्ब्युगो ,	

		जायगोमायसीटीज़ –म्यूकर। एस्कोमायसिटीज़ –यीस्ट, पेजाइजा, बेसिडियोमायसिटीज –पक्सीनिया, डयूटेरोमायसिटीज –आल्टर्नेरिया, लाइकेन्स का सामान्य विवरण।	
Unit-IV	(English)	**Bryophyta** :Genral characters and classification, study of morphology, anatomy,and reproduction of Hepaticopsida- *Riccia, Marchantia*, Anthrocerotopsida -*Anthoceros*, Bryopsida- *Polytrichum*	09
	(हिन्दी)	**ब्रायाफाइटा** : सामान्य लक्षण एवं वर्गीकरण , बाह्य आकारिकी, आतंरिक सरंचना एवं प्रजनन : हिपेटीकोप्सडा – रिक्सिया, मारकेन्शिया , एन्थेसिरोटोप्सिडा–एन्थोसिरोस, ब्रायोप्सिडा–पॉलीट्राइकम	
Unit-V	(English)	**Pteridophyta** : Important characters and classification. Stelar organization. Morphology and anatomy of Rhynia. Structure, anatomy and reproduction in *Lycopodium, Selaginella, Equisetum and Marsilea*.	09
	(हिन्दी)	**टेरिडोफाइटा**: प्रमुख लक्षण एव ं वर्गीकरण। स्टीलर सगंठन, राहिनिया की बाह्य एव ं आंतरिक सरंचना। लाइकापोडियम, सिलेजिनेला, इक्वीसिटम एवं मारसीलिया की बाह्य तथा आंतरिक संरचना एवं प्रजनन।	

Pratical work based on theoty paper

Suggested Books

1. G.M. Smith 1971 Cryptogamic Botany. Vol - I Algae & Fungi Tata McGrraw Hill . Pub. Co. NewDelhi
2. G.M. Smith 1971 Cryptogamic Botany. Vol -II Bryophytes & Pteridophytes. Tata McGrraw HillPub. Co. New Delhi.
3. O.P.Sharma,1992. Text book of Thallophyta McGrraw Hill Pub. Co.
4. O.P.Sharma,1990. Text book of Pteridophyta McMillan india Ltd .
5. P.D.Sharma 1991. The Fungi. rastogi & Co. Meerut.
6. H.C. Dubey.1990. an introduction of Fungi.Vikas Pub. house pvt.ltd.
7. P.Puri 1980. Bryophyta Atma ram & Sons, Delhi.
8. A.Clifton.1958. Introduction to the Bacteria. Mcgrew Hillpub. Co.New delhi.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Under Graduate ANNUAL Pattern of Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		**2017-18**
Class		**B.Sc.. Ist Year**
Subject	**(English)**	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**II**
Title of the Paper	(English)	**Diversity of Higher plants**
	(हिन्दी)	**उच्च पादपो की विविधता**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		40+10CCE=50

Unit		Syllabus	Periods
Unit-I	(English)	**Gymnosperm**: General characters and Classification of Gymnosperms. Heterospory and Origin of Seed Habit. Diversity of Gymnosperm: Geological Time Scale and Fossilization. Fossil Gymnosperms: *Lyginopteris* and *Williamsonia.*	09
	(हिन्दी)	**अनावृत्तबीजी**ः अनावृत्तबीजियों के विशिष्ट लक्षण एवं वर्गीकरण, विषमबीजाणुकता एवं बीज स्वभाव का उद्गम, अनावृत्तबीजियों की विविधताएँ, भू–वैज्ञानिक समय सारणी एवं जीवाश्मीभवन, अनावृत्तबीजी जीवाश्म : लाइजीनोप्टेरिस एवं **विलियमसोनिया**	
Unit-II	(English)	**Gymnosperm**: Morphology, Anatomy Reproduction and life cycle, of *Cycas*, *Pinus* and *Ephedra*.	09
	(हिन्दी)	**अनावृत्तबीजीः** आकारिकी, आन्तरिक संरचना, प्रजनन तथा जीवन–चक्रः साइकस, पाइनस, एवं एफिड्रा।	
Unit-III	(English)	**Taxonomy**: Origin and Evolution of Angiosperms: Principles and rules of Botanical Nomenclature, Museum, Herbarium and Botanical gardens; Classification of Angiosperms: Bentham and Hooker, Modern trends in Taxonomy including Molicular taxonomy. APG IV system.	09
	(हिन्दी)	**वर्गीकी** : आवृतबीजियों का उद्गम एवं विकास। वानस्पतिक नामकरण के सिद्धांत एवं नियम,**संग्रहालय,** हरबेरियम एवं वानस्पतिक उद्यान; आवृतबीजियों का वर्गीकरणः बेन्थम तथा हुकर वर्गिकी में आधुनिक प्रवृत्तियाँ एवं आणविक वर्गिकी ,एपीजी **IV** पद्धति ।	
Unit-	(English)	**Taxonomy:** Terminology for plant description in semi technical language: Diagnostic characteristics and Economic Importance of Families -Ranunculaceae, Brassicaceae,	09

IV		Malvaceae, Rutaceae, Fabaceae, and Apiaceae.	
	(हिन्दी)	**वर्गीकी** : पौधों के वानास्पतिक विवरण की **अर्ध तकनीकी** शब्दावली **।** रेननकुलेसी, ब्रेसीकेसी, मालवेसी, रूटेसी, फेबेसी एवं एपिएसी कुलों के विशिष्ट लक्षण एवं आर्थिक महत्व।	
Unit-V	(English)	**Taxonomy:** Diagnostic characteristics & Economic Importance of Families- Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Poaceae.	09
	(हिन्दी)	**वर्गीकी : रूबिएसी ,** ऐस्टेरेसी ˙मचवंमचवबलदंबमंम ऐपोसाइनेसी, सोलेनेसी, लेमिएसी, यूफोरबिएसी, लिलिएसी एवं पोएसी कुलों के विशिष्ट लक्षण एवं आर्थिक महत्व	

Pratical work based on theory paper

SUGGESTED READINGS:-

- Agarwal, S.B. 2007. Unified Botany, Shivlal Agarwal & Company Indore.
- Bhatnagar, S. P. and Moitra 1996. Gymnosperms. New Age International Limited, New Delhi.
- Davis, P.H. and Heywood, V.H. 1963, Principles of Angiosperm taxonomy. Oliver and Boyd, London.
- Gangulee, H. C. & Kar, A. K. 2006. College Botany Voll.III, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Heywood, V.H. and Moore, D.M. (eds) 1984. Current concepts in plant taxonomy. Academic press London.
- Jeffery, C. 1982. An Introduction of plant taxonomy. Cambridge University Press Cambridge, London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematic. Mc Graw Hill Book Co. New York.
- Kaushik, M.P. 2003. Modern Textbook of Botany, Prakash Publication Muzaffar Nagar U.P.
- Mukherjee, S.K. 2006. College Botany Voll.II, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi- 110055.
- Radford, A.E. 1986. Fundamentals of Plant Systmatics, Happer and Raw, New York.
- Saxena and Sarabhai. 1989. Text book of Botany. Rastogi Publication Meerut.
- Singh, G. 1999. Plant Systematics : Theory and Practice. Oxford and IBH Pvt. Ltd.New Dehli
- Vasishta, P.C. 2005. Botany for degree students Voll. V, Gymnosperms. S. Chand & Company Ltd. Ramnagar, New Delhi- 110055

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		**2017-18**
Class		B.Sc. II
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Structure, Development and Reproduction in flowering plants.**
	(हिन्दी)	**पुष्पीय पौधों की संरचना, विकास एवं प्रजनन**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**70+30 C.C.E**

Unit		Syllabus	Periods
Unit-I	(English)	**The Root system**: Root apical meristems, Differentiation of primary and secondary tissues and their roles. Anatomy of Monocot and Dicot root, Secondary growth in root. Morphological modification of root for storage, respiration and reproduction. Interaction of root with microbes.	09
	(हिन्दी)	**जड़ तंत्र :** जड़ का शीर्ष विभज्योतक, प्राथमिक एवं द्वितीयक ऊतकों का विभदेन एवं उनके कार्य, एकबीजपत्री एवं द्विवीजपत्री जड़ की आन्तरिक सरंचना, जड़ मे द्वितीयक वृद्धि के आकारिकीय रूपान्तरण : सचंयन, श्वसन, प्रजननं । सूक्ष्मजीवों के साथ पारस्परिक क्रिया।	
Unit-II	(English)	**The Shoot system**: Shoot apical meristem and histological organization, Anatomy of Monocotyledons and Dicotyledons: Vascular cambium and its functions, Secondary growth in stem .Characteristics of growth rings, Sapwood and Heart wood, Secondary Phloem, Cork Cambium and Periderm.	09
	(हिन्दी)	**प्ररोह तंत्र** : प्राहे शीर्षस्थ विभज्योतक एवं ऊतकीय सगंठन, एकबीजपत्री एवं द्विबीजपत्री तने की आन्तरिक संरचना– सवंहन एधा एवं उसके कार्य, तने में द्वितीयक वृद्धि , वृद्धि वलय की विशेषताएं, सैप काष्ठ एवं हार्ट काष्ठ, द्वितीयक फ्लोएम, कार्क कैम्बियम एवं पेरीडर्म।	
Unit-III	(English)	**The Leaf system**: Origin, Development of leaf, Diversity in size, shape and arrangement, Internal structure of Dicot and Monocot leaf . Adaptations tophotosynthesis and water stress,	09

		senescence and abscission.	
	(हिन्दी)	पत्ती तंत्र : उत्पत्ति एवं विकास, प्रमाप, आकार एवं विन्यास में विविधताएं, एकबीजपत्री एवं द्विबीजपत्री पर्ण की आतंरिक सरंचना, प्रकाश सश्लेषण एवं जलहास प्रतिबल का अनुकुलन, जीर्णता एवं विलगन।	
Unit-IV	(English)	**Embryology**: Concept of flower as a modified shoot,Structure of Anther, Microsporogenesis and Male Gametophyte. Structure of Pistil, Ovules, Megasporogenesis and Development of Female Gametophyte (Embryo Sac) and its types, Pollination –Mechanism and Agencies of Pollination, Pollen Pistil interactions and Self incompatibility.	09
	(हिन्दी)	**भ्रूण विज्ञान** : पुष्प एक रूपांतरित प्ररोह की अवधारणा, परागकोष की संरचना,लघुबीजाणुजनन एवं नर युग्मकाद्भिद्, स्त्रीकेसर की सरंचना, बीजाण्ड, गुरूबीजाणजनन, मादा यगुमकाद्भिद का विकास(भ्रूण काषे) एवं पकार, परागण –परागण की प्रक्रिया एवं एजेन्सी, पराग स्त्रीकेसर की पारस्परिक क्रिया एवं स्वअनिषेच्यता।	
Unit-V	(English)	**Embryology** : Double Fertilization, Development and types of Endosperm and its morphological nature, Development of Embryo in Monocots and Dicots, Fruit development and maturation. Seed structure and dispersal, Vegetative Propagation.	09
	(हिन्दी)	**भ्रूण विज्ञान :** द्विनिषेचन, भ्रूणपाषे का विकास, प्रकार एवं इसकी आकारिकीय प्रकृति,एकबीजपत्रीय और द्विबीजपत्रीय भ्रूण का विकास, फल का परिवर्धन एवं परिपक्वता, बीज की संरचना एवं प्रकीर्णन, कायिक प्रवधर्न की पकार ।	

Practical work based on theory -

- **Suggested Books:** Gangulee, H.C., Das, K. S. And Dutta, C. 2007. College Botany Vol.I, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Heywood, V.H. & Moore, D.M. (eds) 1984. Current concepts in plant taxonomy. Acedemic press London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986, Plant taxonomy (III edition) Mc Graw Hill Book Co. New York.

- Maheshwari, P.1978. Plant Embryology.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi- 110055.
- Radford, A.E. 1986. Fundamentals of Plant Systematics, Harper and Row,New York.
- Shrivastava and Das. Modern text book of Botany Vol-III & IV.
- Singh, V., Pande P.C. and Jain , D. K. Structure & Development in Angiosperms. Rastogi Publication, Meerut.
- Banson, L.B.; 1957: Plant Classification, Health& Co. Boston.
- Davis, P.R & Heywood, V.H 1973: Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. *Co.* New *York*, USA
- Eames, AJ.; 1961: Morphology of Angiosperms, Mc-Graw Hill, New York.
- Jeffery, C.; 1968: An Introduction to Plant Taxonomy J. & H. Churchill Limited.
- Lawrence, G .H.M.; 1951: Taxonomy of Vascular Plants Macmillan, NewYork.
- Naik V. N.; 1984: Taxonomy of Angiosperms. Tata Mc-Graw Hill Pub. Co. Ltd. New Delhi.
- Porter, L.L.; 1959: Taxonomy of Flowering Plants. San Francisco. Radfor~ *AE.* Dickinson, W.C. MasseyJ.R and. Ben. C.R: 1974: VQ~llar Plant SYstematics, Harper & Row, New York.
- Fahn: Plant Anatomy
- Vashishtha: Anatomy
- Panday,B.P.,: Plant Anatomy
- Esau: Plant Anatomy
- Bhojwani & Bhatnager: Embryology

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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2017-18
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Session		**2017-18**
Class		B.Sc.II
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Plant Ecology, Biodiversity and Phytogeography**
	(हिन्दी)	**पादप पारिस्थितिकी जैव विविधता एव पादप भौगोलिकी**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**70+30 C.C.E.**

Unit		Syllabus	Periods
Unit-I	(English)	**Ecosystem**: concept and types of ecosystem, structure and function of ecosystem, biotic and abiotic components, trophic levels, food chain, food web, ecological pyramids, energy flow. **Biogeochemical cycle**: concept, gaseous composition, gaseous and sedimentary cycles, carbon, nitrogen, phosphorus, and sulphur .	09
	(हिन्दी)	**पारिस्थितिक तंत्रः** संरचना एवं प्रकार, जैविक एवं अजैविक घटक, पोषी स्तर, खाध श्रृंखला, खाद्य जाल, पारिस्थितिक पिरामिड, पारिस्थितिक तंत्र में उर्जा प्रवाह। **जैव भू रासायनिक चक्रः** अवधारणा, गैसीय संगठन, सेडीमेण्टरी चक्र, कार्बन, नाइट्रोजन, फास्फोरस, तथा सल्फर चक्र ।	
Unit-II	(English)	**Ecological adaptations**: Morphological, anatomical and physiological responses,water adaptation (hydrophytes, mesophytes and Xerophytes), temperature adaptation (thermoperiodicity and vernalization) light adaptation (heliophytes and sciophytes), plant **ssuccession**: Causes, trends and process, types of succession- Lithosere, Hydrosere and Xerosere.	09
	(हिन्दी)	पारिस्थितिक अनुकूलनः आकारिकी, आंतरिकी तथा कार्यिकी अनुक्रिया, जल अनुकूलन (जलोदभिद, मरूदभिद तथा समोदभिद) तापक्रम अनुकूलन (तापकालिता तथा वसंतीकरण) प्रकाश अनुकूलन (प्रकाश रागी तथा छाया रागी)	

		पादप अनुक्रमणः कारण, प्रवृत्ति एवं प्रक्रिया, पादप अनुक्रमण के प्रकार, लिथोसियर, हाइड्रोसियर (जलीय अनुक्रमण), जीरोसियर (शुष्क अनुक्रमण)	
Unit-III	(English)	**Population Ecology**:Distribution patterns, Density, Natality, Mortality, Growth curve, Ecotypes and Community ecology: characteristics, classification, life forms. **Biodiversit**y: Basic concept, definition, importance, Biodiversity of India, hot spots, "insitu" and "exsitu" conservations, endangered and threatened species, Red data book.	09
	(हिन्दी)	**जनसंख्या पारिस्थितिकीः** वितरण प्रणाली, घनत्व, जन्मदर, मृत्युदर, वद्धिवक्र, इकोटाइप एवं इक्रेडस : समुदाय परिस्थितिकी : लक्षण वर्गीकरण एवं जीवनरूप। **जैवविविधता** – आधारभूम परिकल्वना, परिभाषा, महत्व भारत की जैवविविधता, तप्तस्थल, इन सीटू संरक्षण विलुप्तप्राय तथा खतरे में पड़ी प्रजातियां, रेड डाटा बुक	
Unit-IV	(English)	**Soil**: Physico-chemical properties of soil., soil formation, development of soil profile, soil classification, soil composition, soil factors. **Pollution**: Defination, types and causes, Global warming, climate change and ozone holes.	09
	(हिन्दी)	**मृदा भौतिक**–रासायनिक गुण, मृदा निर्माण, मृदापरिच्छेदिका का विकास, मृदा का वर्गीकरण, मृदा संगठन, मृदा कारक। **प्रदूषणः** परिभाषा, प्रकार एवं कारक, वैश्विक तपन एवं जलवायु परिवर्तन, ओजोन छिद्र	
Unit-V	(English)	**Phytogeography**: Phytogeographical region of India, vegetation types of Madhya Pradesh, Biosphere reserves, sanctuaries and National parks of Madhya Pradesh. **Natural Resources**: Definition and classification of natural resources, conservation and management of natural resources, land resources management, water resources management, wet land resource management.	09
	(हिन्दी)	**पादप भौगोलिकीः** भारत के पादप भूगोलिकी क्षेत्र, म.प्र. के वनस्पतिक प्रकार, जैव मण्डल संचयन, म.प्र. के अभ्यारण एवं राष्ट्रीय उद्यान **प्राकृतिक स्त्रोतोः** प्राकृतिक स्त्रोतों की परिभाषा एवं वर्गीकरण, प्राकृतिक स्त्रोतों का प्रबंधन एवं संरक्षण, भू–स्रोत प्रबंधन, जल स्रोत प्रबंधन, आर्दभूमि प्रबंधन	

Practical work based on theory

Suggested Books:

- Odum, E.J. 2004.5th ed. Fundamentals of Ecology, Natraj Pub.
- Odum, E.J. 1983 Basic ecology, Saunders, Philadeliphia.
- Kormondy, 1996 Ecology.
- Ambast R.S. plant Ecology.
- Doubenmre: Plant and Environment.
- Puri G.S. 1960. Indian Forest Ecology.
- Sagarcya K.P. Forest and Forestry.
- pandhi-Indian Foresty.
- R.S. Shukla & P.S. Chandel,2006. A Text book of plant Ecology.
- Kumar, U.K. 2006.Biodiversity principles and conservation -Agrobios, Jodhpur.
- Banargee S.1998, Bio diversity conservations- Agrobotamica, Bikaner
- Tandan R.K .,Biodiversity taxonomy & ecology- Scientific pub-Jodhpur.
- Sharma, P.D. 7th ed. 1998 Ecology and Environment, Rastogi Pub.,Meerut,250002

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		**2017-18**
Class		B.Sc. III
Semester		V
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Plant Physiology and Biochemistry**
	(हिन्दी)	**पादप कार्यिकी और जैव रसायन**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**70+30 C.C.E.**

Unit		Syllabus	Periods
Unit-I	(English)	**Plant water relations**: Properties of water, Importance of water in plant life, Diffusion, osmosis and osmotic relation of plant cell, water absorption, Asecent of sap. **Transpiration**: Structure & physiology of stomata, mechanism of transpriation, factors affecting rate of transpiration,	09
	(हिन्दी)	**पादप जल संबंध** : जल के गुण, पादप जीवन में जल का महत्व, विसरण परासरण तथा पादप कोशिका के परासरण संबंध, जल अवशोषण, रसारोहण। **वाष्पोत्सर्जन** : रंध्र की संरचना एवं कायिकी, वाष्पोसर्जन की क्रियाविधि, वाष्पोसर्जन को प्रभावित करने वाले कारक।	
Unit-II	(English)	**Plant Nutrition**: Mineral nutrient, hydroponics, absorption of mineral nutrients, translocation of organic solutes. **Biomolecules:** Sructure classification and functions of carbohydrates, amino acids, proteins and lipids.	09
	(हिन्दी)	**पादप पोषण** : खनिज पोषण , जल सन्वर्धन ,खनिज लवणो का अवशोषण , कार्बनिक विलेय का स्थानांतरण । **जैविक अणु** : कार्बोहाइड्रेट , आमिनो आम्ल , प्रोटीन और लिपिड की संरचना ,वर्गीकरण और कार्य ।	
Unit-III	(English)	**Photosynthesis**: Chloroplast, photosynthetic pigments, red drop and emersion's effect, concept of two photosystems,light reaction, dark reaction – Calvin cycle, Hatch-Slack cycle, CAM cycle, factors affecting rate of photosynthesis and photorespiration.	09

	(हिन्दी)	**प्रकाश संश्लेषण** : क्लोरोप्लास्ट, प्रकाश संश्लेषीय वर्णक, रेड ड्राप तथा इमरसन प्रभाव, दो प्रकाश तंत्र की अवधारणा, प्रकाश अभिक्रिया, अंधकार अभिक्रिया, केलविन चक्र, हेच स्जेक चक्र, सी.ए.एम. चक्र, प्रकाश संश्लेषण को प्रभावित करने वाले कारक एवं प्रकाशीय श्वसन।	
Unit-IV	(English)	**Respiration**: Mitochondrion, aerobic and anaerobic respiration, Respiratory coefficient. Mechanism of respiration-Glycolysis, Kreb's cycle, Pentose phosphate pathway, Electron transport system, factors affecting rate of respiration, Redox Potential and theories of ATP synthesis.	09
	(हिन्दी)	**श्वसन** : माईटोकॉन्ड्रिया, आक्सी एवं अनाक्सी श्वसन, श्वसन गुणांक, श्वसन की क्रियावधि – ग्लाइकोलिसिस, क्रेब चक्र, पेन्टोस फास्फेट मार्ग, इलेक्ट्रान ट्रान्सपोर्ट तंत्र, श्वसन की दर को प्रभावित करने वाले कारक, आक्सीकरण – अपचयन विभव, ए.टी.पी. संश्लेषण के विभिन्न सिद्धांतं	
Unit-V	(English)	**Enzymology:** Classification, nomenclature and characteristics of enzyme, concept of holoenzyme, apoenzyme, co-enzymes and co-factors, mode and mechanism of enzyme action, factors affecting enzyme activity. **Plant harmones**: Discovery , structure, mode of action and role of Auxins, Gibberellins, Cytokinin, Abscissic acid and ethylene.	09
	(हिन्दी)	**ऐंजायमोलोजी :** विकरो का वर्गीकरण, नामकरण एवं अभिलक्षणिक गुण, होलाएन्जाईम, एपोएन्जाईम, कोएन्जाईम एवं कोफेक्टर्स की अवधारणा, एन्जाइम की कार्यप्रणाली एवं क्रियाविधि, एंजाइम प्रतिक्रिया को प्रभावित करने वाले कारक **पादप हार्मोन**, आक्सिजन, जिब्बरेलिन, सायटोकायनिन तथा एब्सीसिक अम्ल एवं इथीलिन की खोज , संरचना , कार्य प्रणाली एवं भूमिका।	

Pratical work based on theory paper

Suggested Books :

- Hopkins W.G. 1995 Introduction of plant physiology Pub. John wiley and sons New York.
- Salisbury F.D., and Ross C.W. 1992 Plant physiology, Wadsworth pub. Co. California, USA
- Taiz & Zeiger, E. 1998, Plant physiology, Sinauer associates, inc. pub. Massachusetts,U.S.A.
- Jain V.K.1974. Fundamentals of plant physiology, S. Chand & company.
- Verma S.K. & Verma M.A. 1995.Text book of plant physiology & Biotechnology, S.Chand & company.
- Verma V. 1995.Plant physiology Emkey pub.
- Devid, L.N. and Michael,M.C.2000. Leninger Principle of Biochemistry, Macmillan Worth Pub. New York,USA.
- Gangulee, H.C.,Das,K.S.,Dutta,C.and Sen, S.2007.College Botany Vol. II.New Centre Book Agency (P)Ltd. Kolkotta,700009

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		**2017-18**
Class		B.Sc. IIIrd yr.
Semester		VI
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Cell Biology , Genetics and Biotechnology**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**70+30 C.C.E.**

Unit		Syllabus	Periods
Unit-I	(English)	**The cell envelops and cell organelles:** plasma membrane, bilayer lipid structure,function of the cell wall. Structure and function of cell organells: nucleus, Chloroplast and Mitochondrion , Golgibodies,ER, Peroxisome and vacuole.	09
	(हिन्दी)	**कोशिका आवरण एवं कोशिकांग** : प्लाज्माझिल्ली, द्विस्तरीय लिपिड संरचना कोशिका भित्ति के कार्य। **कोशिका अंगकों की संरचना एवं कार्य** : केन्द्रक, हरित लवक, माइटोकॉण्ड्रिया गॉल्जीकाय, अन्तःद्रव्यी जालिका, परऑक्सीसोम्स, रिक्तिकाएँ ।	
Unit-II	(English)	**Chomosomal organization :** Structure and functions of chromosome, centromere and telomere special types of chromosomes. Mitosis and Miosis. **Variations in chromosome structure**: Deletion, duplication, translocation and inversion, variation in chromosome number, euploidy, aneuploidy. DNA the genetic material, DNA structure and replication. Nucleosome model.	09
	(हिन्दी)	गुणसूत्र संगठन : गुणसूत्र की आकारिकी एवं कार्य, सेंट्रोमीयर एवं टिलोमीयर। विशेष प्रकार के क्रोमोसोम्स,समसूत्रिय एवम अर्धसूत्रीयविभाजन। **गुणसूत्र** संरचना में विभिन्नताएँ : विलोपन, द्विगुणन, स्थानान्तरण, प्रतिलोमीकरण । गुणसूत्र संख्या में विभिन्नताएँ । यूप्लॉयडी एव एन्यूप्लॉयडी । डी.एन.ए. : आनुवाशिक पदार्थ, डी.एन.ए. की संरचना एवं पुनरावृत्ति, न्यूक्लियोसोम माडल।	
Unit-III	(English)	**Genetic inheritance**: Mendelism; laws of dominance, segregation and independent assortment; linkage analysis; interactions of genes. Cytoplasmic inheritance, mutations-	09

		spontaneous and induced; transposable elements; DNA damage and repair.	
	(हिन्दी)	आनुवाशिक वशागति: मण्डेलवाद, प्रभाविता , पृथ्क्करण एव स्वतंत्र अपव्यहून के नियम, सहलग्नता विश्लेषण, जीन की अन्योन्य क्रियाएँ। कोशिका द्रवीय वंशगति, उत्परिवर्तन,- प्राकृतिक एवं प्रेरित उत्परिवर्तन,स्थान्तरणशील अवयव, डी.एन.ए. क्षति एवं सुधार।	
Unit-IV	(English)	**Gene**: Structure of gene, genetic code, transfer of genetic information; trascription, translation, protein synthesis, tRNA, and ribosomes. Regulation of gene expression in prokaryotes and eukaryotes.	09
	(हिन्दी)	जीन की सरंचना, आनुवाशिक कोड , आनुवाशिक सूचना का स्थानान्तरण, अनुलखेन, अनुवाद, प्रोटीन सश्लेषण, ट्रासंफर आर.एन.ए., राइबोसम्स प्रोकेरियाट्स एव ं यूकैरियाट्स में जीन अभिव्यक्ति का नियमन।	
Unit-V	(English)	**Biotechnology:** Functional definition; basic aspects of plant tissue culture; cellular totipotancy, differentiation and morphogenesis,biology of Agrobacterium; vectors for gene delivery and marker gene; important achievements in crop biotechnology. **Genetic Engineering:** Tools and techniques of recombinant DNA technology; cloning vectors; genomic and cDNA library; transposable elements; gene mapping and chromosome walking.	09
	(हिन्दी)	जैव प्रौद्योगिकी ‘: कार्यात्मक परिभाषा, पादप उक्त संवर्धन के आधारभूत तत्व, कोशीय टोटीपोंटेंशी, विभिन्नीकरण एवं मार्फोजेनेशिस, एग्रोवैक्टीरियम की जैविकी, जीन डिलिवरी के वाहक एवम मार्कर जीन, जैव प्रौद्योगिकी की प्रमुख उपलब्धियाँ। अनुवांशिक अभियांत्रिकी : पुनर्योजक डी.एन.ए. तकनीकी के संयंत्र एवं तकनीक, क्लोनक वाहक, जीनोमिक तथा cDNA लाईब्रेरी, ट्रांसपोसेवल तत्व, जीन मैंपिंग तथा गुणसूत्र वाकिंग।	

Pratical work based on theory paper

Suggested Books :

- P.K.Gupta, 1999 A text book of Cell and Molecular biology, Rastogi pracation Meerut. India
- P.K.Gupta, 1999 Genetics, , Rastogi pracation Meerut. India
- Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
- Rost, T. et: aI. 1998.PIant Biology, Wadsworth Publishing Co., California, U.S.A
- Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A
- Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE
SHIVAJI NAGAR, BHOPAL

Syllabus of Botany

As Recommended by the Board of Studies
2018-19

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College

Shivaji Nagar, Bhopal – 462016

Syllabus

2018-2019

Subject:BOTANY

Details			Page No.
Under Graduate Level			
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	„ „	**B.Sc.II Paper- I**	…9-11
	„ „	**B.Sc.II Paper- II**	…12-14
	„ „	**Semester V**	…15-16
	„ „	**Semester VI**	…17-18
	Practical	**B.Sc.I**	…60
	„ „	**B.Sc.II**	…61
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Post Graduate Level			
	Theory	**Semester I**	…21-28
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	„ „	**Semester II**	…65
	„ „	**Semester III**	…66
	„ „	**Semester IV**	…67

Date of submission in Autonomous Examination cell:

Signature H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College
Shivaji Nagar, Bhopal – 462016

Syllabus of Botany: As Recommended by the Board of Studies
2018-19
Scheme of examination

Course:Botany **B.Sc. (3 Years Degree Course)**

Theory Papers/practical	Title of paper	Compulsory/ Optional	Marks
B.Sc. I Year ANNUAL SYSTEM			
Paper I	Diversity of Lower Plants	Compulsory	50
Paper II	Diversity of Higher Plants	Compulsory	50
Paper I&II	CCE		50
Practical	Botany Practical(based on paper I&II)	Compulsory	50
Total Marks			**200**
B.Sc. II Year ANNUAL SYSTEM			
Paper I	Structure, Development and Reproduction in flowering plants	Compulsory	50
Paper II	Plant Ecology, Biodiversity and Phytogeography	Compulsory	50
Paper I&II	CCE		50
Practical	Botany Practical	Compulsory	50
Total Marks			**200**
SEMESTER V			
Paper	Plant Physiology and Biochemistry	Compulsory	70 + 30 CCE = 100
Practical	Botany Practical	Compulsory	50
Total Marks			**150**
SEMESTER VI			
Paper	Cell Biology, Genetics and Biotechnology	Compulsory	70 + 30 CCE = 100
Practical	Botany Practical	Compulsory	50
Internship / JOPW Training	Job oriented Project / Internship will be carried out in VI Semester for 60 hrs as per the policy of Department of Higher Education	Compulsory	100
Total Marks			**250**

Signature with date

Member Board of Studies:

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Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal
Under Graduate ANNUAL Pattern of Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19
Theory / Practical

Session		**2018-19**
Class		**B.Sc.. Ist Year**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**I**
Title of the Paper	(English)	**Diversity of Lower plants**
	(हिन्दी)	**निम्न श्रेणी के पादपो की विविधता**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Viruses and Prokaryots:** characteristics of Virues, general account of TMV and T4 bacteriophage. Bacterial structure, nutrition, reproduction and economic importance; General account of Mycoplasma Cynobacteria and Actinomycetes.	09
	(हिन्दी)	**वाइरस एवं प्रोकेरियोट :** विषाणुओं के सामान्य लक्षण, टी एम.वी एवं टी फोर बेक्टीरियोफेज का सामान्य विवरण। जीवाणु की संरचना, पोषण, प्रजनन एवं आर्थिक महत्व, मायकोप्लाज्मा सायनो–बेक्टीरिया एवं एक्टीनोमाइसीटीज का सामान्य विवरण।	
Unit-II	(English)	**Algae** : General characters, classification and economic importance. Important features and life history of Chlorophyceae- *Volvox*, *Oedogonium*, Charophyceae- *Chara*, Xanthophyceae - *Vaucheria*, Phaeophyceae - *Ectocarpus*, Rhodophyceae -*Polysiphonia.*	09
	(हिन्दी)	**शैवाल** : शैवालों के सामान्य लक्षण, वर्गीकरण एव ं आर्थिक महत्व, मुख्य लक्षण, एवं जीवन चक्र क्लोरोफायसी–वॉल्वॉक्स, ऊडोगोनियम, कैरोफायसी–कारा, जैन्थोफायसी– वाउचेरिया फियोफायसी–एक्टोकार्पस, रोडोफायसी– पोलीसाइफोनिया।	
Unit-III	(English)	**Fungi**: General characters, classification and economic importance, Important features and life history of Oomycetes- Albugo, Zygomycetes -*Mucor*, Ascomycetes –*Yeast* , *Peziza*, Basidomycetes - *Puccinia*, Deurteromycetes –*Alternaria*, General account of lichens.	09
	(हिन्दी)	**कवक** : कवकों के सामान्य लक्षण एवं वर्गीकरण एवं आर्थिक महत्व। प्रमुख लक्षणों एवं जीवन इतिहास का अध्ययन , उमाइसीटीज़ - अल्ब्युगो , जायगोमायसीटीज़ –म्यूकर। एस्कोमायसिटीज़ –यीस्ट, पेजाइजा, बेसिडियोमायसिटीज –पक्सीनिया,	

		डयूटेरोमायसिटीज –आल्टर्नेरिया, लाइकेन्स का सामान्य विवरण।	
Unit-IV	(English)	**Bryophyta** :Genral characters and classification, study of morphology, anatomy,and reproduction of Hepaticopsida- *Riccia, Marchantia*, Anthrocerotopsida -*Anthoceros*, Bryopsida- *Polytrichum*	09
	(हिन्दी)	**ब्रायाफाइटा** : सामान्य लक्षण एवं वर्गीकरण , बाह्य आकारिकी, आतंरिक सरंचना एवं प्रजनन : हिपेटीकॉप्सडा – रिक्सिया, मारकेन्शिया , एन्थेसिरोटोप्सिडा–एन्थोसिरोस, ब्रायोप्सिडा–पॉलीट्राइकम	
Unit-V	(English)	**Pteridophyta** : Important characters and classification. Stelar organization. Morphology and anatomy of Rhynia. Structure, anatomy and reproduction in *Lycopodium, Selaginella, Equisetum and Marsilea*.	09
	(हिन्दी)	**टेरिडोफाइटा**: प्रमुख लक्षण एव ं वर्गीकरण। स्टीलर सगंठन, राहिनिया की बाह्य एव ं आंतरिक सरंचना। लाइकापोॅडयम, सिलेजिनेला, इक्वीसिटम एवं मारसीलिया की बाह्य तथा आंतरिक संरचना एवं प्रजनन।	

Pratical work based on theoty paper
Suggested Books

1. G.M. Smith 1971 Cryptogamic Botany. Vol - I Algae & Fungi Tata McGrraw Hill . Pub. Co. NewDelhi
2. G.M. Smith 1971 Cryptogamic Botany. Vol -II Bryophytes & Pteridophytes. Tata McGrraw HillPub. Co. New Delhi.
3. O.P.Sharma,1992. Text book of Thallophyta McGrraw Hill Pub. Co.
4. O.P.Sharma,1990. Text book of Pteridophyta McMillan india Ltd .
5. P.D.Sharma 1991. The Fungi. rastogi & Co. Meerut.
6. H.C. Dubey.1990. an introduction of Fungi.Vikas Pub. house pvt.ltd.
7. P.Puri 1980. Bryophyta Atma ram & Sons, Delhi.
8. A.Clifton.1958. Introduction to the Bacteria. Mcgrew Hillpub. Co.New delhi.

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Session		**2018-19**
Class		**B.Sc.. Ist Year**
Subject	**(English)**	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**II**
Title of the Paper	(English)	**Diversity of Higher plants**
	(हिन्दी)	**उच्च पादपो की विविधता**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Gymnosperm**: General characters and Classification of Gymnosperms. Heterospory and Origin of Seed Habit. Diversity of Gymnosperm: Geological Time Scale and Fossilization. Fossil Gymnosperms: *Lyginopteris* and *Williamsonia.*	09
	(हिन्दी)	**अनावृत्तबीजी**: अनावृत्तबीजियों के विशिष्ट लक्षण एवं वर्गीकरण, विषमबीजाणुकता एवं बीज स्वभाव का उद्गम, अनावृत्तबीजियों की विविधताएँ, भू–वैज्ञानिक समय सारणी एवं जीवाश्मीभवन, अनावृत्तबीजी जीवाश्म : लाइजीनोप्टेरिस एवं **विलियमसोनिया**	
Unit-II	(English)	**Gymnosperm**: Morphology, Anatomy Reproduction and life cycle, of *Cycas*, *Pinus* and *Ephedra*.	09
	(हिन्दी)	**अनावृत्तबीजी**: आकारिकी, आन्तरिक संरचना, प्रजनन तथा जीवन–चक्रः साइकस, पाइनस, एवं एफिड्रा।	
Unit-III	(English)	**Taxonomy**: Origin and Evolution of Angiosperms: Principles and rules of Botanical Nomenclature, Museum, Herbarium and Botanical gardens; Classification of Angiosperms: Bentham and Hooker, Modern trends in Taxonomy including Molicular taxonomy. APG IV system.	09
	(हिन्दी)	**वर्गीकी** : आवृतबीजियों का उद्गम एवं विकास। वानस्पतिक नामकरण के सिद्धांत एवं नियम,**संग्रहालय,** हरबेरियम एवं वानस्पतिक उद्यान; आवृतबीजियों का वर्गीकरणः बेन्थम तथा हुकर वर्गिकी में आधुनिक प्रवृत्तियाँ एवं आणविक वर्गिकी ,एपीजी **IV** पद्धति ।	
Unit-IV	(English)	**Taxonomy:** Terminology for plant description in semi technical language: Diagnostic characteristics and Economic Importance of Families -Ranunculaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae, and Apiaceae.	09

	(हिन्दी)	**वर्गीकी** : पौधों के वानास्पतिक विवरण की **अर्ध तकनीकी** शब्दावली **।** रेननकुलेसी, ब्रेसीकेसी, मालवेसी, रूटेसी, फेबेसी एवं एपिएसी कुलों के विशिष्ट लक्षण एवं आर्थिक महत्व।	
Unit-V	(English)	**Taxonomy:** Diagnostic characteristics & Economic Importance of Families- Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Poaceae.	09
	(हिन्दी)	**वर्गीकी : रूबिएसी ,** ऐस्टेरेसी ˙मचवंमचवबलदंबमंम ऐपोसाइनेसी, सोलेनेसी, लेमिएसी, यूफोरबिएसी, लिलिएसी एवं पोएसी कुलों के विशिष्ट लक्षण एवं आर्थिक महत्व	

Pratical work based on theory paper

SUGGESTED READINGS:-

- Agarwal, S.B. 2007. Unified Botany, Shivlal Agarwal & Company Indore.
- Bhatnagar, S. P. and Moitra 1996. Gymnosperms. New Age International Limited, New Delhi.
- Davis, P.H. and Heywood, V.H. 1963, Principles of Angiosperm taxonomy. Oliver and Boyd, London.
- Gangulee, H. C. & Kar, A. K. 2006. College Botany Voll.III, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Heywood, V.H. and Moore, D.M. (eds) 1984. Current concepts in plant taxonomy. Academic press London.
- Jeffery, C. 1982. An Introduction of plant taxonomy. Cambridge University Press Cambridge, London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematic. Mc Graw Hill Book Co. New York.
- Kaushik, M.P. 2003. Modern Textbook of Botany, Prakash Publication Muzaffar Nagar U.P.
- Mukherjee, S.K. 2006. College Botany Voll.II, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi- 110055.
- Radford, A.E. 1986. Fundamentals of Plant Systmatics, Happer and Raw, New York.
- Saxena and Sarabhai. 1989. Text book of Botany. Rastogi Publication Meerut.
- Singh, G. 1999. Plant Systematics : Theory and Practice. Oxford and IBH Pvt. Ltd.New Dehli
- Vasishta, P.C. 2005. Botany for degree students Voll. V, Gymnosperms. S. Chand & Company Ltd. Ramnagar, New Delhi- 110055

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Session		**2018-19**
Class		**B.Sc.II nd Year**
Paper		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Structure, Development and Reproduction in Flowering plants.**
	(हिन्दी)	**पुष्पीय पौधों की संरचना, विकास एवं प्रजनन**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		50

Unit		Syllabus	Periods
Unit-I	(English)	**Tissue System**. Types of vascular bundles, apical meristem, Classification of meristem. The Root System: Root apical meristem. Differentiation of primary and secondary tissues and their role. Anatomy of Monocot and Dicot root. Secondary growth in root. Modification of root for Various Functions, Interaction of root with microbes.	09
	(हिन्दी)	**ऊतक तंत्र** : संवहन पूल के प्रकार, शीर्षस्थ प्रविभाजी ऊतक, प्रविभाजी ऊतक का वर्गीकरण। **जड़ तंत्र** : जड़ का शीर्षस्थ प्रविभाजी ऊतक : प्राथमिक एवं द्वितीयक ऊतकों का विभेदन एवं उनके कार्य। एकबीजपत्री जड़ एवं द्विवीबीजपत्री जड़ की आंतरिक संरचना, जड़ में द्वितीयक वृध्दि। विभिन्न कार्यों हेतु जड़ के रुपान्तरण। सूक्ष्मजीवों के साथ जड़ की पारस्परिक क्रिया।	
Unit-II	(English)	**The Shoot system**: Shoot apical meristem and histological organization, Anatomy of Monocot and Dicot stem: Vascular cambium and its functions, Secondary growth in stem. Characteristics of growth rings: Sapwood and Heart wood, Secondary Phloem, Cork Cambium and Periderm. Anomalous Secondary growth in Nyctanthus, Boerhhavia, Achyranthus, Leptadenia, Salvadora, Bignonia and Dracaena.	09
	(हिन्दी)	**प्ररोह तंत्र** : प्राहे शीर्षस्थ विभज्योतक एवं ऊतकीय सगंठन, एकबीजपत्री एवं द्विबीजपत्री तने की आन्तरिक संरचना सवंहन एधा एवं उसके कार्य, तने में द्वितीयक वृद्धि : वृद्धि वलय की विशेषतायें, सैप काष्ठ एवं हार्ट काष्ठ, द्वितीयक फ्लोएम, कार्क कैम्बियम एवं पेरीडर्म। तने में असामान्य वृध्दि – निक्टेन्थस, बोरहाविया, एकाइरेन्थस, लेप्टाडीनिया, सेल्वाडोरा, बिग्नोनिया, ड्रेसीना।	

Unit-III	(English)	**The Leaf system**: Origin and Development of leaf, Diversity in size, shape and arrangement, Internal structure of Dicot and Monocot leaf. Adaptations to photosynthesis and water stress, senescence and abscission.	09
	(हिन्दी)	पर्ण तंत्र : पर्ण की उत्पत्ति एवं विकास, प्रमाप, आकार एवं विन्यास में विविधताए; एकबीजपत्री एवं द्विबीजपत्री पर्ण की आतंरिक सरंचना, प्रकाश सश्लेषण एवं जलीय प्रतिबल का अनुकुलन, जीर्णता एवं विलगन।	
Unit-IV	(English)	**Embryology**: Concept of flower as a modified shoot, Structure of Anther, Microsporogenesis and Male Gametophyte. Structure of Pistil, Ovules, Megasporogenesis and Development of Female Gametophyte (Embryo Sac) and its types, Pollination –Mechanism and Agencies of Pollination, Pollen Pistil interactions and Self incompatibility.	09
	(हिन्दी)	**भ्रूणिंकी** : पुष्प एक रूपांतरित प्ररोह की अवधारणा, परागकोष की संरचना,लघुबीजाणुजनन एवं नर युग्मकोद्भिद्। स्त्रीकेसर की सरंचना, बीजाण्ड, गुरूबीजाणुजनन, मादा युग्मकोद्भिद (भ्रूणकाष्) का विकास एवं प्रकार। परागण –परागण की प्रक्रिया एवं एजेन्सी, पराग स्त्रीकेसर की पारस्परिक क्रिया एवं स्वअनिषेच्यता।	
Unit-V	(English)	**Embryology**: Double Fertilization and triple fusion. Development and types of Endosperm and its morphological nature, Development of Embryo in Monocot and Dicot plants. Fruit development and maturation, Seed structure and dispersal. Mode of vegetative propagation.	09
	(हिन्दी)	**भ्रूणिंकी** : द्विनिषेचन एवं त्रिसंयोजन। भ्रूणपाष का विकास, प्रकार एवं इसकी आकारिकीय प्रकृति। एकबीजपत्रीय और द्विबीजपत्रीय पौधों में भ्रूण का विकास, फल का परिवर्धन एवं परिपक्वता, बीज की संरचना एवं प्रकीर्णन। कायिक प्रवधर्न के प्रकार।	

Practical work based on theory -

- **Suggested Books:** Gangulee, H.C., Das, K. S. And Dutta, C. 2007. College Botany Vol.I, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Heywood, V.H. & Moore, D.M. (eds) 1984. Current concepts in plant Taxonomy. Acedemic press London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986, Plant taxonomy (III edition) Mc Graw Hill Book Co. New York.
- Maheshwari, P.1978. Plant Embryology.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi- 110055.
- Radford, A.E. 1986. Fundamentals of Plant Systematics, Harper and Row,New York.
- Shrivastava and Das. Modern text book of Botany Vol-III & IV.
- Singh, V., Pande P.C. and Jain , D. K. Structure & Development in Angiosperms. Rastogi Publication, Meerut.
- Banson, L.B.; 1957: Plant Classification, Health& Co. Boston.
- Davis, P.R & Heywood, V.H 1973: Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. *Co.* New *York*, USA
- Eames, AJ.; 1961: Morphology of Angiosperms, Mc-Graw Hill, New York.
- Jeffery, C.; 1968: An Introduction to Plant Taxonomy J. & H. Churchill Limited.
- Lawrence, G .H.M.; 1951: Taxonomy of Vascular Plants Macmillan, NewYork.
- Naik V. N.; 1984: Taxonomy of Angiosperms. Tata Mc-Graw Hill Pub. Co. Ltd. New Delhi.
- Porter, L.L.; 1959: Taxonomy of Flowering Plants. San Francisco. Radfor~ *AE.* Dickinson, W.C. MasseyJ.R and. Ben. C.R: 1974: VQ~llar Plant SYstematics, Harper & Row, New York.
- Fahn: Plant Anatomy
- Vashishtha: Anatomy
- Panday,B.P.,: Plant Anatomy
- Esau: Plant Anatomy
- Bhojwani & Bhatnager: Embryology

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Class		B.Sc.II nd Year
Paper		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Plant Ecology, Biodiversity and Phytogeography**
	(हिन्दी)	**पादप पारिस्थतिकी, जैव विविधता एव पादप भौगोलिकी**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Ecosystem**: concept and types of ecosystem, structure and function of ecosystem, biotic and abiotic components, trophic levels, food chain, food web, ecological pyramids, energy flow. **Concept of Biogeochemical cycle**: gaseous, liquid and sedimentary cycles, carbon, nitrogen, water, phosphorus, and sulphur cycle.	09
	(हिन्दी)	**पारिस्थितिक तंत्रः** अवधारणा एवं प्रकार, संरचना एवं कार्य, जैविक एवं अजैविक घटक, पोषी स्तर, खाद्यश्रृंखला, खाद्य जाल, पारिस्थितिक पिरामिड, पारिस्थितिक तंत्र में उर्जा प्रवाह। **जैव भू रासायनिक चक्रः** अवधारणा, गैसीय द्रव तथा अवसादीय चक्र – कार्बन, नाइट्रोजन, जल, फास्फोरस, तथा सल्फर चक्र ।	
Unit-II	(English)	**Ecological adaptations**: Morphological, anatomical and physiological responses, water adaptation (hydrophytes and Xerophytes), temperature adaptation (thermoperiodism and vernalization) light adaptation (heliophytes and sciophytes), photoperiodism. Plant **succession**: Causes, trends and process, types of succession- Hydrosere and Xerosere.	09
	(हिन्दी)	पारिस्थितिक अनुकूलनः आकारिकी, आंतरिकी तथा कार्यिकी अनुक्रिया, जल अनुकूलन (जलोदभिद् तथा मरूदभिद्) तापक्रम अनुकूलन (तापकालिता तथा वसंतीकरण) प्रकाश अनुकूलन (प्रकाश रागी तथा छाया रागी) प्रकाश	

		दीप्तीकालिता। पादप अनुक्रमणः कारण, प्रवृत्ति एवं प्रक्रिया, पादप अनुक्रमण के प्रकार, हाइड्रोसियर (जलीय अनुक्रमण), जीरोसियर (शुष्क अनुक्रमण)	
Unit-III	(English)	**Population Ecology**: Distribution patterns, Density, Natality, Mortality, Growth curve, Ecotypes and Ecads. Community ecology: Frequency, Density, Abundance, Cover and life forms. **Biodiversit**y: Basic concept, definition, importance, Biodiversity of India, hot spots, "insitu" and "exsitu" conservations, Biosphere reserves, sanctuaries and National parks of Madhya Pradesh. Endangered and threatened species, Red data book.	09
	(हिन्दी)	**जनसंख्या पारिस्थितिकीः** वितरण प्रणाली, घनत्व, जन्मदर, मृत्युदर, वृद्धिवक्र, इकोटाइप एवं इक्रेडस : समुदाय परिस्थितिकी : आवृत्ति, घनत्व, बहुलता,आच्छादन एवं जीवनरूप। **जैवविविधता** – आधारभूत परिकल्पना, परिभाषा, महत्व भारत की जैवविविधता, तप्तस्थल, स्वस्थाने तथा बाह्य स्थाने संरक्षण। जैव मण्डल संचयन, म.प्र. के अभ्यारण एवं राष्ट्रीय उद्यान, विलुप्तप्राय तथा खतरे में पड़ी प्रजातियां, रेड डाटा बुक	
Unit-IV	(English)	**Soil**: Physical and chemical properties of soil., soil formation, development, soil profile, soil classification, soil composition, soil factors. **Pollution**: Defination, types and causes, Global warming, Acid rain, climate change , ozone layer and ozone holes.	09
	(हिन्दी)	**मृदा** : भौतिक–रासायनिक गुण, मृदा निर्माण, मृदापरिच्छेदिका का विकास, मृदा का वर्गीकरण, मृदा संगठन, मृदा कारक। **प्रदूषणः** परिभाषा, प्रकार एवं कारण, वैश्विक तपन, अम्लीय वर्षा, जलवायु परिवर्तन, ओजोन परत एवं ओजोन छिद्र।	
Unit-V	(English)	**Phytogeography**: Phytogeographical region of India, vegetation types of Madhya Pradesh, **Natural Resources**: Definition and classification of natural resources, conservation and management of natural resources, land resource management, water resource management, wet land resource management.	09
	(हिन्दी)	**पादप भौगोलिकीः** भारत के पादप भूगोलिकी क्षेत्र, म.प्र. के वनस्पतिक प्रकार। **प्राकृतिक स्त्रोतः** प्राकृतिक स्त्रोतों की परिभाषा एवं वर्गीकरण, प्राकृतिक स्त्रोतों का प्रबंधन एवं संरक्षण, भू–स्रोत प्रबंधन, जल स्रोत प्रबंधन, आर्द्रभूमि स्त्रोत प्रबंधन।	

Practical work based on theory

Suggested Books:

- Odum, E.J. 2004.5th ed. Fundamentals of Ecology, Natraj Pub.
- Odum, E.J. 1983 Basic ecology, Saunders, Philadeliphia.
- Kormondy, 1996 Ecology.
- Ambast R.S. plant Ecology.
- Doubenmre: Plant and Environment.
- Puri G.S. 1960. Indian Forest Ecology.
- Sagarcya K.P. Forest and Forestry.
- pandhi-Indian Foresty.
- R.S. Shukla & P.S. Chandel,2006. A Text book of plant Ecology.
- Kumar, U.K. 2006.Biodiversity principles and conservation -Agrobios, Jodhpur.
- Banargee S.1998, Bio diversity conservations- Agrobotamica, Bikaner
- Tandan R.K .,Biodiversity taxonomy & ecology- Scientific pub-Jodhpur.
- Sharma, P.D. 7th ed. 1998 Ecology and Environment, Rastogi Pub.,Meerut,250002

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19
Theory / Practical

Session		**2018-19**
Class		B.Sc. III
Semester		V
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Plant Physiology and Biochemistry**
	(हिन्दी)	**पादप कार्यिकी और जैव रसायन**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**70+30 C.C.E.**

Unit		Syllabus	Periods
Unit-I	(English)	**Plant water relations**: Properties of water, Importance of water in plant life, Diffusion, osmosis and osmotic relation of plant cell, water absorption, Asecent of sap. **Transpiration**: Structure & physiology of stomata, mechanism of transpriation, factors affecting rate of transpiration,	09
	(हिन्दी)	**पादप जल संबंध** : जल के गुण, पादप जीवन में जल का महत्व, विसरण परासरण तथा पादप कोशिका के परासरण संबंध, जल अवशोषण, रसारोहण। **वाष्पोत्सर्जन** : रंध्र की संरचना एवं कायिकी, वाष्पोसर्जन की क्रियाविधि, वाष्पोसर्जन को प्रभावित करने वाले कारक।	
Unit-II	(English)	**Plant Nutrition**: Mineral nutrient, hydroponics, absorption of mineral nutrients, translocation of organic solutes. **Biomolecules:** Sructure, classification and functions of carbohydrates, amino acids, proteins and lipids.	09
	(हिन्दी)	**पादप पोषण** : खनिज पोषण , जल सन्वर्धन ,खनिज लवणो का अवशोषण , कार्बनिक विलेय का स्थानांतरण । **जैविक अणु** : कार्बोहाइड्रेट , **अमिनो अम्ल** , प्रोटीन और लिपिड की संरचना ,वर्गीकरण और कार्य ।	
Unit-III	(English)	**Photosynthesis**: Chloroplast, photosynthetic pigments, red drop and emersion effect, concept of two photosystems, light reaction, dark reaction – Calvin cycle, Hatch-Slack cycle, CAM cycle, factors affecting rate of photosynthesis and photorespiration.	09
	(हिन्दी)	**प्रकाश संश्लेषण** : क्लोरोप्लास्ट, प्रकाश संश्लेषीय वर्णक, रेड ड्राप तथा इमरसन प्रभाव, दो प्रकाश तंत्र की अवधारणा, प्रकाश अभिक्रिया, अंधकार अभिक्रिया, केलविन चक्र, हेच स्जेक चक्र, सी.ए.एम. चक्र, प्रकाश संश्लेषण को प्रभावित करने वाले कारक एवं प्रकाशीय श्वसन।	

Unit-IV	(English)	**Respiration**: Mitochondria, aerobic and anaerobic respiration, Fermentation, Respiratory coefficient. Mechanism of respiration-Glycolysis, Kreb's cycle, Pentose phosphate pathway, Electron transport system, factors affecting rate of respiration, Redox Potential and theories of ATP synthesis.	09
	(हिन्दी)	**श्वसन** : माइटोकॉन्ड्रिया, आक्सी एवं अनाक्सी श्वसन, किण्वन, श्वसन गुणांक, श्वसन की क्रियाविधि – ग्लाइकोलिसिस, क्रेब चक्र, पेन्टोस फास्फेट मार्ग, इलेक्ट्रान अभिगमन तंत्र, श्वसन की दर को प्रभावित करने वाले कारक, आक्सीकरण – अपचयन विभव, ए.टी.पी. संश्लेषण के विभिन्न सिद्धांत।	
Unit-V	(English)	**Enzymology:** Classification, nomenclature and characteristics of enzyme, concept of holoenzyme, apoenzyme, co-enzymes and co-factors, mode and mechanism of enzyme action, factors affecting enzyme activity. **Plant harmones**: Discovery , structure, mode of action and role of Auxins, Gibberellins, Cytokinin, Abscissic acid and ethylene.	09
	(हिन्दी)	**ऐंजायमोलोजी :** विकरों का वर्गीकरण, नामकरण एवं अभिलक्षणिक गुण, होलाएन्जाईम, एपोएन्जाईम, कोएन्जाईम एवं कोफेक्टर्स की अवधारणा, विकर की कार्यप्रणाली एवं क्रियाविधि, विकर प्रतिक्रिया को प्रभावित करने वाले कारक **पादप हार्मोन**, आक्सिन, जिब्बरेलिन, सायटोकायनिन तथा एब्सीसिक अम्ल **एवं इथीलिन की खोज , संरचना , कार्यप्रणाली एवं भूमिका।**	

Pratical work based on theory paper

Suggested Books :

- Hopkins W.G. 1995 Introduction of plant physiology Pub. John wiley and sons New York.
- Salisbury F.D., and Ross C.W. 1992 Plant physiology, Wadsworth pub. Co. California, USA
- Taiz & Zeiger, E. 1998, Plant physiology, Sinauer associates, inc. pub. Massachusetts,U.S.A.
- Jain V.K.1974. Fundamentals of plant physiology, S. Chand & company.
- Verma S.K. & Verma M.A. 1995.Text book of plant physiology & Biotechnology, S.Chand & company.
- Verma V. 1995.Plant physiology Emkey pub.
- Devid, L.N. and Michael,M.C.2000. Leninger Principle of Biochemistry, Macmillan Worth Pub. New York,USA.
- Gangulee, H.C.,Das,K.S.,Dutta,C.and Sen, S.2007.College Botany Vol. II.New Centre Book Agency (P)Ltd. Kolkotta,700009

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19
Theory / Practical

Session		**2018-19**
Class		B.Sc. IIIrd yr.
Semester		VI
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Cell Biology , Genetics and Biotechnology**
	(हिन्दी)	कोशिका विज्ञान, आनुवांशिकी एवं जैवप्रौद्योगिकी
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**70+30 C.C.E.**

Unit		Syllabus	Periods
Unit-I	(English)	**The cell envelops and cell organelles:** plasma membrane, bilayer lipid structure, function of the cell wall. Structure and function of cell organells: Nucleus, Chloroplast and Mitochondrion, Golgibodies, ER, Peroxisome and vacuole.	09
	(हिन्दी)	**कोशिका आवरण एवं कोशिकांग** : प्लाज्माझिल्ली, द्विस्तरीय लिपिड संरचना कोशिका भित्ति के कार्य। **कोशिका अंगकों की संरचना एवं कार्य** : केन्द्रक, हरित लवक, माइटोकॉण्ड्रिया गॉल्जीकाय, अन्तःद्रव्यी जालिका, परऑक्सीसोम्स, रिक्तिकाएँ ।	
Unit-II	(English)	**Chomosomal organization:** Structure and functions of chromosome, centromere and telomere, special types of chromosomes. Mitosis and Meosis. **Variations in chromosome structure**: Deletion, duplication, translocation and inversion, variation in chromosome number, euploidy, aneuploidy. DNA the genetic material, DNA structure and replication. Nucleosome model.	09
	(हिन्दी)	गुणसूत्र संगठन : गुणसूत्र की आकारिकी एवं कार्य, सेंट्रोमीयर एवं टिलोमीयर। विशेष प्रकार के क्रोमोसोम्स,समसूत्रिय एवम अर्धसूत्रीयविभाजन। **गुणसूत्र** संरचना में विभिन्नताएँ : विलोपन, द्विगुणन, स्थानान्तरण, प्रतिलोमीकरण । गुणसूत्र संख्या में विभिन्नताएँ । यूप्लॉयडी एव एन्यूप्लॉयडी । डी.एन.ए. : आनुवाशिक पदार्थ, डी.एन.ए. की संरचना एवं पुनरावृत्ति, न्यूक्लियोसोम माडल।	
Unit-III	(English)	**Genetic inheritance**: Mendelism; laws of dominance, segregation and independent assortment; linkage analysis; interactions of genes. Cytoplasmic inheritance, mutations-spontaneous and induced; transposable elements; DNA damage	09

		and repair.	
	(हिन्दी)	आनुवाशिक वशागति: मेण्डलवाद, प्रभाविता , पृथक्करण एव स्वतंत्र अपव्यूहन के नियम, सहलग्नता विश्लेषण, जीन की अन्योन्य क्रियाएँ। कोशिका द्रवीय वंशागति, उत्परिवर्तन,- प्राकृतिक एवं प्रेरित उत्परिवर्तन, स्थानांतरणशील अवयव, डी.एन.ए. क्षति एवं सुधार।	
Unit-IV	(English)	**Gene**: Structure of gene, genetic code, transfer of genetic information; trascription, translation, protein synthesis, tRNA, and ribosomes. Regulation of gene expression in prokaryotes and eukaryotes.	09
	(हिन्दी)	जीन – जीन की सरंचना, आनुवांशिक कोड , आनुवांशिक सूचना का स्थानान्तरण, अनुलेखन, अनुवाद, प्रोटीन सश्लेषण, ट्रासंफर आर.एन.ए., राइबोसोम्स, प्रोकेरियाट्स एव यूकैरियाट्स में जीन अभिव्यक्ति का नियमन।	
Unit-V	(English)	**Biotechnology:** Functional definition; basic aspects of plant tissue culture; cellular totipotancy, differentiation and morphogenesis, biology of Agrobacterium; vectors for gene delivery and marker gene; important achievements in crop biotechnology. **Genetic Engineering:** Tools and techniques of recombinant DNA technology; cloning vectors; genomic and cDNA library; gene mapping and chromosome walking.	09
	(हिन्दी)	जैव प्रौद्योगिकी ‘: कार्यात्मक परिभाषा, पादप ऊतक संवर्धन के आधारभूत तत्व, कोशीय टोटीपोंटेंशी, विभिन्नीकरण एवं मार्फोजेनेशिस, एग्रोवैक्टीरियम की जैविकी, जीन डिलिवरी के वाहक एवं मार्कर जीन, कृषि क्षेत्र में जैव प्रौद्योगिकी की प्रमुख उपलब्धियाँ। आनुवांशिक अभियांत्रिकी : पुनर्योजक डी.एन.ए. तकनीकी के संयंत्र एवं तकनीक, क्लोन वाहक, जीनोमिक तथा c DNA लाईब्रेरी, जीन मैंपिंग तथा गुणसूत्र वाकिंग।	

Pratical work based on theory paper

Suggested Books :

- P.K.Gupta, 1999 A text book of Cell and Molecular biology, Rastogi pracation Meerut. India
- P.K.Gupta, 1999 Genetics, , Rastogi pracation Meerut. India
- Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
- Rost, T. et: aI. 1998.PIant Biology, Wadsworth Publishing Co., California, U.S.A
- Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A
- Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE
SHIVAJI NAGAR, BHOPAL

Syllabus of Botany

As Recommended by the Board of Studies
2019-20

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College

Shivaji Nagar, Bhopal – 462016

Syllabus

2019-2020

Subject: BOTANY

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	Theory	**B.Sc.I Paper- I**	…5-6
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	„ „	**B.Sc.II Paper- II**	…11-12
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Date of submission in Autonomous Examination cell:

Signature H.O.D.

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College
Shivaji Nagar, Bhopal – 462016
Syllabus of Botany: As Recommended by the Board of Studies
2019-20
Scheme of examination

Course:Botany **B.Sc. (3 Years Degree Course)**

Theory Papers/practical	Title of paper	Compulsory/ Optional	Marks
B.Sc. I Year ANNUAL SYSTEM			
Paper I	Diversity of Lower Plants	Compulsory	50
Paper II	Diversity of Higher Plants	Compulsory	50
Paper I&II	CCE		50
Practical	Botany Practical(based on paper I&II)	Compulsory	50
Total Marks			**200**
B.Sc. II Year ANNUAL SYSTEM			
Paper I	Structure, Development and Reproduction in flowering plants	Compulsory	50
Paper II	Plant Ecology, Biodiversity and Phytogeography	Compulsory	50
Paper I&II	CCE		50
Practical	Botany Practical(based on paper I&II)	Compulsory	50
Total Marks			**200**
B.Sc. IIIYear ANNUAL SYSTEM			
Paper I	Plant Physiology and Biochemistry	Compulsory	50
Paper II	Cell Biology, Genetics and Biotechnology	Compulsory	50
Paper I&II	CCE		50
Practical	Botany Practical(based on paper I&II)	Compulsory	50
Total Marks			**200**

Signature with date

Member Board of Studies:

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Sarojini Naidu Govt. Girls P.G. (Autonomous) College, Shivaji Nagar, Bhopal
Under Graduate ANNUAL PATTERN SYLLABUS of Botany
(As Recommended by the Board of Studies)
2019-20
Theory / Practical

Session		**2019-20**
Class		**B.Sc. Ist Year**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**I**

Title of the Paper	(English)	**Diversity of Lower plants**
	(हिन्दी)	**निम्न श्रेणी के पादपो की विविधता**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Viruses and Prokaryots**: Viruses, Viroids**,** and Prion**.** Characteristics of Viruses, general account of TMV and T4 bacteriophage. Bacterial structure, nutrition, reproduction and economic importance; General account of Mycoplasma Cynobacteria and Actinomycetes.Application of Microbiology. Important crop Diseases as Late Blight of Potato, Downy Mildew of Grapes, Peach Leaf Curl, Red Rod of Sugarcane, Tikka Disease of Groundnut, their prevention and control measures.	09
	(हिन्दी)	**वाइरस एवं प्रोकेरियोट** : विषाणु, वायराइड्स एवं प्रियॉन। विषाणुओं के सामान्य लक्षण, टी एम.वी एवं टी फोर बैक्टीरियोफेज का सामान्य विवरण। जीवाणु की संरचना, पोषण, प्रजनन एवं आर्थिक महत्व, मायकोप्लाज्मा सायनो–बेक्टीरिया एवं एक्टीनोमाइसीटीज का सामान्य विवरण। सूक्ष्म जैविकी के अनुप्रयोग। महत्वपूर्ण फसलों के रोग जैसे – आलू का लैट ब्लाइट रोग, अंगुर का डॉनी मिल्यू, गन्ने का लाल तना रोग, मूंगफली का टिक्का रोग, निवारण एवं रोकथाम।	
Unit-II	(English)	**Algae:** General characters, classification and economic importance. Important features and life history of Chlorophyceae- *Volvox, Oedogonium*, Charophyceae- *Chara*, Xanthophyceae - *Vaucheria*, Phaeophyceae - *Ectocarpus*, Rhodophyceae -*Polysiphonia.*	09
	(हिन्दी)	**शैवाल** : शैवालों के सामान्य लक्षण, वर्गीकरण एवं आर्थिक महत्व, मुख्य लक्षण, एवं जीवन चक्र क्लोरोफायसी–वॉल्वॉक्स, ऊडोगोनियम, कैरोफायसी–कारा, जैन्थोफायसी– वाउचेरिया फियोफायसी–एक्टोकार्पस, रोडोफायसी– पोलीसाइफोनिया।	
Unit-III	(English)	**Fungi**: General characters, classification and economic importance, Important features and life history of Oomycetes-Albugo, Zygomycetes -*Mucor*, Ascomycetes –*Yeast* , *Peziza*, Basidomycetes - *Puccinia*, Deurteromycetes –*Alternaria.* General account of lichens.	09
	(हिन्दी)	**कवक** : कवकों के सामान्य लक्षण एवं वर्गीकरण एवं आर्थिक महत्व। प्रमुख लक्षणों एवं जीवन इतिहास का अध्ययन, उमाइसिटीज़ – अल्ब्यूगो, जायगोमायसिटीज़ – म्यूकर। एस्कोमायसिटीज़ – यीस्ट, पेजाइजा, बेसिडियोमायसिटीज़ –पक्सीनिया, डयूटेरोमायसिटीज – अल्टर्नेरिया। लाइकेन्स का सामान्य विवरण।	
Unit-IV	(English)	**Bryophyta** :Genral characters and classification, study of morphology, anatomy,and reproduction of Hepaticopsida-*Riccia*, *Marchantia*, Anthrocerotopsida -*Anthoceros*, Bryopsida- *Polytrichum*	09
	(हिन्दी)	**ब्रायोफाइटा** : सामान्य लक्षण एवं वर्गीकरण, बाह्य आकारिकी, आतंरिक संरचना एवं प्रजननः हिपेटीकोप्सिडा– रिक्सिया, मारकेन्शिया ,	

		एन्थेसिरोटोप्सिडा–एन्थोसिरोस, ब्रायोप्सिडा–पॉलीट्राइकम।	
Unit-V	(English)	**Pteridophyta:** Important characters and classification. Stelar organization. Morphology and anatomy of Rhynia. Structure, anatomy and reproduction in *Lycopodium, Selaginella, Equisetum and Marsilea*.	09
	(हिन्दी)	**टेरिडोफाइटाः** प्रमुख लक्षण एवं वर्गीकरण। स्टीलर सगंठन, राहिनिया की बाह्य एवं आंतरिक सरंचना। लाइकापोडियम, सिलेजिनेला, इक्वीसिटम एवं मारसीलिया की बाह्य तथा आंतरिक संरचना एवं प्रजनन।	

Pratical work based on theoty paper

Suggested Books

1. G.M. Smith 1971 Cryptogamic Botany. Vol - I Algae & Fungi Tata McGrraw Hill . Pub. Co. NewDelhi
2. G.M. Smith 1971 Cryptogamic Botany. Vol -II Bryophytes & Pteridophytes. Tata McGrraw HillPub. Co. New Delhi.
3. O.P.Sharma,1992. Text book of Thallophyta McGrraw Hill Pub. Co.
4. O.P.Sharma,1990. Text book of Pteridophyta McMillan india Ltd .
5. P.D.Sharma 1991. The Fungi. rastogi & Co. Meerut.
6. H.C. Dubey.1990. an introduction of Fungi.Vikas Pub. house pvt.ltd.
7. P.Puri 1980. Bryophyta Atma ram & Sons, Delhi.
8. A.Clifton.1958. Introduction to the Bacteria. Mcgrew Hillpub. Co.New delhi.

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Session		**2019-20**
Class		**B.Sc.. Ist Year**
Subject	**(English)**	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**II**
Title of the Paper	(English)	**Diversity of Higher plants**
	(हिन्दी)	**उच्च पादपो की विविधता**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Gymnosperm**: General characters and Classification and **distribution of Gymnosperms in India**. Heterospory and Origin of Seed Habit. Diversity of Gymnosperm: Geological Time Scale and Fossilization. **Types of Fossils, tools and techniques.** Fossil Gymnosperms: *Lyginopteris* and *Williamsonia.*	09
	(हिन्दी)	**अनावृत्तबीजीः अनावृत्तबीजियों के सामान्य लक्षण, वर्गीकरण एवं भारत में वितरण।** विषमबीजाणुकता एवं बीज स्वभाव का उद्गम, अनावृत्तबीजियों की विविधताएँ, भू–वैज्ञानिक समय सारणी एवं जीवाश्मीभवन, **जीवाश्म के प्रकार, साधन एवं तकनीक**। अनावृत्तबीजी जीवाश्म : लाइजीनोप्टेरिस एवं विलियमसोनिया।	
Unit-II	(English)	**Gymnosperm**: **General account of Cycadofilicales, Bennettiales and Gnetales . General account of Gingoals**. Morphology, Anatomy Reproduction and life cycle, of *Cycas*, *Pinus* and *Ephedra*.	09
	(हिन्दी)	**अनावृत्तबीजीः साइकेडिओफिलीकेल्स, बेनिटाइटेल्स एवं निटेल्स के सामान्य लक्षण। जिंगोएल्स के सामान्य लक्षण।** साइकस, पाइनस, एवं एफिड्रा की आकारिकी, आन्तरिक संरचना, प्रजनन तथा जीवन–चक्र।	
Unit-III	(English)	**Tissue System**. Types of vascular bundles, apical meristem, Classification of meristem. **The Root System**: Root apical meristem. Differentiation of primary and secondary tissues and their role. Anatomy of Monocot and Dicot root. Secondary growth in root. Modification of root for Various Functions, Interaction of root with microbes.	09
	(हिन्दी)	**ऊतक तंत्र** : संवहन पूल के प्रकार, शीर्षस्थ प्रविभाजी ऊतक, प्रविभाजी ऊतक का वर्गीकरण। **जड़ तंत्र** : जड़ का शीर्षस्थ प्रविभाजी ऊतक : प्राथमिक एवं द्वितीयक ऊतकों का विभेदन एवं उनके कार्य। एकबीजपत्री जड़ एवं द्विवीबीजपत्री जड़ की आंतरिक संरचना, जड़ में द्वितीयक वृध्दि। विभिन्न कार्यों हेतु जड़ के रूपान्तरण। सूक्ष्मजीवों के साथ जड़ की पारस्परिक क्रिया।	

Unit-IV	(English)	**The Shoot system**: Shoot apical meristem and histological organization, Anatomy of Monocot and Dicot stem: Vascular cambium and its functions, Secondary growth in stem. Characteristics of growth rings: Sapwood and Heart wood, Secondary Phloem, Cork Cambium and Periderm.**Anatomy of C_3 and C_4 plants**. Anomalous Secondary growth in Nyctanthus, Boerhhavia, Achyranthus, Leptadenia, Salvadora, Bignonia and Dracaena.	09
	(हिन्दी)	**प्ररोह तंत्र** : प्ररोहे शीर्षस्थ विभज्योतक एवं ऊतकीय सगंठन, एकबीजपत्री एवं द्विबीजपत्री तने की आन्तरिक संरचना सवंहन एधा एवं उसके कार्य, तने में द्वितीयक वृद्धि : वृद्धि वलय की विशेषतायें, सैप काष्ठ एवं हार्ट काष्ठ, द्वितीयक फ्लोएम, कार्क कैम्बियम एवं पेरीडर्म। तने में असामान्य वृध्दि – निक्टेन्थस, बोरहाविया, एकाइरेन्थस, लेप्टाडीनिया, सेल्वाडोरा, बिग्नोनिया, ड्रेसीना।	
Unit-V	(English)	**The Leaf system**: Origin and Development of leaf, Diversity in size, shape and arrangement, Internal structure of Dicot and Monocot leaf. Adaptations to photosynthesis and water stress, senescence and abscission.	09
	(हिन्दी)	**पर्ण तंत्र** : पर्ण की उत्पत्ति एवं विकास, प्रमाप, आकार एवं विन्यास में विविधताएं, एकबीजपत्री एवं द्विबीजपत्री पर्ण की आतंरिक सरंचना, प्रकाश सश्लेषण एवं जलीय प्रतिबल का अनुकुलन, जीर्णता एवं विलगन।	

Pratical work based on theory paper

SUGGESTED READINGS:-

- Agarwal, S.B. 2007. Unified Botany, Shivlal Agarwal & Company Indore.
- Bhatnagar, S. P. and Moitra 1996. Gymnosperms. New Age International Limited, New Delhi.
- Davis, P.H. and Heywood, V.H. 1963, Principles of Angiosperm taxonomy. Oliver and Boyd, London.
- Gangulee, H. C. & Kar, A. K. 2006. College Botany Voll.III, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Heywood, V.H. and Moore, D.M. (eds) 1984. Current concepts in plant taxonomy. Academic press London.
- Jeffery, C. 1982. An Introduction of plant taxonomy. Cambridge University Press Cambridge, London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematic. Mc Graw Hill Book Co. New York.
- Kaushik, M.P. 2003. Modern Textbook of Botany, Prakash Publication Muzaffar Nagar U.P.
- Mukherjee, S.K. 2006. College Botany Voll.II, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi- 110055.
- Radford, A.E. 1986. Fundamentals of Plant Systmatics, Happer and Raw, New York.
- Saxena and Sarabhai. 1989. Text book of Botany. Rastogi Publication Meerut.
- Singh, G. 1999. Plant Systematics : Theory and Practice. Oxford and IBH Pvt. Ltd.New Dehli
- Vasishta, P.C. 2005. Botany for degree students Voll. V, Gymnosperms. S. Chand & Company Ltd. Ramnagar, New Delhi- 110055

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Session		**2019-20**
Class		**B.Sc.II nd Year**
Paper		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Title of the Paper	(English)	**Structure, Development and Reproduction in Flowering plants.**
	(हिन्दी)	**पुष्पीय पौधों की संरचना, विकास एवं प्रजनन**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Tissue System**. Types of vascular bundles, apical meristem, Classification of meristem. The Root System: Root apical meristem. Differentiation of primary and secondary tissues and their role. Anatomy of Monocot and Dicot root. Secondary growth in root. Modification of root for Various Functions, Interaction of root with microbes.	09
	(हिन्दी)	**ऊतक तंत्र** : संवहन पूल के प्रकार, शीर्षस्थ प्रविभाजी ऊतक, प्रविभाजी ऊतक का वर्गीकरण। **जड़ तंत्र** : जड़ का शीर्षस्थ प्रविभाजी ऊतक : प्राथमिक एवं द्वितीयक ऊतकों का विभेदन एवं उनके कार्य। एकबीजपत्री जड़ एवं द्विवीबीजपत्री जड़ की आंतरिक संरचना, जड़ में द्वितीयक वृध्दि। विभिन्न कार्यों हेतु जड़ के रूपान्तरण। सूक्ष्मजीवों के साथ जड़ की पारस्परिक क्रिया।	
Unit-II	(English)	**The Shoot system**: Shoot apical meristem and histological organization, Anatomy of Monocot and Dicot stem: Vascular cambium and its functions, Secondary growth in stem. Characteristics of growth rings: Sapwood and Heart wood, Secondary Phloem, Cork Cambium and Periderm. Anomalous Secondary growth in Nyctanthes, Boerrhavia, Achyranthes, Leptadenia, Salvadora, Bignonia and Dracaena.	09
	(हिन्दी)	**प्ररोह तंत्रः** प्ररोह शीर्षस्थ प्रविभाजी ऊतक एवं ऊतकीय सगंठन, एकबीजपत्री एवं द्विबीजपत्री तने की आन्तरिक संरचना सवंहन एधा एवं उसके कार्य, तने में द्वितीयक वृद्धि : वृद्धि वलय की विशेषतायें, सैप काष्ठ एवं हार्ट काष्ठ, द्वितीयक फ्लोएम, कार्क कैम्बियम एवं पेरीडर्म। तने में असामान्य वृध्दि – निक्टेन्थस, बोरहाविया, एकाइरेन्थस, लेप्टाडीनिया, सेल्वाडोरा, बिग्नोनिया, ड्रेसीना।	
Unit-III	(English)	**The Leaf system**: Origin and Development of leaf, Diversity in size, shape and arrangement, Internal structure of Dicot and Monocot leaf. Adaptations to photosynthesis and water stress, senescence and abscission.	09
	(हिन्दी)	**पर्ण तंत्र** : पर्ण की उत्पत्ति एवं विकास, प्रमाप, आकार एवं विन्यास में विविधतायें, एकबीजपत्री एवं द्विबीजपत्री पर्ण की आतंरिक सरंचना, प्रकाश	

		सश्लेषण एवं जलीय प्रतिबल का अनुकूलन, जीर्णता एवं विलगन।	
Unit-IV	(English)	**Embryology**: Concept of flower as a modified shoot, Structure of Anther, Microsporogenesis and Male Gametophyte. Structure of Pistil, Ovules, Megasporogenesis and Development of Female Gametophyte (Embryo Sac) and its types, Pollination –Mechanism and Agencies of Pollination, Pollen Pistil interactions and Self incompatibility.	09
	(हिन्दी)	**भ्रूणिकीः** पुष्प एक रूपांतरित प्ररोह की अवधारणा, परागकोष की संरचना,लघुबीजाणुजनन एवं नर युग्मकोद्भिद्। स्त्रीकेसर की सरंचना, बीजाण्ड, गुरूबीजाणुजनन, मादा युग्मकोद्भिद (भ्रूणकोष्) का विकास एवं प्रकार। परागण –परागण की प्रक्रिया एवं एजेन्सी, पराग स्त्रीकेसर की पारस्परिक क्रिया एवं स्वअनिषेच्यता।	
Unit-V	(English)	**Embryology**: Double Fertilization and triple fusion. Development and types of Endosperm and its morphological nature, Development of Embryo in Monocot and Dicot plants. Fruit development and maturation, Seed structure and dispersal. Mode of vegetative propagation.	09
	(हिन्दी)	**भ्रूणिकीः** द्विनिषेचन एवं त्रिसंयोजन। भ्रूणपाषे का विकास, प्रकार एवं इसकी आकारिकीय प्रकृति। एकबीजपत्रीय और द्विबीजपत्रीय पौधों में भ्रूण का विकास, फल का परिवर्धन एवं परिपक्वता, बीज की संरचना एवं प्रकीर्णन। कायिक प्रवधर्न के प्रकार।	

Practical work based on theory -

- **Suggested Books:** Gangulee, H.C., Das, K. S. And Dutta, C. 2007. College Botany Vol.I, New Central Book Agency (P) Ltd. Kolkata, 700009.
- Heywood, V.H. & Moore, D.M. (eds) 1984. Current concepts in plant Taxonomy. Acedemic press London.
- Jones, S.B. Jr. and Luchsinger, A.E. 1986, Plant taxonomy (III edition) Mc Graw Hill Book Co. New York.
- Maheshwari, P.1978. Plant Embryology.
- Pandey, B. P. 2010. A Text book of Botany- Angiosperms, S. Chand & Company Ltd. Ramnagar, New Delhi- 110055.
- Radford, A.E. 1986. Fundamentals of Plant Systematics, Harper and Row,New York.
- Shrivastava and Das. Modern text book of Botany Vol-III & IV.
- Singh, V., Pande P.C. and Jain , D. K. Structure & Development in Angiosperms. Rastogi Publication, Meerut.
- Banson, L.B.; 1957: Plant Classification, Health& Co. Boston.
- Davis, P.R & Heywood, V.H 1973: Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. *Co.* New *York*, USA
- Eames, AJ.; 1961: Morphology of Angiosperms, Mc-Graw Hill, New York.
- Jeffery, C.; 1968: An Introduction to Plant Taxonomy J. & H. Churchill Limited.
- Lawrence, G .H.M.; 1951: Taxonomy of Vascular Plants Macmillan, NewYork.
- Naik V. N.; 1984: Taxonomy of Angiosperms. Tata Mc-Graw Hill Pub. Co. Ltd. New Delhi.
- Porter, L.L.; 1959: Taxonomy of Flowering Plants. San Francisco. Radfor~ *AE*. Dickinson, W.C. MasseyJ.R and. Ben. C.R: 1974: VQ~llar Plant SYstematics, Harper & Row, New York.
- Fahn: Plant Anatomy
- Vashishtha: Anatomy
- Panday,B.P.,: Plant Anatomy
- Esau: Plant Anatomy
- Bhojwani & Bhatnager: Embryology

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Session		**2019-20**
Class		B.Sc.II nd Year
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**II**
Title of the Paper	(English)	**Plant Ecology, Biodiversity and Phytogeography**
	(हिन्दी)	**पादप पारिस्थितिकी, जैव विविधता एव पादप भौगोलिकी**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Ecosystem**: concept and types of ecosystem, structure and function of ecosystem, biotic and abiotic components, trophic levels, food chain, food web, ecological pyramids, energy flow. **Concept of Biogeochemical cycle**: gaseous, liquid and sedimentary cycles, carbon, nitrogen, water, phosphorus, and sulphur cycle.	09
	(हिन्दी)	**पारिस्थितिक तंत्रः** अवधारणा एवं प्रकार, संरचना एवं कार्य, जैविक एवं अजैविक घटक, पोषी स्तर, खाद्यश्रृंखला, खाद्य जाल, पारिस्थितिक पिरामिड, पारिस्थितिक तंत्र में उर्जा प्रवाह। **जैव भू रासायनिक चक्रः** अवधारणा, गैसीय द्रव तथा अवसादीय चक्र – कार्बन, नाइट्रोजन, जल, फास्फोरस, तथा सल्फर चक्र ।	
Unit-II	(English)	**Ecological adaptations**: Morphological, anatomical and physiological responses, water adaptation (hydrophytes and Xerophytes), temperature adaptation (thermoperiodism and vernalization) light adaptation (heliophytes and sciophytes), photoperiodism. Plant **succession**: Causes, trends and process, types of succession- Hydrosere and Xerosere.	09
	(हिन्दी)	पारिस्थितिक अनुकूलनः आकारिकी, आंतरिकी तथा कार्यिकी अनुक्रिया, जल अनुकूलन (जलोदभिद् तथा मरूदभिद्) तापक्रम अनुकूलन (तापकालिता तथा वसंतीकरण) प्रकाश अनुकूलन (प्रकाश रागी तथा छाया रागी) प्रकाश दीप्तीकालिता। पादप अनुक्रमणः कारण, प्रवृत्ति एवं प्रक्रिया, पादप अनुक्रमण के प्रकार, हाइड्रोसियर (जलीय अनुक्रमण), जीरोसियर (शुष्क अनुक्रमण)	
Unit-III	(English)	**Population Ecology**: Distribution patterns, Density, Natality, Mortality, Growth curve, Ecotypes and Ecads. Community ecology: Frequency, Density, Abundance, Cover and life forms. **Biodiversit**y: Basic concept, definition, importance, Biodiversity of India, hot spots, "insitu" and "exsitu" conservations, Biosphere reserves, sanctuaries and National parks of Madhya Pradesh. Endangered and threatened species, Red data book.	09
	(हिन्दी)	**जनसंख्या पारिस्थितिकीः** वितरण प्रणाली, घनत्व, जन्मदर, मृत्युदर, वृद्धिवक्र, इकोटाइप एवं इक्रेडस : समुदाय परिस्थितिकी : आवृत्ति, घनत्व,	

		बहुलता,आच्छादन एवं जीवनरूप। **जैवविविधता** – आधारभूत परिकल्पना, परिभाषा, महत्व भारत की जैवविविधता, तप्तस्थल, स्वस्थाने तथा बाह्य स्थाने संरक्षण। जैव मण्डल संचयन, म.प्र. के अभ्यारण एवं राष्ट्रीय उद्यान, विलुप्तप्राय तथा खतरे में पड़ी प्रजातियां, रेड डाटा बुक	
Unit-IV	(English)	**Soil**: Physical and chemical properties of soil., soil formation, development, soil profile, soil classification, soil composition, soil factors. **Pollution**: Defination, types and causes, Global warming, Acid rain, climate change , ozone layer and ozone holes.	09
	(हिन्दी)	**मृदा** : भौतिक–रासायनिक गुण, मृदा निर्माण, मृदापरिच्छेदिका का विकास, मृदा का वर्गीकरण, मृदा संगठन, मृदा कारक। **प्रदूषणः** परिभाषा, प्रकार एवं कारण, वैश्विक तपन, अम्लीय वर्षा, जलवायु परिवर्तन, ओजोन परत एवं ओजोन छिद्र।	
Unit-V	(English)	**Phytogeography**: Phytogeographical region of India, vegetation types of Madhya Pradesh, **Natural Resources**: Definition and classification of natural resources, conservation and management of natural resources, land resource management, water resource management, wet land resource management.	09
	(हिन्दी)	**पादप भौगोलिकीः** भारत के पादप भौगोलिकी क्षेत्र, म.प्र. के वानस्पतिक प्रकार। **प्राकृतिक स्त्रोतः** प्राकृतिक स्त्रोतों की परिभाषा एवं वर्गीकरण, प्राकृतिक स्त्रोतों का प्रबंधन एवं संरक्षण, भू–स्रोत प्रबंधन, जल स्रोत प्रबंधन, आर्द्रभूमि स्त्रोत प्रबंधन।	

Practical work based on theory

Suggested Books:

- Odum, E.J. 2004.5th ed. Fundamentals of Ecology, Natraj Pub.
- Odum, E.J. 1983 Basic ecology, Saunders, Philadeliphia.
- Kormondy, 1996 Ecology.
- Ambast R.S. plant Ecology.
- Doubenmre: Plant and Environment.
- Puri G.S. 1960. Indian Forest Ecology.
- Sagarcya K.P. Forest and Forestry.
- pandhi-Indian Foresty.
- R.S. Shukla & P.S. Chandel,2006. A Text book of plant Ecology.
- Kumar, U.K. 2006.Biodiversity principles and conservation -Agrobios, Jodhpur.
- Banargee S.1998, Bio diversity conservations- Agrobotamica, Bikaner
- Tandan R.K .,Biodiversity taxonomy & ecology- Scientific pub-Jodhpur.
- Sharma, P.D. 7th ed. 1998 Ecology and Environment, Rastogi Pub.,Meerut,250002

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Under Graduate ANNUAL Pattern Syllabus of Botany
(As Recommended by the Board of Studies)
2019-20
Theory / Practical

Session		**2019-20**
Class		B.Sc. III Year
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		I
Title of the Paper	(English)	**Plant Physiology and Biochemistry**
	(हिन्दी)	**पादप कार्यिकी और जैव रसायन**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**Plant water relations**: Properties of water, Importance of water in plant life, Diffusion, osmosis and osmotic relation of plant cell, water absorption, Ascent of sap. **Transpiration**: Structure & physiology of stomata, mechanism of transpriation, factors affecting rate of transpiration.	09
	(हिन्दी)	**पादप जल संबंध** : जल के गुण, पादप जीवन में जल का महत्व, विसरण परासरण तथा पादप कोशिका के परासरण संबंध, जल अवशोषण, रसारोहण। **वाष्पोत्सर्जन** : रंध्र की संरचना एवं कायिकी, वाष्पोसर्जन की क्रियाविधि, वाष्पोत्सर्जन को प्रभावित करने वाले कारक।	
Unit-II	(English)	**Plant Nutrition & Biomolecules:** Mineral nutrition, essential macro & micro nutrients and their role. Absorption of mineral nutrients& hydroponics, translocation of organic solutes. **Biomolecules:** Sructure, classification and functions of Carbohydrates, Amino acids, Proteins and Lipids.	09
	(हिन्दी)	**पादप पोषण** एवं **जैविक अणुः** खनिज पोषण, आवश्यक दीर्घ एवं लघु पोषक तत्व एवं उनकी भूमिका, खनिज लवणों का अवशोषण, जल संवर्धन, कार्बनिक विलेय का स्थानांतरण। **जैविक अणुः** कार्बोहाइड्रेट, ऐमिनो अम्ल, प्रोटीन एवं लिपिड की संरचना, वर्गीकरण और कार्य।	
Unit-III	(English)	**Photosynthesis**: Chloroplast, Photosynthetic pigments, Concept of two photosystems, Light reaction, Red drop and Emerson's effect, Dark reaction – Calvin cycle, Hatch & Slack cycle, CAM cycle, factors affecting rate of Photosynthesis and Photorespiration.	09
	(हिन्दी)	**प्रकाश संश्लेषण** : क्लोरोप्लास्ट, प्रकाश संश्लेषीय वर्णक, दो प्रकाश तंत्र की अवधारणा, प्रकाश अभिक्रिया, रेड ड्राप तथा इमरसन प्रभाव, अंधकार अभिक्रिया, केलविन चक्र, हेच एवं स्जेक चक्र, सी.ए.एम. चक्र, प्रकाश संश्लेषण को प्रभावित करने वाले कारक एवं प्रकाशीय श्वसन।	
Unit-IV	(English)	**Respiration**: Mitochondria, aerobic and anaerobic respiration, fermentation, Respiratory coefficient. Mechanism of respiration-Glycolysis, Kreb's cycle, Pentose phosphate pathway, Electron transport system, Factors affecting rate of respiration, Redox Potential and theories of ATP synthesis.	09

	(हिन्दी)	**श्वसन** : माइटोकॉन्ड्रिया, आक्सी एवं अनाक्सी श्वसन, किण्वन, श्वसन गुणांक, श्वसन की क्रियाविधि – ग्लाइकोलिसिस, क्रेब चक्र, पेन्टोस फास्फेट मार्ग, इलेक्ट्रान अभिगमन तंत्र, श्वसन की दर को प्रभावित करने वाले कारक, आक्सीकरण – अपचयन विभव, ए.टी.पी. संश्लेषण के विभिन्न सिद्धांत।	
Unit-V	(English)	**Enzymology and Plant Hormones :** Classification, nomenclature and characteristics of enzymes, concept of holoenzyme, apoenzyme, co-enzymes and co-factors, Mode and mechanism of enzyme action, Factors affecting enzyme activity. **Plant harmones**: Discovery , structure, mode of action and role of Auxins, Gibberellins, Cytokinin, Abscissic acid and Ethylene.	09
	(हिन्दी)	**ऐंजायमोलॉजी तथा पादप हार्मोन** :– विकरों का वर्गीकरण, नामकरण एवं अभिलाक्षणिक गुण, होलाएन्जाईम, एपोएन्जाईम, कोएन्जाईम एवं कोफेक्टर्स की अवधारणा, विकर की कार्यप्रणाली एवं क्रियाविधि, विकर प्रतिक्रिया को प्रभावित करने वाले कारक **पादप हार्मोन**, आक्सिन, जिब्बरेलिन, सायटोकायनिन तथा एब्सीसिक अम्ल एवं इथीलिन की खोज, संरचना, कार्यप्रणाली एवं भूमिका।	

Pratical work based on theory paper

Suggested Books:

- Hopkins W.G. 1995 Introduction of plant physiology Pub. John wiley and sons New York.
- Salisbury F.D., and Ross C.W. 1992 Plant physiology, Wadsworth pub. Co. California, USA
- Taiz & Zeiger, E. 1998, Plant physiology, Sinauer associates, inc. pub. Massachusetts,U.S.A.
- Jain V.K.1974. Fundamentals of plant physiology, S. Chand & company.
- Verma S.K. & Verma M.A. 1995.Text book of plant physiology & Biotechnology, S.Chand & company.
- Verma V. 1995.Plant physiology Emkey pub.
- Devid, L.N. and Michael,M.C.2000. Leninger Principle of Biochemistry, Macmillan Worth Pub. New York,USA.
- Gangulee, H.C.,Das,K.S.,Dutta,C.and Sen, S.2007.College Botany Vol. II.New Centre Book Agency (P)Ltd. Kolkotta,700009

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Shivaji Nagar, Bhopal
Under Graduate ANNUAL Pattern Syllabus of Botany
(As Recommended by the Board of Studies)
2019-20
Theory / Practical

Session		**2019-20**
Class		B.Sc. IIIrd yr.
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		II
Title of the Paper	(English)	**Cell Biology , Genetics and Biotechnology**
	(हिन्दी)	कोशिका विज्ञान, आनुवांशिकी एवं जैवप्रौद्योगिकी
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		**50**

Unit		Syllabus	Periods
Unit-I	(English)	**The cell envelops and cell organelles:** plasma membrane, bilayer lipid structure, function of the cell wall. Structure and function of cell organells: Nucleus, Chloroplast and Mitochondrion, Golgibodies, ER, Peroxisome and Vacuole.	09
	(हिन्दी)	**कोशिका आवरण एवं कोशिकांग** : प्लाज्माझिल्ली, द्विस्तरीय लिपिड संरचना कोशिका भित्ति के कार्य। कोशिका अंगकों की संरचना एवं कार्यः केन्द्रक, हरित लवक, माइटोकॉण्ड्रिया गॉल्जीकाय, अंतःद्रव्यी जालिका, परऑक्सीसोम्स, रिक्तिकाएँ ।	
Unit-II	(English)	**Chomosomal organization:** Structure and functions of chromosome, centromere and telomere, Nucleosome model special types of chromosomes. Mitosis and Meosis. **Variations in chromosome structure**: Deletion, duplication, translocation and inversion, variation in chromosome number, euploidy, aneuploidy. DNA the genetic material, DNA structure and replication.	09
	(हिन्दी)	**गुणसूत्र संगठन** : गुणसूत्र की आकारिकी एवं कार्य, सेंट्रोमीर्धसूत्रीय विभाजन।यर एवं टिलोमीयर न्यूक्लियोसोम मॉडल, विशेष प्रकार के क्रोमोसोम्स, समसूत्र एवं अर्धसूत्री विभाजन। **गुणसूत्र संरचना में विभिन्नताएँ** : विलोपन, द्विगुणन, स्थानान्तरण, प्रतिलोमीकरण। गुणसूत्र संख्या में विभिन्नताएँ । यूप्लॉयडी एव एन्यूप्लॉयडी । डी.एन.ए. : आनुवांशिक पदार्थ, डी.एन.ए. की संरचना एवं पुनरावृत्ति।	
Unit-III	(English)	Genetic inheritance: Mendelism; segregation and independent assortment; linkage analysis; interactions of genes. Cytoplasmic inheritance, mutations- spontaneous and induced; transposable elements; DNA damage and repair.	09
	(हिन्दी)	आनुवांशिक वशांगति: मेण्डलवाद, पृथक्करण एव स्वतंत्र अपव्यूहन के नियम, सहलग्नता विश्लेषण, जीन की अन्योन्य क्रियाएँ। कोशिकाद्रव्यी वंशागति, उत्परिवर्तन, प्राकृतिक एवं प्रेरित उत्परिवर्तन, स्थानांतरणशील अवयव, डी.एन.ए. क्षति एवं सुधार।	
Unit-IV	(English)	Gene: Structure of gene, genetic code, transfer of genetic	09

		information; trascription, translation, protein synthesis, tRNA, and ribosomes. Regulation of gene expression in prokaryotes and eukaryotes.	
	(हिन्दी)	जीन – जीन की सरंचना, आनुवांशिक कोड , आनुवांशिक सूचना का स्थानान्तरण, अनुलेखन, अनुवाद, प्रोटीन सश्लेषण, ट्रासंफर आर.एन.ए., राइबोसोम्स, प्रोकेरियाट्स एवं यूकैरियाट्स में जीन अभिव्यक्ति का नियमन।	
Unit-V	(English)	**Biotechnology:** Functional definition; basic aspects of plant tissue culture; cellular totipotancy, differentiation and morphogenesis, important achievements in crop biotechnology. **Genetic Engineering:** Tools and techniques of recombinant DNA technology; cloning vectors, Biology of Agrobacterium, vector for gene delivery and marker gene. Genomic and cDNA library; gene mapping and chromosome walking.	09
	(हिन्दी)	जैव प्रौद्योगिकी ‘: कार्यात्मक परिभाषा, पादप ऊतक संवर्धन के आधारभूत तत्व, कोशीय टोटीपोंटेंशी, विभिन्नीकरण एवं मार्फोजेनेशिस, कृषि क्षेत्र में जैव प्रौद्योगिकी की प्रमुख उपलब्धियाँ। आनुवांशिक अभियांत्रिकी : पुनर्योजक डी.एन.ए. तकनीकी के संयंत्र एवं तकनीक, क्लोन वाहक, एग्रोवैक्टीरियम की जैविकी, जीन डिलिवरी के वाहक एवं मार्कर जीन, जीनोमिक तथा c DNA लाईब्रेरी, जीन मैंपिंग तथा गुणसूत्र वाकिंग।	

Pratical work based on theory paper

Suggested Books:

- P.K.Gupta, 1999 A text book of Cell and Molecular biology, Rastogi pracation Meerut. India
- P.K.Gupta, 1999 Genetics, , Rastogi pracation Meerut. India
- Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA
- Rost, T. et: aI. 1998.PIant Biology, Wadsworth Publishing Co., California, U.S.A
- Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A
- Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE
SHIVAJI NAGAR, BHOPAL

Syllabus of Botany

As Recommended by the Board of Studies
2017-18

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College

Shivaji Nagar, Bhopal – 462016

Syllabus

2017-2018

Subject:BOTANY

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Date of submission in Autonomous Examination cell:

Signature H.O.D.

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of M.Sc. Botany
(As Recommended by the Board of Studies)
2017-18
Theory / Practical
M.Sc. Botany

First Semester

Course No.	Name of the Course	Total
PG 101	Biology& Diversity of Virus,Bacteria & Fungi	70 + CCE 30 = 100
PG 102	Biology and Diversity of Algae	70+ CCE 30 = 100
PG 103	Biology & Diversity of Bryophyta and Pteridophyta	70 + CCE 30= 100
PG 104	Biology and Diversity of Gymnosperms	70+ CCE 30 = 100
PG 105	Practical I – based on Course PG 101 & 102	100
PG 106	Practical II – based on Course PG 103 & 104	100
	Project work related to course Paper	50
	Total	**650**

Second Semester

Course No.	Name of the Course	Total
PG 201	Cell Biology and Genetics	70 + CCE 30 = 100
PG 202	Plant Development & Reproduction	70 + CCE 30 = 100
PG 203	Plant Physiology-I	70 + CCE 30 = 100
PG 204	Plant Ecology-I	70 + CCE 30 = 100
PG 205	Practical I – based on Course PG 201 & 202	100
PG 206	Practical II – based on Course PG 203 & 204	100
	Project work related to course Paper	50
	Total	**650**

M.Sc. Botany

Third Semester

Course No.	Name of the Course	Total
PG 301	Systematic of Angiosperms	70 + CCE 30 = 100
PG 302	Molecular Biology and Plant Breeding	70 + CCE 30 = 100
PG 303	Plant Physiology, Biochemistry and Metabolism	70 + CCE 30 =100
PG 304	**Plant** Ecology-II (Conservation & Utilization of Plant Resources)	70 + CCE 30 =100
PG 305	Practical I – based on Course PG 301 & 302	100
PG 306	Practical II – based on Course PG 303 & 304	100
	Project work related to course Paper	50
	Total	**650**

Fourth Semester

Course No.	Name of the Course	Total
PG 401	Biotechnology and Tissue Culture	70 + CCE 30 = 100
PG 402	Applied Botany & Instrumentation	70 + CCE 30 = 100
PG 403	Elective Paper- I*	70 + CCE 30 =100
PG 404	Elective Paper- II*	70 + CCE 30 =100
PG 405	Practical I – based on Course PG 401 & 402	100
PG 406	Practical II – based on Course PG 403 & 404	100
	Internship Training	**100**
	Total	**700**

Note: Excursion is compulsory for all students (local) in Previous and Final year.

* List of Elective Papers are enclosed.

Signature with date

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)

2017-18

Theory / Practical

Session		**2017-18**
Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 101
		Paper-I
Title of the Paper	(English)	**: Biology & Diversity of Viruses, Bacteria and Fungi**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Virus: characteristics, classification and ultrastructure of virions, isolation and purification of viruses; chemical nature, replication, transmission of viruses; economic importance of viruses.	9
Unit-II	General characteristics, ultrastructure, nutrition and reproduction, biology and economic importance of Archaebacteria and Eubacteria, Cyanobacteria, Actinomycetes Mycoplasma, Rickettsiae, Chlamydiae.	9
Unit-III	General characteristics, classification of fungi substrate relationship in fungi, reproduction, heterothallism, parasexuality, Economic Importance of fungi (fungi in industries, medicine, as food, fungal diseases in plants and humans, fungus as biocontrol agent), mycorrhiza.	9
Unit-IV	General characteristics of Mastigomycotina-Synchytrium, Saprolegnia, Pythium, Phytophthora, Peronospora, Sclerospora. General characteristics of Zygomycotina –Rhizopus, Pilobolus. General characteristics of Ascomycotina-Yeast, Taphrina, Penicillium, Erysiphe, Phyllactinia, Uncinula, Chaetomium, Peziza, Morchella.	9
Unit-V	General characteristics of Basidiomycotina- Puccinia, Melampsora, Ustilago, Agaricus, Geastrum. General characteristics of Deuteromycotina- Alternaria, Curvularia Cercospora, Colletotrichum	9

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of reproductive members of fungi and cynobacteria : Peronospora, Albugo, Mucor, Pilobolus, Yeast, Chaetomium, Morchella, Agaricus, Melampsora curvularia, Polyporus, Phoma, Penicillium, Fusarium, Rhizopus, Asprgillus, Colletotrichum, Nostoc, Anabaena, Gleotrichia, Rivularia, Microcystis, Oscillatoria, Lyngbya.**
2. **Symptomatology of some diseased specimens: White rust, Downy mildew, Powdery mildew, Rusts, Smut, Ergot, Groundnut leaf spot , Red rot of sugarcane, Wilts, Paddy Blast, Citrus canker, Bacterial blight of paddy, Angular leaf spot of cotton, Tobacco mosaic, Little leaf of brinjal, Mango malformation, Leaf curl of papaya.**
3. **Gram staining of Bacteria.**
4. **Sterilization methods, preparation of media and stains.**
5. **Isolation of microbes from soil, water and air.**

SUGGESTED READINGS

- Alexopoulus, C.J. Mims, C. W. and Blackwel, M; 1996: Introductory coO' Mycology, Jbon Wjley & Sons Inc.
- Clifton, A; 1958: Introduction to Bacteria, Mcgraw- Hills Book Co.New Delhi.
- Madigan, M T. Martinko, J. M and Parker Jack; I 997: Brock Biology Of Microorganisms, (8th edition) Prentice Hall, N,J. U.S.A
- Mandahar, C. L.; 1978: Introduction to Plant Viruses. Chand & Co.Ltd. Delhi.
- Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate Press.
- Rangaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in Indja (4th edjtjon).PrentjceHaJl ofInilia Ltd. New Delbj.
- Webster, J.; 1985: Introduction to Fungi Cambridge University Press. Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbjology, S. Chand Publisher, New Delh

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Session		**2017-18**
Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 102
		Paper-II
Title of the Paper	(English)	**Biology & Diversity of Algae**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General characteristics of Algae; Classification of algae, diversified habitats, thallus organization, cell ultrastructure, reproduction, pigments, reserve foods, types of flagella, Economic importance of Algae.	9
Unit-II	General characteristics of Chlorophyta and Charophyta-Chlamydomonas, Pandorina, Eudorina, Chlorella, Hydrodictyon, Pediastrum, Ulothrix, Cladophora, Draparnaldiopsis, Spirogyra, Zygnema, Bryopsis and Nitella	9
Unit-III	General characteristics of Xanthophyta: Botrydium, Vaucheria. General characteristics of Bacillariophyta: Diatoms (Pennularia). General characteristics of Euglenophyta: Euglena.	9
Unit-IV	General characteristics of Phaeophyta : Ectocarpus, Dictyota, Laminaria, Fucus, Sargassum	9
Unit-V	General characteristics of Rhodophyta: Porphyra, Batrachospermum, Gelidium, Cryptonemia, Rhodymenia, Polysiphonia.	9

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of representative members of Algae**
2. **Algae :- Volvox, Pandorina, Chara, Nitella, Oedogoneum, Spirogyra, Zygnema, Coleochaete, Chaetophora, Hydrodictyon, Ulva, Pithophora , Stigloclonium , Draparnaldiopsis , Clostridium , Cosmarium , Valonia , Vaucharia , Botydium, Dictyota , Padina , Laminaria , Saragassum, Fucus , Cutleria , Porphyra , Batrachospermum , Gracillaria, Polysiphonia**
3. **Study of algae as Biofertilizers, algal bloom.**
4. **Study the role of algae in Eutrophication.**
5. **Culture technique of Algae**

SUGGESTED READINGS

- Smith G. M. Cryptogamic Botany VoL I(1st edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Kumar H. D. 1988: Introduction to Phycology. Affiliated East-West Press Ltd.
- Prescott,G.W.,1969. The Algae:A review . Butler &Tanner Ltd., From & London
- Chapmam & Chapman, The Algae
- Sharma O.P.,The Algae
- Gangulee, H.C. &Car ,A.K. Vol. I&II ,1989, College Botany, Books & allied(P Ltd. , Calcutta
- Fritsch, F.E. , Vol.I, 1965, The Structure and Reproduction of the Algae,The Syndics of Cambridge university Press

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Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 103
		Paper-III
Title of the Paper	(English)	**Biology & Diversity of Bryophyta& Pteridophyta**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit-I	General Characteristics, classification , Morphology, reproduction and life history, distribution, Origin, Evolution& Affinities, Ecology and Economic importance of Bryophytes. Contribution to Bryophyta in India	9
Unit-II	General Characteristics of Hepaticopsida-Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Sphaerocarpus, Pellia, Porella. General Characteristics of Anthocerotopsida-Anthoceros, Notothylas. General Characteristics of Bryopsida-Sphagnum, Polytrichum.	9
Unit-III	General characteristics of Pteridophyta; Classification, origin, telome theory, stelar organization, Homospory, Heterospory and Seed Habits, Reproduction , Indian contribution to Pteridophyta, Paleobotany and Geological Time-Scale, types of fossils.	9
Unit-IV	General characteristics of Psilophyta-Rhynia, Horneophyton, Zosterophyllum, Psilophyton, Asteroxylon, Psilotum, Tmesipteris. General characteristics of Lycophyta- Lycopodium, Protolepidodendron, Lepidodendron, Isoetes, Selaginella.	9
Unit-V	General characteristics of Sphenophyta-Eqisetum, Hyenia, Calamites, Paleostachys, Calamostachys, Sphenophyllum. General characteristics of Pterophyta-Ophioglassum, Osmunda,	9

	Gleichenia, Pteris, Lygodium, Marsilia, Salvinia, Azolla.	

SUGGESTED READINGS

- Smith G. M. Cryptogamic Botany VoLII I(2nd edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Brower- 1926: Primitive Land Plants~ Cambridge At the University Press.
- Kashyap- 1972 LiveIWorts of Western Himalayas and Punjab. Researchco Publication.
- Puri P. 1980~ Bryophyta -Morphology, Growth & Differentiation. Atma Ram & Sons, Delhi.
- Chopra & Kumara- 1988: Biology of Bryophyta; Wiley Eastern Ltd.
- Ram Udar; 1970: An Introduction to Bryophyta; Shashidhar Malviya Prakashan.
- Watson; 1968: Structure and life of Bryophyta; Hutchinson & Co. Ltd.
- Campbell; 1939: The evolution of land plants; Stanford University.
- Sporne, K.R. 1991. The Morphology of Pteridophyta
- Parihar N.S. 1996 Biology and Morphology of Pteridophytes, CentralBook Depot. Allahabad.
- Arnold C. A; An Introduction to Paleobotany; Tata Mc Graw –Hill Publishing Co. New Delhi.
- Stewart, W. N. and RathweIL G. W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.
- Eames A J.; Morphology of Vascular Plants-Lower Groups.Tata Mc Graw -Hill Publishing Co. New Delhi
- Rashid A. 1999; An introduction to Pteridophytes; Vikas Publishing House Pvt. Ltd..
- Gangulee & Kar College Botany Vol II

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of representative members of**

   Bryophyta: Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Pellia, Porella, Anthoceros, Notothylas, Sphagnum, Polytrichum.

   Pteridophyta :- Psilotum , Isoetes , Lycopodium , Sellagena , Ophioglossum , Osmunda , Lyathia , Marsilea , Salvinia , Azolla ,

   Gleichenia , Dryopteris , Alsophilla , Study of fossil members.

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Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
Paper		PG – 104
		Paper-IV
Title of the Paper	(English)	**Biology & Diversity of Gymnosperms**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General Characteristics and Classification of Gymnosperms, Distribution of Gymnosperms in India, Economic Importance, Evolutionary tendencies in Gymnosperms. Indian contribution to Gymnosperms.	9
Unit-II	General Characteristics of Fossil Gymnosperms (Pteridospermales) - Lyginopteris, Medullosa, Glossopteris, Pentoxylon, Caytonia.	9
Unit-III	General Characteristics of Cycadeoidales, Cycadales, Bennettitales-Williamsonia, Cycadeoidea: Cycas, Zamia, Nilssonia.	9
Unit-IV	General Characteristics of Ginkgoales, Cordaitales & Coniferales-Ginkgo biloba, Cordaites, Cedrus, Pinus, Araucaria, Cryptomeria, Thuja, Cupressus Podocarpus, Taxus.	9
Unit-V	General Characteristics of Ephedrales- Ephedra. General Characteristics of Welwitschiales- Welwitschia. General Characteristics of Gnetales- Gnetum.	9

SUGGESTED LABORATORY EXERCISES

1. Monographic study of following :- Cycas , Ginkgo , Cedrus , Abies , Picea , Cupressus , Araucaria , Cryptomeria , Taxodium , Podocarpus , Agathis , Taxus , Ephedra and Gnetum.
2. Study of important fossil gymnosperm from prepared slides and specimens.

SUGGESTED READINGS

- Bhatnagar, S.P. and Moitra, A; 1996: Gymnosperms. New Age International Pvt. Ltd., New Delhi.
- Singh H.; 1978: Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
- Spome K R; 1991: The Morphology of Gymnosperms; Hutchinson Univ. Library; London.
- Foster A S. & Gifford E. M; Comparative morphology of vascular Plants; Vakils, Feffer, & Simons Private Ltd. Bombay. Chamberlain; Gymnosperms -Structure & Evolution; CBS Publishers & Distributors Delhi.
- Shukla A C. & Mishra S. P.; Essentials of Paleobotany; Vikas Publishing House Pvt. Ltd. Delhi-Bombay-:6angalore-Calcutta-Kanpur .

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Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 201
		Paper-I
Title of the Paper	(English)	**Cell Biology and Genetics**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Structure and organization of plant cell, Structure and functions of cell wall, Plasma membrane, Ion carriers, channels and pumps, Receptors, Plasmodesmata, Sites for ATPases.	9
Unit-II	Structure and function of Cell organelles: Chloroplast, Mitochondria, Vacuole, Endoplasmic Reticulum, Lysosomes, Ribosome, Golgi body.	9
Unit-III	Structure and Function of Nucleus ,Nucleosome, Chromosome structure and packaging of DNA, Euchromatin and heterochromatin, karyotype , banding patterns, specialized types of chromosomes.	9
Unit-IV	Cell division, Cell cycle, Programmed cell death, Structural changes in Chromosomes(Duplication, Deficiency Inversion and Translocation), Numerical changes in chromosomes(Aneuploids and Euploids, haploids)	9
Unit-V	Mendel's Laws, Genetics of Mitochondria and Chloroplast polygenetic inheritance, crossing over and linkage, Transposable elements.	9

SUGGESTED LABORATORY EXERCISES

1. **Isolation of genomic DNA from plant tissue using ETAB (ethyl tri methyl ammonium bromide) method.**
2. **Isolation of plant DNA and its quantitaion by a spectrophotometric method.**
3. **Isolation of DNA and preparation of "cot" curve.**
4. **Restriction of digestion of plant DNA, its separation by agarose gel Electrophoresis and visualization by ethidium bromide staining (Et.Br.Staining).**

5. **Isolation of RNA and quantitaion by a spectrophotometric method.**
6. **Separation of plant RNA by agarose gel electrophoresis and visualization by (Et.Br.Staining).**
7. **Immunological techniques: orchterlony method ELISA and Western blotting.**
8. **Demonstration of SEM and TEM.**
9. **Isolation of Mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDH).**
10. **Isolation of chloroplasts and SDS-PAGE. Profile of proteins to demarcate the two submits of Rubisco.**
11. **Demonstration of Mitosis.**
12. **To determine Mitotic Index in onion root tip cells.**
13. **Demonstration of Meiosis (normal) in Tradeshcantia.**
14. **Demonstration of abnormal meiosis.**
15. **Demonstration of special types of chromosomes.**
16. **Demonstration of plant breeding techniques.**
17. **Preparation of karyotype and Idiogram.**

Section the following Review Journals:-

1. **Annual Review of plant physiology and Molecular Biology.**
2. **Current Advances in Plant Sciences.**
3. **Nature Reviews: Molecular and Cell Biology.**

SUGGESTED READINGS

Lewin, B. 2000, Genes VIL Oxford University Press, New York.

Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.

Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Rost, T. et: aI. 1998.PIant Biology, Wadsworth Publishing Co., California, U.S.A

Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A

Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA

De, D.N. 2000: Plant Cell Vacuoles: An Introduction. CSIRO Publication, ColliJ18W~ Australia.

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Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 202
		Paper-II
Title of the Paper	(English)	**Plant Development & Reproduction**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Organization of the higher plant body: shoot and reproductive meristem, Tissue system, Shoot apical meristem (SAM), Root apical meristem, Lateral meristem, control of tissue differentiation especially xylem and phloem, Lateral root and root hair.	9
Unit-II	Development of Shoot ,Secondary growth in stem, primary and secondary anomaolus structure of stem. origin, development , differentiation, arrangement, diversity, venation, modification and anatomy of leaves.	9
Unit-III	Flower development, floral organ differentiation, homeotic mutants in *Arabidiopsis* and *Antirrhinum*, Androecium, Microsporangium, Microsporogenesis, role of tapetum, Male gametophytes and their development, pollen storage,Pollen allergy and Pollen enbryos, Male sterility.	9
Unit-IV	Gynoecium: structure of Megasporangium, Ovule development, Types and development, megasporogenesis, organization of embryo sacs, Pollination Mechanisms and vectors, Self incompatibility.	9
Unit-V	Double fertilization: Endosperm development, embryogenesis, storage proteins of endosperms and embryo. Fruit growth: biochemistry and molecular biology of fruit maturation. Seed growth and their dispersal, Polyembryony, apogamy and apomixes.	9

SUGGESTED LABORATORY / FIELD EXERCISES

1. **Effect of gravity unilateral light and plant growth regulators (PGRs) on the growth of young seedlings.**
2. **Role of dark and light on the expansion of cotyledons and epicotylar hook opening in pea.**
3. **Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double strained permanent slides of suitable plant such as Coleus , Tobacco.**
4. **Study of shoot apices in a monocotyledon in both TS and LS to show the origin and arrangement of leaf Primordia.**
5. **Study of phyllotaxy of various plant species.**
6. **Anatomy of leaf available locally.**
7. **Study of trichomes, glands in few species Osimum , Azadirecta Indica , Plumbago , Eucalyptus etc.**
8. **Study of morphology pollengrains of different species.**
9. **Study of pollen germinations and test for pollen viability using strains**
10. **Study of microsporogenesis and gametogenesis in section of Anthers.**
11. **Pollen storage, pollen pistil interaction, self incompatibility In- vitro pollination.**
12. **Study of monosporic, bisporic and tetra sporic type of embryosac.**
13. **Emasculation , bagging and hand pollination to study pollen germination seed set and fruit development using self compatible and obligate outcrossing systems.**
14. **Suitable seeds and polyembryony in Citrus , Jamun , etc by dissection.**

SUGGESTED READINGS

- Bhojwani,S.S.and Bhatnagar,S.P.2000. The Embryology of Angiosperms(4th revised and enlarged edition). Vikas Publishing House,New Delhi.
- Burgess.J.1985.An introduction to Plant Cell Development.Cambridge University Press, Cambridge.
- Fageri,K.and Van der Pijl,L1979. The Principles of Pollination Ecology .Pergamon Press, Oxford.
- Fahn, A 1 982.Plant Anatomy.(3rd edition).Pergamon Press,Oxford.
- F osket, D .E.1994 .Plant Growth and Development. A Molecular Approach.Academic Press, San Diego.
- Howell, S.H.1998. Molecular Genetics of Plant Development, Cambridge University Press, Cambridge.
- Leins,P., Tucker,S.C.and Endress,P .K.1988.Aspects of Floral Development. J. Cramer, Germany.
- Lyndon, R.F.1990.Plant Development. The Cellular Basis. Unin Hyman .London.
- Murphy, T. M. and Thompson, W. E. 1988 Molecular Plant Development. Prentice Hall, New Jersey.
- Proctor, M. and Yeo,P.1973.The Pollination of Flowers. William Collins Sons, London.
- Raghvan, V .1997 .Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
- RaghVan, V. 1999. Development Biology of Flowering P Jants. Springer-verlag.
- Atwell, B. J., Kriedermann, P.E. and Jurnbull, C.G.N.(eds)1999.PIants in Action: Adaptation in Nature, Perfonnance in Cultivation, MacMillan Education, Sydney, Austr

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Class		M.Sc.
Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 203
		Paper-III
Title of the Paper	(English)	**Plant Physiology-I**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Principles of thermodynamics, Free energy and redox potential, Plant water relation, mechanisms of water absorption, water transport through xylem, Transpiration, root-microbe interactions in facilitating nutrient uptake, Mineral nutrition, Membrane transport protein.	9
Unit-II	Phloem transport, Signal transduction, receptors and G-proteins, phospholipids signaling, Role of cyclic nucleotide, calcium-calmodulin cascade.	9
Unit-III	Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, bracinosteroids, polyamines, jasmonic acid, and salicylic acid. Hormone receptors.	9
Unit-IV	Flowering process: Floral induction and development, photoperiodism and its significance, endogenous clock and its regulation, Movement, Phytochrome and cryptochrome, their photochemical and biochemical properties, Molecular mechanism of action of photomorphogenic receptors, Vernalization.	9
Unit-V	Stress physiology: Plant responses to biotic and abiotic stress, Water deficit and drought resistance. Salinity stress and resistance. Concepts of freezing, heat stress and oxidative stress.	9

SUGGESTED LABORATORY EXERCISES

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry, Spectrophotometry and florimetry.
   Study of physiological sress in terms of Water,light and tempreture.
3. Determine rate of transpiration by Ganong's potometer.
4. Determine rate of respiration in germinating/young buds by Ganong's respirometer.
5. Determine effect of light intensity / wave length on rate of photosynthesis.
6. Determine effect of temperature / pH/Toxins on permiability of cell membrane.
7. Study of physiological apperatus.
8. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids.
9. To determine the chlorophyll-a / chlorophyll b ratio in C_3 and C_4 plants.
10. Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.
11. Bioassay of plant hormones- auxins, ethylene, GA, ABA and Cytokinin.
12. To determine stomatal index, stomatal frequency and percentage of leaf area open through stomata. Also, to study the effect of ABA on stamatal closure.

Other experiments based on theory paper

Suggested readings

- **Hopkins, W.G. 1995**. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- **Moore, T.C. 1989**. Biochemistry and Physiology of Plant Hormones (second edition). Springer -Verlag, New York. USA.
- **Nobel, P.S. 1999**. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz l and Zeiger E1998** Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 204
		Paper-IV
Title of the Paper	(English)	**Plant Ecology-I**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Introduction, division of plant Ecology, Ecosystem component (abiotic and biotic) , Factors(light, temperature, water), Population Ecology, Inter and intra specific competition and self regulation. **Biostatistic**s: mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test)	9
Unit-II	Community organization: Concepts of community and continuum, analysis of community (analytical and synthetic characters), Community coefficients, Association (negative and positive associations), Concept of ecological niche, Concept of Biodiversity evolution and differentiation of species , allopatric and sympatric speciation, Ecads and Ecotypes.	9
Unit-III	Ecosystem development and stability: Temporal changes(cyclic and non cyclic), Succession processes & types, Mechanism of succession, facilitation, tolerance and inhibition models, Concept of climax, persistence , Ecological stability concept(resilience and resistance), Ecological perturbation natural and anthropogenic and their impact on plants and ecosystem,Ecosystem restoration.	9
Unit-IV	Fate of energy and matter in Ecosystems: Trophic organization(ecological pyramids) and structure, Food chains & food webs, Ecological energetics, energy flow pathways, Ecological efficiencies, consumption, assimilation and production at trophic level, Primary production measurement methods, Limiting factors, litter fall and decomposition , Recycling pathway relation between energy flow and nutrient cycling ,Global Biogeochemical cycle of C,N,P,S.	9

Unit-V	Major Biomes of the World, Major Vegetation types- Tropical rain forests, Temperate forests, Seasonal forests, Boreal forest, Grasslands, Deserts, Aquatic ecosystems, Wetlands, and Soil types of World .	9

SUGGESTED LABORATORY EXERCISES

1. To determine minimum size and number of quadrat required for study of vegetation by species area curve method
2. To determine percentage frequency and frequency classes of various species by quadrate and line transect method using Raunkiaer's Law.
3. To study density and abundance of species.
4. To calculate relative frequency , relative density and relative dominance (or basal area) and determine importance value Index (IVI) of the species.
5. To determine diversity Index or community coefficient for two different vegetation / protected and unprotected grassland.
6. To determine gross and net phytoplankton productivity by light and dark bottle method.
7. To calculate Basal area of tree species found locally.
8. To find out reproductive capacity of the seeds.
9. To study the foliar injuries of plants which are exposed by SO_2.
10. To determine dust deposition on leaves of polluted and non polluted area.
11. To estimate the dissolved oxygen (DO) content in entrophic and oligotrophic water sample by azide modification of Winkler's method.
12. Physical and Chemical analysis of soil.
13. To study water holding capacity, porocity, bulk density of soil.
14. Ecological adaptations: Hydrophyte, Xerophyte, Epiphyte, Parasite etc.
15. To study- Hygrometer , Minimum Maximum Thermometer ,sling Psychrometer , Saci disc , pH meter , Spectrophotometer, Soxhlet apparatus , Kjehldal's apparatus.
16. **Biostatistics:** mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test).
17. **To study various Biotic and abiotic components of pond and forest ecosystem.**
18. **Mapping of Biomes on world map.**

SUGGESTED READINGS

- Smith. R.L. 1996. Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- Begon. M.. Harper, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science. Cambridge.
- Ludwig. J. and Reynolds. J.F. 1988. Statistical Ecology. John Wiley & Sons.
- Odum. E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
- Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. Cambridge University Press, Cambridge, U.K.
- Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.
- Treshow. M. 1985. Air Pollution and Plant Life. Wiley Interscience.
- Heywood, V.H. and Watson. R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
- Mason, C.F. 1991. Biology of Freshwater Pollution. Longman. 'Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .
- Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.

M. Sc. Botany (Semester System)

List of suggested Project work/Dissertation work

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Inventroization of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR

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Session		**2017-18**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 301
		Paper-I
Title of the Paper	(English)	**Systemetics ofAngiosperms**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		35

Unit	Syllabus	Period
Unit-I	Morphology of flower, floral induction and development, morphology of stamens and carpals, carpels evolution, morphology of inferior ovary, placentation: their origin and types.	9
Unit-II	The species concept Taxonomic hierarchy, International Code of Botanical Nomenclature, Taxonomic evidences (morphology, anatomy, palynology, embryology, cytology, phytochemistary). Taxonomic tools(Herbarium, Botanical garden, Taxonomic keys, Taxonomic literature, floras, histological, biochemical, cytological phytochemical, serological, and molecular technique)	9
Unit-III	Systems of Angiosperm classification: Origin of angiosperms Phenetic versus phylogenetic system, Cladistics in taxonomy, relative merits and demerits of major system of classification, Plant exploration , invasions and introduction and secondary centers, World centres of primary diversity of domesticated plant.	9
Unit-IV	Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae.	9
Unit-V	Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae , Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales, Santanales, Centrospermales, and Hellobiales.	9

SUGGESTED LABORATORY EXERCISES

1. Study of stamens and carpals in various species.
2. Different kinds of placentations
3. Description of various species of a genus, location of Key characters and preparation of Key at generic level.
4. Location of key characters and use of keys at family level.
5. Training for herbarium preparation.
6. Preparation of Herbarium sheet of such plants, wild cultivated medicinal as are available locally.
7. Locally available Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae
8. Locally available Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales Santanales, Centrospermales, and Hellobiales.

Suggested Reading

Heywood & Moore, D.M; 1984: CWTent concept in Plant Taxonomy Academic Press.

Banson, L.B.;1957; Plant Classification, Health & Co. Boston.

Davis, P.R & Heywood, V.H 1973; Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. Co. New York USA.

Eames, AL.; 1961; Morphology of Angiosperms, McGraw Hill, New York.

Lawerence, G.H.M,;1951: Taxonomy of Vascular Plants Macmillan, New York

Naik V.N,:1984: Taxonomy of Angiosperms. Tata McGraw Pub Co. Ltd New Delhi.

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Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-302
		II
Title of the Paper	(English)	**Molecular Biology and Plant Breeding**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Nuclear DNA content DNA structure and forms, DNA replication, mutation, C value paradox, cot curve, and its significance, damage and repair, Restriction Mapping, Multigene families and their evolution.	9
Unit-II	Gene structure and expression, Gene fine structure, cis and trans test of recombination, introns and exons, their significance, Genetics of Bacteria and Virus (genetic transformation, conjugation, transduction, Recombination in Phage), Regulation of gene expression in Prokaryotes and Eukaryotes.	10
Unit-III	RNA synthesis and processing-adding, splicing, polyadenilation, structure and function of different types of RNA , RNA transport.	9
Unit-IV	Genetic code, Protein synthesis–Ribosome structure and site of protein synthesis, initiation complex, factors, elongation, and termination. Post translation modification of protein, protein sorting. Targeting of protein to organelles.	9
Unit-V	Plant breeding,: In situ Hybridization-Concept and techniques. Genetic basis of inbreeding and heterosis, exploitation of hybrid vigor, Cancer onkogene, Apoptosis, Immune innate and adaptive immune system	8

SUGGESTED LABORATORY EXERCISES

1. Isolation of genomic DNA from plant tissue using CTAB (cetyetri methyl ammonium bromide) or any animal tissue.
2. Isolation of DNA & its quantitation by a spectrophometric method.
3. Restriction digestion of plant DNA, its seperation by Agrose gel electrophoresis and visualization by ethidium bromide staining.
4. Isolation of RNA and quantitation by a spectrophotometric method.
5. Separation of RNA by Agrose gel electrophoresis and visualization by Et. Br. staining.
6. Immunological techniques : Ouchterlony method, ELISA & western blotting.
7. Isolation of chloroplats and SDS-PAGE. profile of proteins to demarcate the two subunits of Rubisco.
8. Emasculation technique.

Other experiments based on theory paper

Suggested Readings:

- Alberts, B. Bray, D. Lewis, J. Raff: M. Roberts, K. and Watson,J. D. 1989 Molecular Biology of the Cell (2nd edition). Garland Publishing Inc., New York. U. S. A.
- Karp, G. 1999 Cells and Molecular Biology: Concepts and Experiments John Wiley & Sons, Inc. U. S.A
- Malacinski, G. M. and Freifelder, D. 1998. Essentials of Molecular Biology *(3M* edition). Jones and Barlett Publishers, Inc. London.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, WadsworthPublishing Co., California, USA.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, *K.*, and Watson, J.D. 1999.Molecular Biology of the Cell. Garland Publishing:Inc., New York.
- Rost, T. et al. 1 998.Plant Biology, Wadsworth Publishing Co.,California, U.S.A
- Krishanmurthy K. V. 2000 Methods in Cell Wall Cytochemistry, CRCPress, Boca Raton, Florida U.S.A
- Buchanan, B.B. Gruissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA
- De, D.N. 2000 Plant Cell Vacuoles: An Introduction.CSIRO Publication, Collingwood, Australia.
- Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA
- Lodish H. Bert, A,zipursky, S.L.,Matsudaira, p.,Baltimore, D. and Darnell, J. 2000.Molecular Cell Biology, W.H.Freeman and Co., NewYork, U.S.A
- Twyman, R. M. 2003. Advanced Molecular Biology. Viva Books Private Ltd. New Delhi. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer - Verlag, New York. USA.
- Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- Salisbury FB and Ross CW 1991 Plant Physiology IV edition Wdsworth Publishing co. California USA.
- Taiz l and Zeiger E1998 Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997 Plant Metabolism II Ed. Longman England.
- Buchanan, B.B.Gruissem, W. and Jones R.L. 2000. Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-303
		III
Title of the Paper	(English)	Plant Physiology, Biochemistry and Metabolism
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Fundamentals of Enzymology: General aspects, Allosteric mechanism, regulatory and sites, Isoenzyme, Kinetics of enzymatic catalysis, Michaelis-Menten equation and its significance, Mechanism of enzyme action.	9
Unit-II	Photochemistry and Photosynthesis: General concept and Historical back ground, evolution of photosynthetic apparatus, photosynthetic pigment and light harvesting complexes, Photo oxidation of water, mechanism of electron and proton transport, Carbon assimilation, Calvin cycle, Photorespiration and its significance, C-4 cycle, CAM path way, physiological and ecological consideration.	9
Unit-III	Respiration : Overview of plant respiration, Glycolysis, TCA cycle, Electron Transport, Structure, function & synthesis of ATP, oxidative pentose phosphate pathway.	9
Unit-IV	Structure, classification and function of carbohydrates, biosynthesis of sucrose and starch, Structure and function of Lipids, Fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids, , and their catabolism, Glyoxilate cycle and alternative oxidases system.	9
Unit-V	Nitrogen fixation, (chemical and biological), Nodule formation, Mechanism of Nitrate uptake and reduction, ammonium assimilation, Sulphate uptake, transport and assimilation. Sulphur metabolism, Vitamins (structure and role).	9

Suggested Laboratory Exercise based on P.G 301 :

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry and Spectrophotometry.
3. Determine rate of respiration in germinating/young buds by Ganong's respirometer.
4. Determine effect of light intensity / wave length on rate of photosynthesis.
5. Determine effect of temperature / pH/Toxins on permiability of cell membrane.
6. Study of physiological apperatus.
7. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids.
8. To determine the chlorophyll-a / chlorophyll b ratio in C_3 and C_4 plants.
9. Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.
10. Effect of time and enzyme concentration on the rate of reaction of enzyme C e.g. acid Phosphatase, nitrate reductase.
11. Effect of substrate concentration on activity of any enzyme C (catalase, Amylase)
12. Demonstration of the substrate inducibility of the enzyme nitrate reductase.
13. Determination of succinate dehydrogenase activity, Its kinetics and sensitivity to inhibitors.
14. Separation of isoenzymes of esterase, Peroxidases by native polyacrylamide gel electrophoresis.
15. To demonstrate photophosphorylation in intact chloroplasts, resolve the phosphoproteins by SDS-PAGE and perform autoradiography desalting of proteins by gel filtration chromatography embaying Sephadex G-25.
16. Biochemistry of carbohydrates and lipids.
17. Study of structure and formation of Root nodule in leguminous plants

Suggested readings

- **Hopkins, W.G. 1995**. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- **Moore, T.C. 1989**. Biochemistry and Physiology of Plant Hormones (second edition). Springer - Verlag, New York. USA.
- **Nobel, P.S. 1999**. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz l and Zeiger E1998** Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-304
		IV
Title of the Paper	(English)	**Plant Ecology-II (Conservation & Utilization of Plant Resources)**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant biodiversity concept, status in India, and world. World centres of primary diversity of domesticated plants with special reference to Indoburmiese centre and secondary centres.	9
Unit-II	Sustainable development, utilization, of resources from forest, grassland, aquatic habitats, food, fodder, forage, timber and non wood forest products. Threats to quality and quantity of resources due to over exploitation. Speciation and Extinction, IUCN categories of threat. Distribution and global pattern of terrestrial biodiversity, Hot spots and inventory.	9
Unit-III	Strategies for conservation of resources: Social forestry, Principle of conservation, In situ conservation (Sanctuaries, National Parks, Biosphere reserves for wild life conservation), Ex situ conservation(Botanical Garden, Field gene bank, Seed banks, in vitro repositories, Cryo banks).	9
Unit-IV	Pollution and Climate change : Air, Water and Soil pollution(Kinds, sources, quality parameters) and their effects on plants and ecosystem. Green house gases- CO2 ,CH4, N2O, CFCs (source, trend and role). Ozone layer and Ozone Hole, Consequences of climate change, (Co2 as fertilizer, Global warming, sea level rise, UV radiation). Bioremediation (Management of Pollution).	9

Unit-V	Resource Monitoring Remote sensing Concepts and tools, Satellite remote sensing ,basics, sensors, Visual and digital interpretation) EMR bands and their application , Indian remote sensing Program Thematic mapping of resources Application of Remote sensing.	9

Suggested Laboratory Exercise -

1. Study of locally available plants.
2. Food crops – Wheat, rise, maize, chickpea, potato tapioca, sweet potato, sugarcane , morphology , anatomy , economic importance.
3. Forage / fodder plants – study of any five important crops of locally available.
4. Textile fibres – cotton, jute, linen, sun hump, cannabis.
5. Maceration technique and staining technique of fibres.
6. Fibres for stuffing – silk cotton or Kapok.
7. Medicinal and aromatic plants:- morphology and importance of Papaver somnifera , Atropa balladona , Catharanthus roseus , Adhathoda vasaca , Rauwolfia serpentina , Withania somnifera , Phyllanthus nurori , Andrographis paniculata , Aloe barbedensis , Mentha arvensis , Rosa , Pogostemon cablin , Viteveris zizanioides , Jasminum grandiflorum , cymbopogon sp. , Rosa , Pandanus odoratissimus .
8. Fire wood and timber yielding plants and Non wood forest products (NWFPs).
9. Morphology and Anatomy of oil yielding tissue and their test (Biochemical or by staining).
10. Prepare an inventory of medicinal and aromatic plants, bamboos and timber yielding plants of your area giving their scientific and local name their important uses appropriate illustrations.
    - **Study of live or herbarium specimens or other visual materials to become familiar with these resource.**
11. **Remote sensing image interpretation**.
12. **Mapping of natural resourses (water and forest) of M.P.**
13. **Enlist wild and cultivated varieties of cereal crops of M.P.**
14. **Study of pollination indicator plants.**
15. **Water and soil analysis.**
16. **Study of leaf injury.**
17. **Cellulose test for natural fibers.**

Study of live or herbarium specimens or other visual materials to become familiar with these resource

The student should be taken to one of the following-

1. A protected areas (biosphere reserve- Pachmari, national park or a sanctuary).
2. A wet land.
3. Botanical survey of India (BSI).
4. CSIR Laboratory doing research on plants and their utilization.
5. Botanical Gardens or Museum.
6. FRI Forest Research Centre, Dehradun.

Note **– The students are expected to prepare a brief illustrated narrative of the field survey and scientific visits. After evaluation the grades awarded to students by teachers and should be added to the final assessment of practical examination**.

Suggested Reading

Brady,N.C.1990 The Nature and Properties of Soil MacMillan.

Heywood, V.H. and Watson, R.T. 1995 Global Biodiversity Assessment. Cambridge University Press.

Hill, M.K. 1997 Understanding Environmental Pollution,. Cambridge University, Press.

Kohli, R. Arya, K.S., Singh, P.H. and Dhillon, H.S,. 1994 Tree Directory of Chandigarh, Lovedale Educational, New Delhi.

Kothari A. 1997 Understanding Biodiversity Life Sustainability and Equity.

Orient Longman.Mason, C.F. 1991. Biology of fresh water Pollution Longman.

Nair, M.N.B.et.al.1998Sustainable Management of Non Wood Forest Products.

Faculty of Forestry, University Putra Malasia 434004 PM Serdong Selangor Malaysia

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Session		**2017-18**
Class		M.Sc.
Semester		IV
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-401
Title of the Paper	(English)	**Biotechnology and Tissue Culture**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant cell and tissue culture: General introduction, history, scope, concept of cellular differentiation and Totipotancy. Establishment of lab, aseptic technique and sterilization of glassware. Different types and preparation of media. Ex plant technique of tissue culture, meristem, anther, embryo culture and organogenesis.	9
Unit-II	Somatic Hybridization, Protoplast isolation, Fusion and culture, Somatic cell genetics, application of tissue culture, Artificial seed, Somaclonal variation, Production of Secondary metabolites, cryopreservation, and germplasm storage.	9
Unit-III	Biotechnology Principles and Application of biotechnology in agriculture, horticulture, forestry, food, and industries, health care and immunology, environment biotechnology, and ethics. Intellectual Property Right. Genetic engineering of plants, aims, strategies of Transgenic Agrobcterium, T-DNA, Gene tagging microbial genetic manipulation, genetic improvement of industrial microbes, fermentation technology.	9
Unit-IV	Recombinant DNA technology : gene cloning, principle and technique, construction of genomic and c-DNA library Vector, Plasmid, DNA synthesis, Polymerase Chain Reaction(PCR), DNA fingerprinting.	9
Unit-V	Genomics and proteomics, molecular markers, Artificial chromosomes, High through put sequencing, genome projects, bioinformatics, microarrays, protein profiling and its significance.	9

Suggested Laboratory Exercise : -

1. **To prepare biotechnology lab**.
2. Sterilization techniques.
3. Preparation of culture medium.
4. Sterilization of medium.
5. To demonstrate growth characteristics of E.coli using plating method.
6. To demonstrate growth characteristics of E.coli by turbidiometric method.
7. Demonstration of DNA sequencing by Sanger's dideoxy method.
8. Isolation of DNA and preparation of 'Cot' curve.
9. Isolation of DNA & its quantitation by a spectrophometric methods.
10. Isolation of genomic DNA from plant tissue using CTAB (cetyltri methyl ammonium bromide) method.
11. Isolation of chloroplasts &SDS-PAGE. Profile of demarcate the two subunits of Rubisco.
12. To study the effect of antibiotics on growth of microorganism.
13. To study fermentation techniques.
14. Study of nitrogen fixer & its applications.
15. **To prepare tissue culture lab.**
16. Stertization techniques.
17. Sterilization of glassware.
18. Preparation of tissue culture medium.
19. Stertization of Explants.
20. Study effect of plant growth hormones (PGR) on tissue culture.
21. To perform the techniques of micro propagation/ somatic embryogenesis /anandroganesis.
22. To perform the techniques of organogenesis.
23. Study of applications of tissue culture.

Suggested Reading

Butenko, R.G. 2000 Plant Cell Culture. University Press Of pacific.
Collin, H.A. and Edwards, s. 1998 Plant Cell culture. Bios scientific publishers Oxford. UK.
Callow, J.A. Ford-Lioyd, B.V. and Newbury, H.J.1997 Biotechnology and plant genetic Resources, Conservation and Use.CAB, International Oxon, UK.
Dixon, R.A. 1987 Plant Cell Culture; a Practical Approach. IRL press, Oxford. George, E.F.1993 Plant Propagation by Tissue culture part- 1&2 Exegetics Ltd Edington. UK.
Glick, B.R. and Thompson, J.E. 1993 methods in Plant molecular Biology and Biotechnology Grc Press Boca Raton. Florida.
Primrose, S.B. 1995 Principles of Genome Analysis, Blackwell Science ltd., Oxford,

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Class		M.Sc.
Semester		IV
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG 402**
		II
Title of the Paper	(English)	**Applied Botany and Instrumentation**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plants used in daily life: plants used in cosmetics, herbal cosmetic products and applications. Plants used in hair care and skin care. **Herbal dyes and their uses .** Herbal beverages. Small scale industries.	6
Unit-II	Aromatherapy: Introduction, History, modern concept of Aromatherapy. Essential oils, Extraction technique by Sohxlate method. Applied aspects of Aromatherapy.	9
Unit-III	Organic Farming and applications, Bio-fertilizers, Vermiculture, Floriculture, Mushroom cultivation technique, Nursery management and applications, marketing strategies, possibilities and loan schemes. Entrepreneurial Development.	10
Unit-IV	Microscopy: Principle and applications. Different types of microscopes. Basic knowledge of spectrophotometer, Electrophoresis, Colorimeter, pH meter and Centrifuge.	10
Unit-V	Introduction to computer: fundamentals, MS ,DOS,MS WORD , MS EXCEL usage of Computer in Biology, Sample graph plotting, Net working of Computer, basic need and applications , modern strategies of literature search.Record and presentation of Data and scope.	10

Suggested Practical Exercises-

1. Extraction technique by sohxalate method of essential oils
2. methods of processing of crude plants and their storage.
3. Traditional method of beautification of skin and their application-
   - Cleansing-Alove,Papaya,Lemon etc.
   - Nutritive-Ashwagandha,Ginsing,Nagarmotha etc
   - Bleaching-Amba haldi,Raktachuran,kachur,suganthi etc
   - Anti wrinkle-Manjistha,papaya,suganthiets,Kumari etc

4. Hair care- amla, shikakai, Aritha, Nagarmotha etc.
5. Aromaterapy by –Chameli, Rose, Eucaliptus, Tulsi etc.
6. **Enlist herbal pesticides and herbicides.**
7. Techniques of vermiculture, Mushroom culture, nursery management
8. Perfoma preparation of proposal of marketing of plants
9. Herbal dyes and their uses.
10. Working principle and Practical based on pH meter, Electrophoresis, Spectrophotometer, Centrifuge etc
11. MS office,DOS,MS WORD , MS EXCEL .Usage of Computer in Botany.

Suggested Reading

- Biotechnology-R.C. Dubey
- Biostatistics and Computer Application- Dr. R Goswami
- Mushroom Cultivation-
- Vermiculture-
- Floriculture-
- Aromatherapy -a Complete Guide to the Healing Art- Kathi Kerthi and Mendy Green
- Essential oils for Radiant Health- Susanne Fischer Rizzi 1998
- Beauty through Herbs- Dr. Urjita Jain, Institute of Herbal Science, Mumbai,1997
- Text book of Cosmetology-Harry
- Cosmetic Science and technology-Sagarin C.B.
- The Skin care Book: Simple Herbal Recipes-Kathryn wartrochi, Ist Edition 1996,Paper Gooseberry Hill Publication.
- Natural organic Hair & Skin care :Including A to z Guide to natural & Synthetic Chemicals in cosmetics- ISBN-1990,Aubrey Hampton organic press
- Instrumentation-
- Wealth of India-CSIR New Delhi Publication
- Entrepreneurial Development concept and practices-Dilip Sarwate, Everest Himalaya Publication
- Entrepreneurial Development –S.S.Khan ,S Chand Publication
- Entrepreneurial Development in India- Dr. C. B. Gupta & Dr. N. P. Shrinivasan, S Chand Publication ,4th Edition

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
Theory / Practical

Session		**2017-18**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG-403: Elective Paper-I**
		III
Title of the Paper	(English)	
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers I

1. Limnology
2. Industrial microbiology
3. Taxonomy of Angiosperms
4. Applied Mycology
5. Forest Biology, Forest vegetation of India and Management of Forest Resources
6. Plants and Society
7. **Environmental science**

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Theory / Practical

Session		**2017-18**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**Elective Paper-I**
		III
Title of the Paper	(English)	**PG-403: Environmental Science**
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Global distribution and Classification of climate(Koppen's classification); Climatic types and their distribution. Climate of India. Soil types of India.	9
Unit-II	**Global warming and climate change**: Green house effect; consequences ; responsible factors . Environmental Impact Assessment . Environmental management.	9
Unit-III	**Toxicology** : Radiation toxicants - Kinds, sources & biological effects. Chemical toxicants - Sources & biological effects of Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides. Bioremediation : Need , scope & technology .	9
Unit-IV	**Environmental Laws** : Goal, objectives and guiding principles of Environmental Laws; Indian Environmental Laws; National Environmental Policies ; Environmental priorities in India and sustainable development.	9
Unit-V	**Environmental Education and Organization** : Goal, objectives and guiding principles of Environmental Education ; Environmental Education in educational Institutes; Environmental organizations and agencies; Man and Biosphere Programme (MAB).	9

Suggested Practical exercises-

1. **Meteorological recording-**
   Determination of air temperature by Min.-Max. thermometer.

   Determination of light intensity.

   Determination of clouds by Okta scale.

   Determination of wind velocity.

   Determination of precipitation by Rain Gauge.

2. **Non-conventional Bio-management of waste-**

   1. Planning of Root Zone treatment.

   2. Vermicomposting.

3. **Sampling for physico-chemical properties of water-**

   1. To measure temperature by Thermister.
   2. To measure pH by pH meter.
   3. To determine turbidity by Secchi disc & turbidometer.
   4. To determine light intensity by photometer.
   5. To determine DO(dissolved oxygen) in eutrophic & oligotrophic water.
   6. To determine BOD(biological oxygen demand) of pond water.
   7. To determine the amount of chloride/fluoride.

4. **Sampling for soil analysis-**

   1. To determine Nitrate, Phosphate, Carbonate.

   2. To determine water holding capacity of soil.

   3. To determine organic matter content of soil.

   4. To determine bulk density and porosity of soil.

Exercises based on pollution-

1. To study the foliar injuries of plants which are exposed to SO_2.
2. To determine dust deposition on leaves of polluted and non polluted areas.
3. To determine pH of plants growing in under polluted and non-polluted areas.
4. To study environmental impact of a given developmental activity using checklist as AIE method.

The purpose of above practical exercises is to make the students aware of the issues related to environmental science specially global warming, climate change and impact on nature and for ecological services.

<u>SUGGESTED READINGS</u>

- **Smith. R.L. 1996.** Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- **Begon. M.. Harper, J.L. and Townsend, C.R. 1996**. Ecology. Blackwell Science. Cambridge.
- **Ludwig. J. and Reynolds. J.F. 1988**. Statistical Ecology. John Wiley & Sons.
- **Odum. E.P. 1971**. Fundamentals of Ecology. Saunders, Philadelphia.
- **Odum, E.P. 1983**. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- **Kormondy, E.J. 1996**. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- **Chapman, J.L. and Reiss, M.J. 1988**. Ecology: Principles and Applications. t::ambridge University Press, Cambridge, U.K.
- **Moldan, B. and Billharz, S. 1997**. Sustainability Indicators. John Wiley & Sons, New York.
- **Treshow. M. 1985**. Air Pollution and Plant Life. Wiley Interscience.
- **Heywood, V.H. and Watson. R.T. 1995**. Global Biodiversity Assessment. Cambridge University Press.
- **Mason, C.F. 1991.** Biology of Freshwater Pollution. Longman. 'Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .
- **Brady, N.C. 1990**. The Nature and Properties of Soils. MacMillan.
- **Mason, C.F. 1991**. Biology of Freshwater Pollution. Longman. '
- **Hill. M.K. 1997**. Understanding Environmental Pollution. Cambridge University Press. .
- **Kothari, A 1997**. Understanding Biodiversity: Life'Sustainability and Equity. Orient Longman.
- **Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994**. Tree Directory of Chandigarh. Lovedale Educational, New Delhi.
- **Nair, M.N.B. et. al (Eds) 1998**. Sustainable Management of Non-wood Forest Products. Faculty of Forestry, Universiti Putra Malaysia. 434004 PM Serdong, Selangor, Malaysia.
- **Rodgers, N.A. and Panwar, H.S. 1988**. Planning a Wildlife Protected Area Network in India. Vol. 1. The Report. Wildlife Institute of India, Dehradun.
- **Walter, K.S. and Gillett, H.J. 1998. 1997** IUCN Red List of Threatened Plants. IUCN, the World Conservation Union. IUCN, Gland, Switzerland, and Cambridge,

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Session		**2017-18**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG 404: Elective Paper-II**
		IV
Title of the Paper	(English)	
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers II

1. Plant protection
2. Bioinformatics and computer applications and Biostatistics
3. Molecular biology and biotechnology
4. Pollution Ecology
5. **Ethnobotany**

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As Recommended by the Board of Studies
2017-18
Theory / Practical

Session		**2017-18**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**Elective Paper- 404**
		IV
Title of the Paper	(English)	**Ethnobotany**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Definition and scope of Ethnobotany Historical review and outline idea of archaeoethnobotany. Ethnoecology, Ethnomedicines, Ethnonarcotics, Ethnopharmacology, Ethnotaxonomy, Ethnocosmetics, Ethnolinguistics, Ethnoorthopaedics, Ethnopaediatrics.	9
Unit-II	Preservation of Genetic diversity, plants used in various systems of medicines, Ayurvedic, Unani, Homoeopathic and Allopathic systems. Plants used by villagers and tribal people. Role of ethnobotany in the development of Society.	9
Unit-III	**Ethnobotanical importance of :***Aconitum napellus, Allium cepa, Mentha arvensis, Allium sativum, Nux-vomica, Aloe vera, Ocimum sanctum, Atropa belladona, Azadirchta indica, Piper nigrum, Butea monospera, Pterocarpus marsupium, Terminalia bellerica, Terminalia arjuna, Terminalia chebula , Eugenia aromatica, Eugenia jambolana, Hollarrhena antidysenterica, Withania somnifera, Lawsonia inermis.*	9
Unit-IV	Plants in mythology, Taboos and Totems in relation to plants, folklore and folk tales, Wild life protection by tribal, plants domestication by the tribals. Plants in similes and metaphors.	9

	Ethnobotanical importance of *:Cassia fistula, Cannabis sativa, Ricinus communis, Emblica officinalis, Santalum album.*	
Unit-V	Detailed study of the common plants and their parts used in the treatment of following diseases:Expulsion of worms, Skin diseases, Bronchial inflammation and Asthma, Tuberculosis, Urino - genital problems, Amoebic dysentery, Malaria, Rheumatism, Leprosy, Jaundice, Heart diseases, Piles, Leukoderma.	9

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

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As Recommended by the Board of Studies
2017-18
M.Sc. Botany

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Investigation of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR
28. Somatic Hybridization
29. Biofertilizers and Bioinoculants
30. Transgenics
31. Exploitation of Rhizospheric microbes including mycorrhizae
32. Recycling of domestic, municipal and industrial wastes
33. Vermicomposting and Biomethanation
34. Environmental Monitoring
35. Assessment of Pollution in different habitats

List of Journals-

1. Indian journal of Multidisciplinary Research-CMRA Kerala.
2. National journal of Life Science.
3. International Journal of Biotechnology.
4. Journal of Biotechnology
5. Pollution Research.
6. Science Reporter.
7. University New- UGC.
8. Acta Botanica.
9. Acta Ecologica.
10. Tropical Ecology.
11. Annual Review of Plant Physiology and Molecular Biology.
12. Current Advance in Plant Science.
13. Nature Review: Molecular and Cell Biology.
14. Indian journal of Biotechnology (NISCAIR New Delhi).

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Annual System
Syllabus of Botany
(As Recommended by the Board of Studies)
Practical scheme 2017-18(based on Paper I&II)

B.Sc. I Year

M.Marks-50

B.Sc. I Year Practical Objectives :-

i) To develop the skills of staining and observation of lower organism.

ii) To impart the skills of temporary and permanent slide preparations.

iii) To enhance ability to identify the lower organisms using microscope.

iv) To familiarize the students with diseases and their causative agents.

B.Sc. I Year- Scheme of practical examination based on paper I&II

Time: 4 hrs Marks: 50

Q.1 Algae/Fungi ---------- 05
Q.2 Bryophyta/Pteridophyta---------- 05
Q. 3 Gymnosperms---------- 05
Q. 4 Taxonomy ---------- 10
Q. 5 Spotting (1 to 5) ----------10
Q. 6 Viva----------05
Q. 7 Sessional ---------- 10

Total 50

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
Practical Scheme 2017-18

B.Sc. Semester-III
Practical Exercises + Scheme

Practical Objectives :To provide knowledge about structure, development and reproduction in flowering plants

i) To provide skills of section cutting of angiosperms.
ii) To provide field experiences for studying sources of fire woods, timber yielding and medicinal plants.
iii) To familiarize the students with morphology and anatomy of flowers.
iv) To provide the knowledge of sexual reproduction.

Scheme of Practical Examination Semester III

Time: 4 hrs **Marks: 50**

1-	Exercise based on anatomy of root/stem.	10
2-	Exercise based on anatomy of leaf.	10
3-	Study of shoot apex/root apex/Ovules and Anthers .	5
4-	Spotting- (1-5)	10
5-	-Viva- voce	5
6-	Sessional	10
		Total-50

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies

Practical Scheme 2017-18

B.Sc. Semester-IV
Practical Exercises + Scheme

M.Marks- 50

Practical Objectives :

i) To enable the students to understand the plant in relation to environment.

ii) ii) To develop the knowledge of different types of vegetation.

iii) iii) To familiarize the students with conservation practices. Practical Scheme Semester-

B.Sc. Semester-IV: Scheme of practical examination

Time: 4 hrs **Marks: 50**

1-Exercise based on Ecology	10
2- Soil Test	5
3- Exercise based on Ecologycal adaptation	5
4-To comment upon Phytogeographic region (model/ charts) and National Parks(Photographs).	5
5-Spotting (1-5)	10
6-Viva- voce	5
7-Sessional	10
	Total: 50

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18

BOTANY PRACTICAL EXERCISES + SCHEME

B.Sc. Semester-V

Maximum 50 Marks

Question 1. Any two exercise from below mentioned list 20

Exercise 1.Preparation of solution of specific Normality,Molal and Molar solutions.

Exercise 2. Exercises related on osmosis and osmotic relation.

Exercise 3. Exercises related transpiration.

Exercise 4. To separate plastidial pigments by Paper Chromatography.

Exercise 5. To perform the exercise of Photosynthesis and Respiration.

Exercise 6. To perform biochemical test for carbohydrate, lipid and protein.

Exercise 7. To extract Enzyme for any plant part and demonstrate its activity.

Question 2.Comment on any technique related to Biotechnology 05

Question 3. Spotting 10

Question 4. Viva-Voce 05

Question 5. Sessional 10

Total **50**

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Theory / Practical

BOTANY PRACTICAL EXERCISES + SCHEME
B.Sc. Semester-VI
2017-18 Maximum 50 Marks

Practical Work

Objectives

i) To impart understanding of internal cell structures and their organization.
ii) To develop the skills for the preparation of smear for study of cell division.
iii) To develop the skills for the understanding of mendel's law.
iv) To impart the skills of isolation of DNA.
v) To familiarize the students with the technique of micro propagation and isolation of protoplast.

Semester-VI Scheme of practical examination

Time: 4 Hrs	Marks:50
1.Exercise Based on cell division (Mitosis/Meiosis)	10
2.Exercise Based on Genetic problem	5
3.Study of Cell and Cell inclusions	5
4.Exercise based on Biotechnology	5
5 Spotting (1-5)	10
6.Viva – Voce	5
7. Sessional	10

Total	**50**

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
M.Sc Botany (Semester system)
SEMESTER-I
Practical scheme for Part-I
(Based on Course PG 101 and 102)

M.M-100 **Time 4 Hrs**

Exercise –

1. **Prepare a slide of given material A (fungi). Draw well labelled diagrams. Identify giving reasons……. 16**
2. **Bacterial Staining …..... . 10**
3. **Prepare slide of given material B (Algae) , Draw well labelled diagrams. Identify three algae with giving reasons…… 24**
4. **1 to 10 spot……. 20**
5. **Viva Voce…… 10**
6. **Sessional…… .. 20**

Total 100

M.Sc Botany SEMESTER –I
Practical scheme for Part-II
(Based on Course PG 103 and 104)

M.M-100 **Time 4 Hrs**

Exercise –

1. **Prepare a slide of given material A (Bryophyte). Draw well labelled diagrams. Identify giving reasons……. 15**
2. **Prepare a slide of given material B (Pteridophyte). Draw well labelled diagrams. Identify giving reasons 15**
3. **Monographic study of given material C (Gymnosperm). Draw well labelled diagrams. Identify giving reasons 20**
4. **1 to 10 spot……. 20**
5. **Viva Voce……. 10**
6. **Sessional……. 20**

TotalS **100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2017-18
M.Sc (Previous) Botany
SEMESTER-II
Practical scheme for Part-I (Based on PG 201 and 202)

M.M-100 **Time 4 Hrs**

1. **Exercise based on Cell Biology……..….. 15**
2. **Exercise based on Cytogenetics…… 10**
3. **Study of Anther / Ovule / Seed…….15**
4. **Demonstration of Emasculation Tech…… ….10**
5. **Spot 1 to 10……...20**
6. **Viva-Voce…….....10**
7. **Sessional and Records…….20**

Total 100

M.Sc (Previous) Botany

SEMESTER-II

Practical scheme for Part-II (Based on PG 203 and 204)

M.M-100 **Time 4 Hrs**

Exercise –

1 .Exercise based on Physiology (major)…….……15
2 .Exercise based on Physiology (minor)……..……10
3. Exercise based on ecology (community study)…….....10
4**. Exercise based on ecological adaptation…… ….…….15**
5**. Spotting 1 to 10…….…..….…... 20**
6. Viva-Voce……..….... 10
7. Sessional and Records…….……. 20

……..
Total 100

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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As Recommended by the Board of Studies
2017-18
M.Sc. SEMESTER- III
Botany Practical Part-I
Practical Scheme
(Practical based on PG 301 & 302)

MM – 100 ***Time :- 4 hrs***

Execises :-

1. Exercise based on Taxonomy
   (Study of given plant up to genus level)----------15
2. Exercise based on Morphology
   (Study of stamens/ carpels/ placentation) ---------- 10
3. Exercise based on Molecular Biology ---------- 15
4. Exercise based on Plant Breeding ---------- 10
5. Spot 1 to 10---------- ---------- 20
6. Viva-Voce ---------- 10
7. Sessional & Record ---------- 20

TOTAL 100

M. Sc. Botany (Semester System)

Third Semester
Practical scheme for Part - II
(Based on course PG 303 & 304)

Time :- 5 hrs. ***MM - 50***

Exercises :-

1. Exercise based on Physiology---------- 15
2. Exercise based on Biochemistry and Metabolism---------- 10
3. Exercise based on Ecology of
   Food/Forage/Fodder/Medicinal Plants ---------- 15
4. Report on field survey ---------- 10
5. Spot 1 to 10 ---------- ---------- 20
6. Viva-Voce ---------- 10
7. Sessional & Record ---------- 20

TOTAL 100

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Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

2017-18

M.Sc Botany SEMESTER-IV

Botany Practical Part -I

Practical Scheme

(Practical based on PG 401 & 402)

Time : 4 hrs **Botany Practical-I Scheme (Practical based on PG 401 & 402)**

MM 100 **Time : 4 hrs**

Exercises

1.	Exercise based on Biotechnology……	15
2.	Exercise based on Tissue culture …… …	10
3.	Exercise based on Applied Botany……	15
4.	Exercise based on Instrumentation …… …	10
5.	Spot 1 to 10 ……	20
6.	Viva-Voce …….	10
7.	Sessionals and Record ……..	20
		……
		100

Practical Base on the Course Code 403: Elective-I Course Code 404: Elective-II

2017-18

M.Sc Botany SEMESTER-IV

Botany Practical Part -II

Botany Practical Scheme (Practical based on PG 403 & 404)

MM 100 Time : 4 hrs

Exercises

1.	Major Exercise based on Elective - I ……..	15
2.	Minor Exercise based on Elective - I……..	10
3.	Major Exercise based on Elective - II ……..	15
4.	Minor Exercise based on Elective - II……..	10
5.	Spot 1 to 10 ……	20
6.	Viva-Voce …….……	10
7.	Sessionals and Record ……..…..	20
		……
		100

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE
SHIVAJI NAGAR, BHOPAL

Syllabus of Botany

As Recommended by the Board of Studies
2018-19

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College

Shivaji Nagar, Bhopal – 462016

Syllabus

2018-2019

Subject:BOTANY

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Date of submission in Autonomous Examination cell:

Signature H.O.D.

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Semester Wise Syllabus of M.Sc. Botany
(As Recommended by the Board of Studies)
2018-19
Theory / Practical
M.Sc. Botany

First Semester

Course No.	Name of the Course	Total
PG 101	Biology& Diversity of Virus,Bacteria & Fungi	70 + CCE 30 = 100
PG 102	Biology and Diversity of Algae	70+ CCE 30 = 100
PG 103	Biology & Diversity of Bryophyta and Pteridophyta	70 + CCE 30= 100
PG 104	Biology and Diversity of Gymnosperms	70+ CCE 30 = 100
PG 105	Practical I – based on Course PG 101 & 102	100
PG 106	Practical II – based on Course PG 103 & 104	100
	Project work related to course Paper	50
	Total	**650**

Second Semester

Course No.	Name of the Course	Total
PG 201	Cell Biology and Genetics	70 + CCE 30 = 100
PG 202	Plant Development & Reproduction	70 + CCE 30 = 100
PG 203	Plant Physiology-I	70 + CCE 30 = 100
PG 204	Plant Ecology-I	70 + CCE 30 = 100
PG 205	Practical I – based on Course PG 201 & 202	100
PG 206	Practical II – based on Course PG 203 & 204	100
	Project work related to course Paper	50
	Total	**650**

M.Sc. Botany

Third Semester

Course No.	Name of the Course	Total
PG 301	Systematic of Angiosperms	70 + CCE 30 = 100
PG 302	Molecular Biology and Plant Breeding	70 + CCE 30 = 100
PG 303	Plant Physiology, Biochemistry and Metabolism	70 + CCE 30 =100
PG 304	**Plant** Ecology-II (Conservation & Utilization of Plant Resources)	70 + CCE 30 =100
PG 305	Practical I – based on Course PG 301 & 302	100
PG 306	Practical II – based on Course PG 303 & 304	100
	Project work related to course Paper	50
	Total	**650**

Fourth Semester

Course No.	Name of the Course	Total
PG 401	Biotechnology and Tissue Culture	70 + CCE 30 = 100
PG 402	Applied Botany & Instrumentation	70 + CCE 30 = 100
PG 403	Elective Paper- I*	70 + CCE 30 =100
PG 404	Elective Paper- II*	70 + CCE 30 =100
PG 405	Practical I – based on Course PG 401 & 402	100
PG 406	Practical II – based on Course PG 403 & 404	100
	Internship Training	**100**
	Total	**700**

Note: Excursion is compulsory for all students (local) in Previous and Final year.

* List of Elective Papers are enclosed.

Signature with date

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Session		**2018-19**
Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 101
		Paper-I
Title of the Paper	(English)	**: Biology & Diversity of Viruses, Bacteria and Fungi**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Virus: characteristics, classification and ultrastructure, Isolation and Purification of viruses; chemical nature, replication, transmission of viruses, economic importance of viruses.	9
Unit-II	General characteristics, ultrastructure, nutrition and reproduction, biology and economic importance of Archaebacteria and Eubacteria. General characteristics of Cyanobacteria, Actinomycetes Mycoplasma, Rickettsiae, Chlamydiae.	9
Unit-III	General characteristics, classification of fungi substrate relationship in fungi, reproduction, heterothallism, parasexuality, Economic Importance of fungi (fungi in industries, medicine, as food**, symptoms & signs of Fungal Diseases in Plants and fungal diseases in Humans -Dermatophytes),** fungus as biocontrol agent, mycorrhiza.	9
Unit-IV	General characteristics of Mastigomycotina-Synchytrium, Saprolegnia, Pythium, Phytophthora, Peronospora, Sclerospora. General characteristics of Zygomycotina –Rhizopus, Pilobolus. General characteristics of Ascomycotina-Yeast, Taphrina, Penicillium, Erysiphe, Phyllactinia, Uncinula, Chaetomium, Peziza, Morchella.	9
Unit-V	General characteristics of Basidiomycotina- Puccinia, Melampsora, Ustilago, Agaricus, Geastrum. General characteristics of Deuteromycotina- Alternaria, Curvularia	9

	Cercospora, Colletotrichum	

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of reproductive members of fungi and cynobacteria : Peronospora, Albugo, Mucor, Pilobolus, Yeast, Chaetomium, Morchella, Agaricus, Melampsora curvularia, Polyporus, Phoma, Penicillium, Fusarium, Rhizopus, Asprgillus, Colletotrichum, Nostoc, Anabaena, Gleotrichia, Rivularia, Microcystis, Oscillatoria, Lyngbya.**
2. **Symptomatology of some diseased specimens: White rust, Downy mildew, Powdery mildew, Rusts, Smut, Ergot, Groundnut leaf spot , Red rot of sugarcane, Wilts, Paddy Blast, Citrus canker, Bacterial blight of paddy, Angular leaf spot of cotton, Tobacco mosaic, Little leaf of brinjal, Mango malformation, Leaf curl of papaya.**
3. **Gram staining of Bacteria.**
4. **Sterilization methods, preparation of media and stains.**
5. **Isolation of microbes from soil, water and air.**

SUGGESTED READINGS

- Alexopoulus, C.J. Mims, C. W. and Blackwel, M; 1996: Introductory coO' Mycology, Jbon Wjley & Sons Inc.
- Clifton, A; 1958: Introduction to Bacteria, Mcgraw- Hills Book Co.New Delhi.
- Madigan, M T. Martinko, J. M and Parker Jack; I 997: Brock Biology Of Microorganisms, (8th edition) Prentice Hall, N,J. U.S.A
- Mandahar, C. L.; 1978: Introduction to Plant Viruses. Chand & Co.Ltd. Delhi.
- Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate Press.
- Rangaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in Indja (4th edjtjon).PrentjceHaJl ofInilia Ltd. New Delbj.
- Webster, J.; 1985: Introduction to Fungi Cambridge University Press. Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbjology, S. Chand Publisher, New Delh

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Semester		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 102
		Paper-II
Title of the Paper	(English)	**Biology & Diversity of Algae**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General characteristics of Algae; Classification of algae, diversified habitats, thallus organization, cell ultrastructure, reproduction, pigments, reserve foods, types of flagella, Economic importance of Algae.	9
Unit-II	General characteristics of Chlorophyta and Charophyta-Chlamydomonas, Pandorina, Eudorina, Chlorella, Hydrodictyon, Pediastrum, Ulothrix, Cladophora, Draparnaldiopsis, Spirogyra, Zygnema, Bryopsis and Nitella	9
Unit-III	General characteristics of Xanthophyta: Botrydium, Vaucheria. General characteristics of Bacillariophyta: Diatoms (Pennularia). General characteristics of Euglenophyta: Euglena.	9
Unit-IV	General characteristics of Phaeophyta : Ectocarpus, Dictyota, Laminaria, Fucus, Sargassum	9
Unit-V	General characteristics of Rhodophyta: Porphyra, Batrachospermum, Gelidium, Cryptonemia, Rhodymenia, Polysiphonia.	9

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of representative members of Algae**
2. **Algae :- Volvox, Pandorina, Chara, Nitella, Oedogoneum, Spirogyra, Zygnema, Coleochaete, Chaetophora, Hydrodictyon, Ulva, Pithophora , Stigloclonium , Draparnaldiopsis , Clostridium , Cosmarium , Valonia , Vaucharia , Botydium, Dictyota , Padina , Laminaria , Saragassum, Fucus , Cutleria , Porphyra , Batrachospermum , Gracillaria, Polysiphonia**
3. **Study of algae as Biofertilizers, algal bloom.**
4. **Study the role of algae in Eutrophication.**
5. **Culture technique of Algae**

SUGGESTED READINGS

- Smith G. M. Cryptogamic Botany VoL I(1st edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Kumar H. D. 1988: Introduction to Phycology. Affiliated East-West Press Ltd.
- Prescott,G.W.,1969. The Algae:A review . Butler &Tanner Ltd., From & London
- Chapmam & Chapman, The Algae
- Sharma O.P.,The Algae
- Gangulee, H.C. &Car ,A.K. Vol. I&II ,1989, College Botany, Books & allied(P Ltd. , Calcutta
- Fritsch, F.E. , Vol.I, 1965, The Structure and Reproduction of the Algae,The Syndics of Cambridge university Press

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Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 103
		Paper-III
Title of the Paper	(English)	**Biology & Diversity of Bryophyta& Pteridophyta**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit-I	General Characteristics, classification , Morphology, reproduction and life history, distribution, Origin, Evolution& Affinities, Ecology and Economic importance of Bryophytes. Contribution to Bryophyta in India	9
Unit-II	General Characteristics of Hepaticopsida-Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Sphaerocarpus, Pellia, Porella. General Characteristics of Anthocerotopsida-Anthoceros, Notothylas. General Characteristics of Bryopsida-Sphagnum, Polytrichum.	9
Unit-III	General characteristics of Pteridophyta; Classification, origin, telome theory, stelar organization, Homospory, Heterospory and Seed Habits, Reproduction , Indian contribution to Pteridophyta, Paleobotany and Geological Time-Scale, types of fossils.	9
Unit-IV	General characteristics of Psilophyta-Rhynia, Horneophyton, Zosterophyllum, Psilophyton, Asteroxylon, Psilotum, Tmesipteris. General characteristics of Lycophyta- Lycopodium, Protolepidodendron, Lepidodendron, Isoetes, Selaginella.	9
Unit-V	General characteristics of Sphenophyta-Eqisetum, Hyenia, Calamites, Paleostachys, Calamostachys, Sphenophyllum. General characteristics of Pterophyta-Ophioglassum, Osmunda, Gleichenia, Pteris, Lygodium, Marsilia, Salvinia, Azolla.	9

SUGGESTED READINGS

- Smith G. M. Cryptogamic Botany VoLII I(2nd edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Brower- 1926: Primitive Land Plants~ Cambridge At the University Press.
- Kashyap- 1972 LiveIWorts of Western Himalayas and Punjab. Researchco Publication.
- Puri P. 1980~ Bryophyta -Morphology, Growth & Differentiation. Atma Ram & Sons, Delhi.
- Chopra & Kumara- 1988: Biology of Bryophyta; Wiley Eastern Ltd.
- Ram Udar; 1970: An Introduction to Bryophyta; Shashidhar Malviya Prakashan.
- Watson; 1968: Structure and life of Bryophyta; Hutchinson & Co. Ltd.
- Campbell; 1939: The evolution of land plants; Stanford University.
- Sporne, K.R. 1991. The Morphology of Pteridophyta
- Parihar N.S. 1996 Biology and Morphology of Pteridophytes, CentralBook Depot. Allahabad.
- Arnold C. A; An Introduction to Paleobotany; Tata Mc Graw –Hill Publishing Co. New Delhi.
- Stewart, W. N. and RathweIL G. W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.
- Eames A J.; Morphology of Vascular Plants-Lower Groups.Tata Mc Graw -Hill Publishing Co. New Delhi
- Rashid A. 1999; An introduction to Pteridophytes; Vikas Publishing House Pvt. Ltd..
- Gangulee & Kar College Botany Vol II

SUGGESTED LABORATORY EXERCISES

1. **Morphological & Anatomical study of representative members of the Bryophyta:** Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Pellia, Porella, Anthoceros, Notothylas, Sphagnum, and Polytrichum.
2. **Morphological & Anatomical study of representative members of the Pteridophyta** :- Psilotum , Isoetes , Lycopodium , Sellagena , Ophioglossum , Osmunda , Lyathia , Marsilea , Salvinia , Azolla , Gleichenia, Dryopteris, Alsophilla, Study of fossil members.

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Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
Paper		PG – 104
		Paper-IV
Title of the Paper	(English)	**Biology & Diversity of Gymnosperms**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General Characteristics and Classification of Gymnosperms, Distribution of Gymnosperms in India, Economic Importance, Evolutionary tendencies in Gymnosperms. Indian contribution to Gymnosperms – **Dr. Birbal Sahni, Dr. P. Maheshwari & Dr. M.S. Swaminathan.**	9
Unit-II	General Characteristics of Fossil Gymnosperms (Pteridospermales) - Lyginopteris, Medullosa, Glossopteris, Pentoxylon, Caytonia.	9
Unit-III	General Characteristics of Cycadeoidales, Cycadales, Bennettitales-Williamsonia, Cycadeoidea: Cycas, Zamia, Nilssonia.	9
Unit-IV	General Characteristics of Ginkgoales, Cordaitales & Coniferales-Ginkgo biloba, Cordaites, Cedrus, Pinus, Araucaria, Cryptomeria, Thuja, Cupressus Podocarpus, Taxus.	9
Unit-V	General Characteristics of Ephedrales- Ephedra. General Characteristics of Welwitschiales- Welwitschia. General Characteristics of Gnetales- Gnetum.	9

SUGGESTED LABORATORY EXERCISES

1. Monographic study of following :- Cycas , Ginkgo , Cedrus , Abies , Picea , Cupressus , Araucaria , Cryptomeria , Taxodium , Podocarpus , Agathis , Taxus , Ephedra and Gnetum.
2. Study of important fossil gymnosperm from prepared slides and specimens.

SUGGESTED READINGS

- Bhatnagar, S.P. and Moitra, A; 1996: Gymnosperms. New Age International Pvt. Ltd., New Delhi.
- Singh H.; 1978: Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
- Spome K R; 1991: The Morphology of Gymnosperms; Hutchinson Univ. Library; London.
- Foster A S. & Gifford E. M; Comparative morphology of vascular Plants; Vakils, Feffer, & Simons Private Ltd. Bombay. Chamberlain; Gymnosperms -Structure & Evolution; CBS Publishers & Distributors Delhi.
- Shukla A C. & Mishra S. P.; Essentials of Paleobotany; Vikas Publishing House Pvt. Ltd. Delhi-Bombay-:6angalore-Calcutta-Kanpur .

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Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 201
		Paper-I
Title of the Paper	(English)	**Cell Biology and Genetics**
	(हिन्दी)	कोशिका विज्ञान एवं आनुवांशिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Structure and organization of plant cell, Structure and functions of cell wall, Plasma membrane, Ion carriers, channels and pumps, Receptors, Plasmodesmata, Sites for ATPases.	9
Unit-II	Structure and function of Cell organelles: Chloroplast, Mitochondria, Vacuole, Endoplasmic Reticulum, Lysosomes, Ribosome, Golgi body.	9
Unit-III	Structure and Function of Nucleus ,Nucleosome, Chromosome structure and packaging of DNA, Euchromatin and heterochromatin, karyotype , banding patterns, specialized types of chromosomes.	9
Unit-IV	Cell division, Cell cycle, Programmed cell death, Structural changes in Chromosomes(Duplication, Deficiency Inversion and Translocation), Numerical changes in chromosomes(Aneuploids and Euploids, haploids)	9
Unit-V	Mendel's Laws, Genetics of Mitochondria and Chloroplast polygenetic inheritance, crossing over and linkage, Transposable elements.	9

SUGGESTED LABORATORY EXERCISES

1. Isolation of plant DNA and its quantitaion by a spectrophotometric method.
2. Isolation of RNA and quantitaion by a spectrophotometric method.
3. Demonstration of SEM and TEM.
4. Isolation of Mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDH).
5. Isolation of chloroplasts and SDS-PAGE. Profile of proteins to demarcate the two submits of Rubisco.
6. Demonstration of Mitosis.
7. To determine Mitotic Index in onion root tip cells.
8. Demonstration of Meiosis (normal) in Tradeshcantia.
9. Demonstration of abnormal meiosis.
10. Demonstration of special types of chromosomes.
11. Preparation of karyotype and Idiogram.
12. Calculation of Nucleo Cytoplasmic Index of onion/garlic root tip with the help of micrometric method.

Section the following Review Journals:-

1. **Annual Review of plant physiology and Molecular Biology.**
2. **Current Advances in Plant Sciences.**
3. **Nature Reviews: Molecular and Cell Biology.**

SUGGESTED READINGS

Lewin, B. 2000, Genes VIL Oxford University Press, New York.

Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.

Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Rost, T. et: aI. 1998.PIant Biology, Wadsworth Publishing Co., California, U.S.A

Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A

Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA

De, D.N. 2000: Plant Cell Vacuoles: An Introduction. CSIRO Publication, ColliJ18W~ Australia.

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Class		M.Sc.
Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 202
		Paper-II
Title of the Paper	(English)	**Plant Development & Reproduction**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Organization of the higher plant body: shoot and reproductive meristem, Tissue system, Shoot apical meristem (SAM), Root apical meristem, Lateral meristem. Control of tissue differentiation especially xylem and phloem, Lateral root and root hair.	9
Unit-II	Development of Shoot, Secondary growth in stem, primary and secondary anomaolus structure of stem. Origin, development, differentiation, arrangement, diversity, venation, modification and anatomy of leaves.	9
Unit-III	Flower development, floral organ differentiation, homeotic mutants in *Arabidiopsis* and *Antirrhinum*, Androecium, Microsporangium, Microsporogenesis, role of tapetum, Male gametophytes and their development, Pollen storage,Pollen allergy and Pollen enbryos, Male sterility.	9
Unit-IV	Gynoecium: structure of Megasporangium, Ovule development, Types and development, Megasporogenesis, organization of Embryo sacs, Pollination Mechanisms and vectors, Self incompatibility.	9
Unit-V	Double fertilization: Endosperm development, embryogenesis, storage proteins of endosperms and embryo. Fruit growth: biochemistry and molecular biology of fruit maturation. Seed growth and their dispersal, Polyembryony, apogamy and apomixes.	9

SUGGESTED LABORATORY / FIELD EXERCISES

1. **Effect of gravity, unilateral light and plant growth regulators (PGRs) on the growth of young seedlings.**
2. **Role of dark and light on the expansion of cotyledons and epicotylar hook opening in pea.**
3. **Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double strained permanent slides of suitable plant such as Coleus , Tobacco.**
4. **Study of shoot apices in a monocotyledon in both TS and LS to show the origin and arrangement of leaf Primordia.**
5. **Study of phyllotaxy of various plant species.**
6. **Anatomy of leaf available locally.**
7. **Study of trichomes, glands in few species Osimum , Azadirecta Indica , Plumbago , Eucalyptus etc.**
8. **Study of morphology pollengrains of different species.**
9. **Study of pollen germinations and test for pollen viability using strains**
10. **Study of microsporogenesis and gametogenesis in section of Anthers.**
11. **Pollen storage, pollen pistil interaction, self incompatibility In- vitro pollination.**
12. **Study of monosporic, bisporic and tetra sporic type of embryosac.**
13. **Emasculation , bagging and hand pollination to study pollen germination seed set and fruit development using self compatible and obligate outcrossing systems.**
14. **Suitable seeds and polyembryony in Citrus , Jamun , etc by dissection.**

SUGGESTED READINGS

- Bhojwani,S.S.and Bhatnagar,S.P.2000. The Embryology of Angiosperms(4th revised and enlarged edition). Vikas Publishing House,New Delhi.
- Burgess.J.1985.An introduction to Plant Cell Development.Cambridge University Press, Cambridge.
- Fageri,K.and Van der Pijl,L1979. The Principles of Pollination Ecology .Pergamon Press, Oxford.
- Fahn, A 1 982.Plant Anatomy.(3rd edition).Pergamon Press,Oxford.
- F osket, D .E.1994 .Plant Growth and Development. A Molecular Approach.Academic Press, San Diego.
- Howell, S.H.1998. Molecular Genetics of Plant Development, Cambridge University Press, Cambridge.
- Leins,P., Tucker,S.C.and Endress,P .K.1988.Aspects of Floral Development. J. Cramer, Germany.
- Lyndon, R.F.1990.Plant Development. The Cellular Basis. Unin Hyman .London.
- Murphy, T. M. and Thompson, W. E. 1988 Molecular Plant Development. Prentice Hall, New Jersey.
- Proctor, M. and Yeo,P.1973.The Pollination of Flowers. William Collins Sons, London.
- Raghvan, V .1997 .Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
- RaghVan, V. 1999. Development Biology of Flowering P Jants. Springer-verlag.
- Atwell, B. J., Kriedermann, P.E. and Jurnbull, C.G.N.(eds)1999.PIants in Action: Adaptation in Nature, Perfonnance in Cultivation, MacMillan Education, Sydney, Austr

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Class		M.Sc.
Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 203
		Paper-III
Title of the Paper	(English)	**Plant Physiology-I**
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Principles of thermodynamics, Free energy and redox potential, Plant water relation, mechanisms of water absorption, water transport through xylem, Transpiration, root-microbe interactions in facilitating nutrient uptake, Mineral nutrition, Membrane transport protein.	9
Unit-II	Phloem transport, Signal transduction, receptors and G-proteins, phospholipids signaling, Role of cyclic nucleotide, calcium-calmodulin cascade.	9
Unit-III	Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, bracinosteroids, polyamines, jasmonic acid, and salicylic acid, Hormone receptors.	9
Unit-IV	Flowering process: Floral induction and development, photoperiodism and its significance, endogenous clock and its regulation, Movement, Phytochrome and cryptochrome, their photochemical and biochemical properties, Molecular mechanism of action of photomorphogenic receptors, Vernalization.	9
Unit-V	Stress physiology: Plant response to biotic and abiotic stress, Water deficit and drought resistance, Salinity stress and resistance, Concepts of freezing, heat stress and oxidative stress.	9

SUGGESTED LABORATORY EXERCISES

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry, Spectrophotometry and florimetry.
3. Study of physiological stress in terms of Water, light and tempreture.
4. Determine rate of transpiration by Ganong's potometer.
5. Determine rate of transpiration by Gravimetric Method.
6. Demonstration of the effect of light intensity and wind velocity on the rate of transpiration by Ganong's potometer.
7. To Study the comparision between stomatal and cuticular transpiration by Cobalt Chloride Method and Four Leaf Method.
8. To Study the comparision between evaporation and transpiration and find out T/E ratio.
9. Bioassay of plant hormones- auxins, ethylene, GA, ABA and Cytokinin.
10. To study the effect of ausins (IAA/BAP/NA) on plant growth.
11. Effect of time and enzyme concentration on the rate of reaction of enzyme C e.g. acid Phosphatase, nitrate reductase.
12. Effect of substrate concentration on activity of any enzyme C (catalase, Amylase)
13. Demonstration of the substrate inducibility of the enzyme nitrate reductase.
14. Determination of succinate dehydrogenase activity, Its kinetics and sensitivity to inhibitors.
15. Separation of isoenzymes of esterase, Peroxidases by native polyacrylamide gel electrophoresis
16. To determine stomatal index, stomatal frequency and percentage of leaf area open through stomata. Also, to study the effect of ABA on stamatal closure.

Suggested readings

- **Hopkins, W.G. 1995**. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- **Moore, T.C. 1989**. Biochemistry and Physiology of Plant Hormones (second edition). Springer -Verlag, New York. USA.
- **Nobel, P.S. 1999**. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz l and Zeiger E1998** Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 204
		Paper-IV
Title of the Paper	(English)	**Plant Ecology-I**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Introduction, division of plant Ecology, Ecosystem component (abiotic and biotic), Factors(light, temperature, water), Population Ecology, Inter and intra specific competition and self regulation. **Biostatistic**s: mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test)	9
Unit-II	Community organization: Concepts of community and continuum, analysis of community (analytical and synthetic characters), Community coefficients, Association (negative and positive associations), Concept of ecological niche, Concept of Biodiversity evolution and differentiation of species , allopatric and sympatric speciation, Ecads and Ecotypes.	9
Unit-III	Ecosystem development and stability: Temporal changes(cyclic and non cyclic), Succession processes & types, Mechanism of succession, facilitation, tolerance and inhibition models, Concept of climax, persistence , Ecological stability concept(resilience and resistance), Ecological perturbation natural and anthropogenic and their impact on plants and ecosystem,Ecosystem restoration.	9
Unit-IV	Fate of energy and matter in Ecosystems: Trophic organization(ecological pyramids) and structure, Food chains & food webs, Ecological energetics, energy flow pathways, Ecological efficiencies, consumption, assimilation and production at trophic level, Primary production measurement methods, Limiting factors, litter fall and decomposition , Recycling pathway relation between energy flow and nutrient cycling ,Global Biogeochemical cycle of C,N,P,S.	9
Unit-V	Major Biomes of the World, Major Vegetation types- Tropical rain forests, Temperate forests, Seasonal forests, Boreal forest, Grasslands, Deserts, Aquatic ecosystems and Wetlands.	9

SUGGESTED LABORATORY EXERCISES

1. To determine minimum size and number of quadrat required for study of vegetation by species area curve method.
2. To determine percentage frequency and frequency classes of various species by quadrate and line transect method using Raunkiaer's Law.
3. To study density and abundance of species.
4. To calculate relative frequency , relative density and relative dominance (or basal area) and determine importance value Index (IVI) of the species.
5. To determine diversity Index or community coefficient for two different vegetation / protected and unprotected grassland.
6. To determine gross and net phytoplankton productivity by light and dark bottle method.
7. To calculate Basal area of tree species found locally.
8. To find out reproductive capacity of the seeds.
9. To study the foliar injuries of plants which are exposed by SO_2.
10. To determine dust deposition on leaves of polluted and non polluted area.
11. To estimate the dissolved oxygen (DO) content in entrophic and oligotrophic water sample by azide modification of Winkler's method.
12. Physical and Chemical analysis of soil.
13. To study water holding capacity, porocity, bulk density of soil.
14. Ecological adaptations: Hydrophyte, Xerophyte, Epiphyte, Parasite etc.
15. To study- Hygrometer , Minimum Maximum Thermometer ,sling Psychrometer , Saci disc , pH meter , Spectrophotometer, Soxhlet apparatus , Kjehldal's apparatus.
16. **Biostatistics:** mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test).
17. **To study various Biotic and abiotic components of pond and forest ecosystem.**
18. **Mapping of Biomes on world map.**

SUGGESTED READINGS

- Smith. R.L. 1996. Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- Begon. M.. Harper, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science. Cambridge.
- Ludwig. J. and Reynolds. J.F. 1988. Statistical Ecology. John Wiley & Sons.
- Odum. E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
- Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. Cambridge University Press, Cambridge, U.K.
- Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.
- Treshow. M. 1985. Air Pollution and Plant Life. Wiley Interscience.
- Heywood, V.H. and Watson. R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
- Mason, C.F. 1991. Biology of Freshwater Pollution. Longman. 'Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .
- Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.

M. Sc. Botany (Semester System)

List of suggested Project work/Dissertation work

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Inventroization of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR

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2018-19
Theory / Practical

Session		**2018-19**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 301
		Paper-I
Title of the Paper	(English)	**Systemetics ofAngiosperms**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Morphology of flower, floral induction and development, morphology of stamens and carpals, carpels evolution, morphology of inferior ovary, placentation: their origin and types.	9
Unit-II	The species concept Taxonomic hierarchy, International Code of Botanical Nomenclature, Taxonomic evidences (morphology, anatomy, palynology, embryology, cytology, phytochemistary). Taxonomic tools(Herbarium, Botanical garden, Taxonomic keys, Taxonomic literature, floras.) Histological, biochemical, cytological phytochemical, serological, and molecular technique.	9
Unit-III	Systems of Angiosperm classification: Origin of angiosperms Phenetic versus phylogenetic system, Cladistics in taxonomy, relative merits and demerits of major system of classification, Plant exploration , invasions and introduction and, **World centres of primary and Secondary centers diversity of domesticated plant**.	9
Unit-IV	Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae.	9
Unit-V	Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae , Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales, Santanales, Centrospermales, and Hellobiales.	9

SUGGESTED LABORATORY EXERCISES

1. Study of stamens and carpals in various species.
2. Different kinds of placentations
3. Description of various species of a genus, location of Key characters and preparation of Key at generic level.
4. Location of key characters and use of keys at family level.
5. Training for herbarium preparation.
6. Preparation of Herbarium sheet of such plants, wild cultivated medicinal as are available locally.
7. Locally available Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae
8. Locally available Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales Santanales, Centrospermales, and Hellobiales.

Suggested Reading

Heywood & Moore, D.M; 1984: CWTent concept in Plant Taxonomy Academic Press.

Banson, L.B.;1957; Plant Classification, Health & Co. Boston.

Davis, P.R & Heywood, V.H 1973; Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. Co. New York USA.

Eames, AL.; 1961; Morphology of Angiosperms, McGraw Hill, New York.

Lawerence, G.H.M,;1951: Taxonomy of Vascular Plants Macmillan, New York

Naik V.N,:1984: Taxonomy of Angiosperms. Tata McGraw Pub Co. Ltd New Delhi.

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Session		**2018-19**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-302
		II
Title of the Paper	(English)	**Molecular Biology and Plant Breeding**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Nuclear DNA content DNA structure and forms, DNA replication, mutation, C value paradox, cot curve, and its significance, damage and repair, Restriction Mapping, Multigene families and their evolution.	9
Unit-II	Gene structure and expression, Gene fine structure, cis and trans test of recombination, introns and exons, their significance, Genetics of Bacteria and Virus (genetic transformation, conjugation, transduction, Recombination in Phage), Regulation of gene expression in Prokaryotes and Eukaryotes.	10
Unit-III	RNA synthesis and processing-adding, splicing, polyadenilation, structure and function of different types of RNA, RNA transport.	9
Unit-IV	Genetic code, Protein synthesis–Ribosome structure and site of protein synthesis, initiation complex, factors, elongation, and termination. Post translation modification of protein, protein sorting. Targeting of protein to organelles.	9
Unit-V	Plant breeding,: In situ Hybridization-Concept and techniques. Genetic basis of inbreeding and heterosis, exploitation of hybrid vigor, Cancer oncogene, Apoptosis, Immune innate and adaptive immune system	8

SUGGESTED LABORATORY EXERCISES

1. Isolation of genomic DNA from plant tissue using CTAB (cetyetri methyl ammonium bromide) or any animal tissue.
2. Isolation of DNA & its quantitation by a spectrophometric method.
3. Restriction digestion of plant DNA, its seperation by Agrose gel electrophoresis and visualization by ethidium bromide staining.
4. Isolation of RNA and quantitation by a spectrophotometric method.
5. Separation of RNA by Agrose gel electrophoresis and visualization by Et. Br. staining.
6. Immunological techniques : Ouchterlony method, ELISA & western blotting.
7. Isolation of chloroplats and SDS-PAGE. profile of proteins to demarcate the two subunits of Rubisco.
8. Emasculation technique.

Other experiments based on theory paper

Suggested Readings:

- Alberts, B. Bray, D. Lewis, J. Raff: M. Roberts, K. and Watson,J. D. 1989 Molecular Biology of the Cell (2nd edition). Garland Publishing Inc., New York. U. S. A.
- Karp, G. 1999 Cells and Molecular Biology: Concepts and Experiments John Wiley & Sons, Inc. U. S.A
- Malacinski, G. M. and Freifelder, D. 1998. Essentials of Molecular Biology *(3M* edition). Jones and Barlett Publishers, Inc. London.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, WadsworthPublishing Co., California, USA.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, *K.*, and Watson, J.D. 1999.Molecular Biology of the Cell. Garland Publishing:Inc., New York.
- Rost, T. et al. 1 998.Plant Biology, Wadsworth Publishing Co.,California, U.S.A
- Krishanmurthy K. V. 2000 Methods in Cell Wall Cytochemistry, CRCPress, Boca Raton, Florida U.S.A
- Buchanan, B.B. Gruissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA
- De, D.N. 2000 Plant Cell Vacuoles: An Introduction.CSIRO Publication, Collingwood, Australia.
- Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA
- Lodish H. Bert, A,zipursky, S.L.,Matsudaira, p.,Baltimore, D. and Darnell, J. 2000.Molecular Cell Biology, W.H.Freeman and Co., NewYork, U.S.A
- Twyman, R. M. 2003. Advanced Molecular Biology. Viva Books Private Ltd. New Delhi. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer - Verlag, New York. USA.
- Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- Salisbury FB and Ross CW 1991 Plant Physiology IV edition Wdsworth Publishing co. California USA.
- Taiz l and Zeiger E1998 Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997 Plant Metabolism II Ed. Longman England.
- Buchanan, B.B.Gruissem, W. and Jones R.L. 2000. Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Theory / Practical

Session		**2018-19**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-303
		III
Title of the Paper	(English)	Plant Physiology, Biochemistry and Metabolism
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Fundamentals of Enzymology: General aspects, Allosteric mechanism, regulatory and sites, Isoenzyme, Kinetics of enzymatic catalysis, Michaelis-Menten equation and its significance, Mechanism of enzyme action.	9
Unit-II	Photochemistry and Photosynthesis: General concept and Historical back ground, evolution of photosynthetic apparatus, photosynthetic pigment and light harvesting complexes, Photo oxidation of water, mechanism of electron and proton transport, Carbon assimilation, Calvin cycle, Photorespiration and its significance, C-4 cycle, CAM path way, physiological and ecological consideration.	9
Unit-III	Respiration: Overview of plant respiration, Glycolysis, TCA cycle, Electron Transport, Structure, function & synthesis of ATP, oxidative pentose phosphate pathway.	9
Unit-IV	Structure, classification and function of carbohydrates, biosynthesis of sucrose and starch, Structure and function of Lipids, Fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids, , and their catabolism, Glyoxilate cycle and alternative oxidases system.	9
Unit-V	Nitrogen fixation, (chemical and biological), Nodule formation, Mechanism of Nitrate uptake and reduction, ammonium assimilation, Sulphate uptake, transport and assimilation. Sulphur metabolism, Vitamins (structure and role).	9

Suggested Laboratory Exercise based on P.G 301 :

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry and Spectrophotometry.
3. Determine rate of respiration in germinating/young buds by Ganong's respirometer.
4. Determine rate of respiration in terms of oxygen utilized by plant material by volume method/ weight method.
5. Determine effect of light intensity / wave length on rate of photosynthesis.
6. Determine effect of Co2 concentration on rate of photosynthesis
7. Determine effect of temperature / pH/Toxins on permiability of cell membrane.
8. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids by spectrophotometer.
9. To seperate chloroplast pigments by strip paper chromatography/circular paper chromatography.
10. To determine the chlorophyll-a / chlorophyll b ratio in C_3 and C_4 plants by spectrophotometer.
11. Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.
12. To demonstrate photophosphorylation in intact chloroplasts, resolve the phosphoproteins by SDS-PAGE and perform autoradiography desalting of proteins by gel filtration chromatography embaying Sephadex G-25.
13. Biochemistry of carbohydrates and lipids.
14. Study of structure and formation of Root nodule in leguminous plants

Suggested readings

- **Hopkins, W.G. 1995**. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- **Moore, T.C. 1989**. Biochemistry and Physiology of Plant Hormones (second edition). Springer - Verlag, New York. USA.
- **Nobel, P.S. 1999**. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz l and Zeiger E1998** Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-304
		IV
Title of the Paper	(English)	**Plant Ecology-II (Conservation & Utilization of Plant Resources)**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant biodiversity concept, status in India, and world. World centres of primary diversity of domesticated plants with special reference to Indoburmiese centre and secondary centres.	9
Unit-II	Sustainable development, utilization, of resources from forest, grassland, aquatic habitats, food, fodder, forage, timber and non wood forest products. Threats to quality and quantity of resources due to over exploitation. Speciation and Extinction, IUCN categories of threat. Distribution and global pattern of terrestrial biodiversity, Hot spots and inventory.	9
Unit-III	Strategies for conservation of resources: Social forestry, Principle of conservation, In situ conservation (Sanctuaries, National Parks, Biosphere reserves for wild life conservation), Ex situ conservation(Botanical Garden, Field gene bank, Seed bank, in vitro repositories, Cryo banks).	9
Unit-IV	Pollution and Climate change : Air, Water and Soil pollution(Kinds, sources, quality parameters) and their effects on plants and ecosystem. Green house gases- CO2 , CH4, N2O, CFCs (source, trend and role). Ozone layer and Ozone Hole, Consequences of climate change, (Co2 as fertilizer, Global warming, sea level rise, UV radiation). Bioremediation (Management of Pollution).	9
Unit-V	Resource Monitoring Remote sensing Concepts and tools, Satellite remote sensing ,basics, sensors, Visual and digital interpretation) EMR bands and their application , Indian remote sensing Program Thematic mapping of resources Application of Remote sensing.	9

Suggested Laboratory Exercise -

1. Study of locally available plants.
2. Food crops – Wheat, rise, maize, chickpea, potato tapioca, sweet potato, sugarcane , morphology , anatomy , economic importance.
3. Forage / fodder plants – study of any five important crops of locally available.
4. Textile fibres – cotton, jute, linen, sun hump, cannabis.
5. Maceration technique and staining technique of fibres.
6. Fibres for stuffing – silk cotton or Kapok.
7. Medicinal and aromatic plants:- morphology and importance of Papaver somnifera , Atropa balladona , Catharanthus roseus , Adhathoda vasaca , Rauwolfia serpentina , Withania somnifera , Phyllanthus nurori , Andrographis paniculata , Aloe barbedensis , Mentha arvensis , Rosa , Pogostemon cablin , Viteveris zizanioides , Jasminum grandiflorum , cymbopogon sp. , Rosa , Pandanus odoratissimus .
8. Fire wood and timber yielding plants and Non wood forest products (NWFPs).
9. Morphology and Anatomy of oil yielding tissue and their test (Biochemical or by staining).
10. Prepare an inventory of medicinal and aromatic plants, bamboos and timber yielding plants of your area giving their scientific and local name their important uses appropriate illustrations.
    - Study of live or herbarium specimens or other visual materials to become familiar with these resource.
11. Remote sensing image interpretation.
12. Mapping of natural resourses (water and forest) of M.P.
13. Enlist wild and cultivated varieties of cereal crops of M.P.
14. Study of pollination indicator plants.
15. Water and soil analysis.
16. Study of leaf injury.
17. Cellulose test for natural fibers.

Study of live or herbarium specimens or other visual materials to become familiar with these resource

The student should be taken to one of the following-

1. A protected areas (biosphere reserve- Pachmari, national park or a sanctuary).
2. A wet land.
3. Botanical survey of India (BSI).
4. CSIR Laboratory doing research on plants and their utilization.
5. Botanical Gardens or Museum.
6. FRI Forest Research Centre, Dehradun.

Note **– The students are expected to prepare a brief illustrated narrative of the field survey and scientific visits. After evaluation the grades awarded to students by teachers and should be added to the final assessment of practical examination**.

Suggested Reading

Brady,N.C.1990 The Nature and Properties of Soil MacMillan.

Heywood, V.H. and Watson, R.T. 1995 Global Biodiversity Assessment. Cambridge University Press.

Hill, M.K. 1997 Understanding Environmental Pollution,. Cambridge University, Press.

Kohli, R. Arya, K.S., Singh, P.H. and Dhillon, H.S,. 1994 Tree Directory of Chandigarh, Lovedale Educational, New Delhi.

Kothari A. 1997 Understanding Biodiversity Life Sustainability and Equity.

Orient Longman.Mason, C.F. 1991. Biology of fresh water Pollution Longman.

Nair, M.N.B.et.al.1998Sustainable Management of Non Wood Forest Products.

Faculty of Forestry, University Putra Malasia 434004 PM Serdong Selangor Malaysia

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Semester Wise Syllabus of Botany

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Session		**2018-19**
Class		M.Sc.
Semester		IV
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-401
Title of the Paper	(English)	Biotechnology and Tissue Culture
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant cell and tissue culture: General introduction, history, scope, concept of cellular differentiation and Totipotancy. Establishment of lab, aseptic technique and sterilization of glassware. Different types and preparation of media. Ex plant technique of tissue culture, meristem, anther, embryo culture and organogenesis.	9
Unit-II	Somatic Hybridization, Protoplast isolation, Fusion and culture, Somatic cell genetics, application of tissue culture, Artificial seed, Somaclonal variation, Production of Secondary metabolites, cryopreservation, and germplasm storage.	9
Unit-III	Biotechnology Principles and Application of biotechnology in agriculture, horticulture, forestry, food, and industries, health care and immunology, environment biotechnology, and ethics. Intellectual Property Right. Genetic engineering of plants, aims, strategies of Transgenic Agrobcterium, T-DNA, Gene tagging microbial genetic manipulation, genetic improvement of industrial microbes, fermentation technology.	9
Unit-IV	Recombinant DNA technology: gene cloning, principle and technique, construction of genomic and c-DNA library, Vector, Plasmid, DNA synthesis, Polymerase Chain Reaction (PCR), DNA fingerprinting.	9
Unit-V	Genomics and proteomics, molecular markers, Artificial chromosomes, High through put sequencing, genome projects, bioinformatics, microarrays, protein profiling and its significance.	9

Suggested Laboratory Exercise: -

1. To prepare biotechnology lab.
2. Sterilization techniques.
3. Preparation of culture medium.
4. Sterilization of medium.
5. To demonstrate growth characteristics of E.coli using plating method.
6. To demonstrate growth characteristics of E.coli by turbidiometric method.
7. To study the effect of antibiotics on growth of microorganism.
8. To study fermentation techniques.
9. Study of nitrogen fixer & its applications.
10. To prepare tissue culture lab.
11. Stertization techniques.
12. Sterilization of glassware.
13. Preparation of tissue culture medium.
14. Stertization of Explants.
15. Study effect of plant growth hormones (PGR) on tissue culture.
16. To perform the techniques of micro propagation/ somatic embryogenesis /anandroganesis.
17. To perform the techniques of organogenesis.
18. Study of applications of tissue culture.
19. Raising of callus by isolation of an explants from Daucus carota on MS medium
20. Preparation of artificial seeds.

Suggested Reading

Butenko, R.G. 2000 Plant Cell Culture. University Press Of pacific.
Collin, H.A. and Edwards, s. 1998 Plant Cell culture. Bios scientific publishers Oxford. UK.
Callow, J.A. Ford-Lioyd, B.V. and Newbury, H.J.1997 Biotechnology and plant genetic Resources, Conservation and Use.CAB, International Oxon, UK.
Dixon, R.A. 1987 Plant Cell Culture; a Practical Approach. IRL press, Oxford. George, E.F.1993 Plant Propagation by Tissue culture part- 1&2 Exegetics Ltd Edington. UK.
Glick, B.R. and Thompson, J.E. 1993 methods in Plant molecular Biology and Biotechnology Grc Press Boca Raton. Florida.
Primrose, S.B. 1995 Principles of Genome Analysis, Blackwell Science ltd., Oxford,

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Session		**2018-19**
Class		M.Sc.
Semester		IV
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG 402**
		II
Title of the Paper	(English)	**Applied Botany and Instrumentation**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plants used in daily life: plants used in cosmetics, herbal cosmetic products and applications. Plants used in hair care and skin care. Herbal dyes and their uses **.** Herbal beverages. Small scale industries.	6
Unit-II	Aromatherapy: Introduction, History, modern concept of Aromatherapy. Essential oils, Extraction technique by Sohxlate method. Applied aspects of Aromatherapy.	9
Unit-III	Organic Farming and applications, Bio-fertilizers, Vermiculture, Floriculture, Mushroom cultivation technique, Nursery management and applications, marketing strategies, possibilities and loan schemes. Entrepreneurial Development.	10
Unit-IV	Microscopy: Principle and applications. Types of microscopes. Basic knowledge of spectrophotometer, Electrophoresis, Colorimeter, pH meter and Centrifuge.	10
Unit-V	Introduction to computer: fundamentals, MS ,DOS,MS WORD , MS EXCEL usage of Computer in Biology, Sample graph plotting, Net working of Computer, basic need and applications , modern strategies of literature search.Record and presentation of Data and scope.	10

Suggested Practical Exercises-

1. Extraction technique by sohxalate method of essential oils
2. methods of processing of crude plants and their storage.
3. Traditional method of beautification of skin and their application-
   - Cleansing-Alove,Papaya,Lemon etc.
   - Nutritive-Ashwagandha,Ginsing,Nagarmotha etc
   - Bleaching-Amba haldi,Raktachuran,kachur,suganthi etc
   - Anti wrinkle-Manjistha,papaya,suganthiets,Kumari etc

4. Hair care- amla, shikakai, Aritha, Nagarmotha etc.
5. Aromaterapy by –Chameli, Rose, Eucaliptus, Tulsi etc.
6. **Enlist herbal pesticides and herbicides.**
7. Techniques of vermiculture, Mushroom culture, nursery management
8. Perfoma preparation of proposal of marketing of plants
9. Herbal dyes and their uses.
10. Working principle and Practical based on pH meter, Electrophoresis, Spectrophotometer, Centrifuge etc
11. MS office,DOS,MS WORD , MS EXCEL .Usage of Computer in Botany.

Suggested Reading

- Biotechnology-R.C. Dubey
- Biostatistics and Computer Application- Dr. R Goswami
- Mushroom Cultivation-
- Vermiculture-
- Floriculture-
- Aromatherapy -a Complete Guide to the Healing Art- Kathi Kerthi and Mendy Green
- Essential oils for Radiant Health- Susanne Fischer Rizzi 1998
- Beauty through Herbs- Dr. Urjita Jain, Institute of Herbal Science, Mumbai,1997
- Text book of Cosmetology-Harry
- Cosmetic Science and technology-Sagarin C.B.
- The Skin care Book: Simple Herbal Recipes-Kathryn wartrochi, Ist Edition 1996,Paper Gooseberry Hill Publication.
- Natural organic Hair & Skin care :Including A to z Guide to natural & Synthetic Chemicals in cosmetics- ISBN-1990,Aubrey Hampton organic press
- Instrumentation-
- Wealth of India-CSIR New Delhi Publication
- Entrepreneurial Development concept and practices-Dilip Sarwate, Everest Himalaya Publication
- Entrepreneurial Development –S.S.Khan ,S Chand Publication
- Entrepreneurial Development in India- Dr. C. B. Gupta & Dr. N. P. Shrinivasan, S Chand Publication ,4th Edition

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19
Theory / Practical

Session		**2018-19**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG-403: Elective Paper-I**
		III
Title of the Paper	(English)	
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers I

1. Limnology
2. Industrial microbiology
3. Taxonomy of Angiosperms
4. Applied Mycology
5. Forest Biology, Forest vegetation of India and Management of Forest Resources
6. Plants and Society
7. **Environmental science**

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2018-19
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Session		**2018-19**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**Elective Paper-I**
		III
Title of the Paper	(English)	**PG-403: Environmental Science**
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Global distribution and Classification of climate (Koppen's classification); Climatic types and their distribution. Climate of India.**Climatic Factors (Light, Temperature, Water)** Soil types of India and **Soil type of World**	9
Unit-II	**Global warming and climate change**: Green house effect; consequences; responsible factors. Environmental Impact Assessment. Environmental management.	9
Unit-III	**Toxicology** : Radiation toxicants - Kinds, sources & biological effects. Chemical toxicants - Sources & biological effects of Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides. Bioremediation : Need , scope & technology .	9
Unit-IV	**Environmental Laws** : Goal, objectives and guiding principles of Environmental Laws; Indian Environmental Laws; National Environmental Policies ; Environmental priorities in India and sustainable development.	9
Unit-V	**Environmental Education and Organization** : Goal, objectives and guiding principles of Environmental Education ; Environmental Education in educational Institutes; Environmental organizations and agencies; Man and Biosphere Programme (MAB).	9

Suggested Practical exercises-

1. **Meteorological recording-**
   Determination of air temperature by Min.-Max. thermometer& humidity by hygrometer,Sling pschrometer .
   Determination of light intensity.
   Determination of clouds by Okta scale.
   Determination of wind velocity.
   Determination of precipitation by Rain Gauge.
   Determination of light penetration by Sachi disc.

2. **Non-conventional Bio-management of waste-**
   1. Planning of Root Zone treatment.
   2. Vermicomposting.

3. **Sampling for physico-chemical properties of water-**
   1. To measure temperature by thermometer.
   2. To measure pH by pH meter/pH indicator.
   3. To determine turbidity by turbidometer.
   4. To determine light intensity by photometer.
   5. To determine DO(dissolved oxygen) in eutrophic & oligotrophic water.
   6. To determine BOD(biological oxygen demand) of pond water.
   7. Determinetion of chloride/fluoride/nitrate/phosphate/hardness.

4. **Sampling for soil analysis-**
   1. To determine Nitrate, Phosphate, Carbonate,Potessium .
   2. To determine water holding capacity of soil.
   3. To determine organic matter content of soil.
   4. To determine bulk density and porosity of soil.

5.Exercises based on pollution-

- To study the foliar injuries of plants which are exposed to SO_2..
- To determine dust deposition on leaves of polluted and non polluted areas.
- To determine pH of plants growing in under polluted and non-polluted areas.
- To study environmental impact of a given developmental activity using checklist as AIE method.

The purpose of above practical exercises is to make the students aware of the issues related to environmental science specially global warming, climate change and impact on nature and for ecological services.

7. Study of Toxicants- Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides.
8. Study of Bioremidiation
9. Study of bioindicators

<u>SUGGESTED READINGS</u>

- **Smith. R.L. 1996.** Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- **Begon. M.. Harper, J.L. and Townsend, C.R. 1996**. Ecology. Blackwell Science. Cambridge.
- **Ludwig. J. and Reynolds. J.F. 1988**. Statistical Ecology. John Wiley & Sons.
- **Odum. E.P. 1971**. Fundamentals of Ecology. Saunders, Philadelphia.

- **Odum, E.P. 1983**. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- **Kormondy, E.J. 1996**. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- **Chapman, J.L. and Reiss, M.J. 1988**. Ecology: Principles and Applications. t::ambridge University Press, Cambridge, U.K.
- **Moldan, B. and Billharz, S. 1997**. Sustainability Indicators. John Wiley & Sons, New York.
- **Treshow. M. 1985**. Air Pollution and Plant Life. Wiley Interscience.
- **Heywood, V.H. and Watson. R.T. 1995**. Global Biodiversity Assessment. Cambridge University Press.
- **Mason, C.F. 1991.** Biology of Freshwater Pollution. Longman. 'Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .
- **Brady, N.C. 1990**. The Nature and Properties of Soils. MacMillan.
- **Mason, C.F. 1991**. Biology of Freshwater Pollution. Longman. '
- **Hill. M.K. 1997**. Understanding Environmental Pollution. Cambridge University Press. .
- **Kothari, A 1997**. Understanding Biodiversity: Life'Sustainability and Equity. Orient Longman.
- **Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994**. Tree Directory of Chandigarh. Lovedale Educational, New Delhi.
- **Nair, M.N.B. et. al (Eds) 1998**. Sustainable Management of Non-wood Forest Products. Faculty of Forestry, Universiti Putra Malaysia. 434004 PM Serdong, Selangor, Malaysia.
- **Rodgers, N.A. and Panwar, H.S. 1988**. Planning a Wildlife Protected Area Network in India. Vol. 1. The Report. Wildlife Institute of India, Dehradun.
- **Walter, K.S. and Gillett, H.J. 1998. 1997** IUCN Red List of Threatened Plants. IUCN, the World Conservation Union. IUCN, Gland, Switzerland, and Cambridge,

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(As Recommended by the Board of Studies)
2018-19
Theory / Practical

Session		**2018-19**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG 404: Elective Paper-II**
		IV
Title of the Paper	(English)	
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers II

1. Plant protection
2. Bioinformatics and computer applications and Biostatistics
3. Molecular biology and biotechnology
4. Pollution Ecology
5. **Ethnobotany**

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2018-19
Theory / Practical

Session		**2018-19**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**Elective Paper- 404**
		IV
Title of the Paper	(English)	**Ethnobotany**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Definition and scope of Ethnobotany Historical review and outline idea of archaeoethnobotany. Ethnoecology, Ethnomedicines, Ethnonarcotics, Ethnopharmacology, Ethnotaxonomy, Ethnocosmetics, Ethnolinguistics, Ethnoorthopaedics, Ethnopaediatrics.	9
Unit-II	Preservation of Genetic diversity, plants used in various systems of medicines, Ayurvedic, Unani, Homoeopathic and Allopathic systems. Plants used by villagers and tribal people. Role of ethnobotany in the development of Society.	9
Unit-III	**Ethnobotanical importance of :***Aconitum napellus, Allium cepa, Mentha arvensis, Allium sativum, Nux-vomica, Aloe vera, Ocimum sanctum, Atropa belladona, Azadirchta indica, Piper nigrum, Butea monospera, Pterocarpus marsupium, Terminalia bellerica, Terminalia arjuna, Terminalia chebula , Eugenia aromatica, Eugenia jambolana, Hollarrhena antidysenterica, Withania somnifera, Lawsonia inermis.*	9
Unit-IV	**Ethnobotanical importance of**: Cassia *fistula, Cannabis sativa, Ricinus communis, Emblica officinalis, Santalum album.* Plants in mythology, Taboos and Totems in relation to plants, folklore and folk tales, Wild life protection by tribal, plants domestication by the tribals. Plants in similes and metaphors.	9
Unit-V	Detailed study of the common plants and their parts used in the treatment of following diseases:Expulsion of worms, Skin diseases, Bronchial inflammation and Asthma, Tuberculosis, Urino - genital problems, Amoebic dysentery, Malaria, Rheumatism, Leprosy, Jaundice, Heart diseases, Piles, Leukoderma.	9

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

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As Recommended by the Board of Studies
2018-19
M.Sc. Botany

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Investigation of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR
28. Somatic Hybridization
29. Biofertilizers and Bioinoculants
30. Transgenics
31. Exploitation of Rhizospheric microbes including mycorrhizae
32. Recycling of domestic, municipal and industrial wastes
33. Vermicomposting and Biomethanation
34. Environmental Monitoring
35. Assessment of Pollution in different habitats

List of Journals-

1. Indian journal of Multidisciplinary Research-CMRA Kerala.
2. National journal of Life Science.
3. International Journal of Biotechnology.
4. Journal of Biotechnology
5. Pollution Research.
6. Science Reporter.
7. University New- UGC.
8. Acta Botanica.
9. Acta Ecologica.
10. Tropical Ecology.
11. Annual Review of Plant Physiology and Molecular Biology.
12. Current Advance in Plant Science.
13. Nature Review: Molecular and Cell Biology.
14. Indian journal of Biotechnology (NISCAIR New Delhi).

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Under Graduate ANNUAL Pattern of Syllabus of Botany
Syllabus of Botany
(As Recommended by the Board of Studies)
Practical scheme 2018-19(based on Paper I&II)

B.Sc. I Year

M.Marks-50

B.Sc. I Year Practical Objectives :-

i) To develop the skills of staining and observation of lower organism.

ii) To impart the skills of temporary and permanent slide preparations.

iii) To enhance ability to identify the lower organisms using microscope.

iv) To familiarize the students with diseases and their causative agents.

B.Sc. I Year- Scheme of practical examination based on paper I&II

Time: 4 hrs Marks: 50

Q.1 Algae/Fungi ---------- 05
Q.2 Bryophyta/Pteridophyta---------- 05
Q. 3 Gymnosperms---------- 10
Q. 4 Taxonomy ---------- 10
Q. 5 Spotting (1 to 5) ----------10
Q. 6 Viva----------05
Q. 7 Sessional ---------- 05

Total 50

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Under Graduate ANNUAL Pattern of Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19
Practical Scheme 2017-18

B.Sc. II Year
Practical Exercises + Scheme based on paper I&II

Practical Objectives :

i) To provide skills of section cutting of angiosperms.
ii) To provide field experiences for studying sources of fire woods, timber yielding and medicinal plants.
iii) To familiarize the students with morphology,embryology and anatomy of flowers.
iv) To provide the knowledge of sexual reproduction.
v) To enable the students to understand the plant in relation to environment.
vi) To develop the knowledge of different types of vegetation.
vii) To familiarize the students with conservation practices.
vii) Mapping of phytogeographical regions of India and National parks of M.P.

Time: 4 hrs **Marks: 50**

1. Section Cutting – Root/Stem/Leaf	**-**	**10**
2. Embryology-Anther/Ovule/Placentation	**-**	**10**
3. Exercise based on Ecology	**-**	**10**
4. Exercise based on Phytogeography/National Parks	**-**	**05**
5. Spotting (01 - 05)	**-**	**10**
6. Viva Voce	**-**	**05**
7. Sessionals	**-**	**05**
	Total-50	

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19

BOTANY PRACTICAL EXERCISES + SCHEME

B.Sc. Semester-V

Maximum 50 Marks

Question 1. Any two exercise from below mentioned list 20

Exercise 1.Preparation of solution of specific Normality, Molal and Molar solutions.
Exercise 2. Exercises related on osmosis and osmotic relation.
Exercise 3. Exercises related transpiration.
Exercise 4. To separate pigments by Paper Chromatography.
Exercise 5. To perform the exercise of Photosynthesis and Respiration.
Exercise 6. To perform biochemical test for carbohydrate, lipid and protein.
Exercise 7. To extract Enzyme for any plant part and demonstrate its activity.

Question 2.Comment on any technique related to Biotechnology 05

Question 3. Spotting 10

Question 4. Viva-Voce 05

Question 5. Sessional 10

Total **50**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19

Theory / Practical

BOTANY PRACTICAL EXERCISES + SCHEME
B.Sc. Semester-VI
2018-19 Maximum 50 Marks

Practical Work

Objectives

i) To impart understanding of internal cell structures and their organization.
ii) To develop the skills for the preparation of smear for study of cell division.
iii) To develop the skills for the understanding of mendel's law.
iv) To impart the skills of isolation of DNA.
v) To familiarize the students with the technique of micro propagation and isolation of protoplast.

Semester-VI Scheme of practical examination

Time: 4 Hrs	Marks:50
1.Exercise Based on cell division (Mitosis/Meiosis)	10
2.Exercise Based on Genetic problem	5
3.Study of Cell and Cell inclusions	5
4.Exercise based on Biotechnology	5
5 Spotting (1-5)	10
6.Viva – Voce	5
7. Sessional	10

Total	**50**

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19
M.Sc Botany (Semester system)
SEMESTER-I
Practical scheme for Part-I
(Based on Course PG 101 and 102)

M.M-100 **Time 4 Hrs**

Exercise –

1. **Prepare a slide of given material A (fungi). Draw well labelled diagrams. Identify giving reasons……. 16**
2. **Bacterial Staining …..... . 10**
3. **Prepare slide of given material B (Algae) , Draw well labelled diagrams. Identify three algae with giving reasons…… 24**
4. **1 to 10 spot……. 20**
5. **Viva Voce…… 10**
6. **Sessional…… .. 20**

Total 100

M.Sc Botany SEMESTER –I
Practical scheme for Part-II
(Based on Course PG 103 and 104)

M.M-100 **Time 4 Hrs**

Exercise –

1. **Prepare a slide of given material A (Bryophyte). Draw well labelled diagrams. Identify giving reasons……. 15**
2. **Prepare a slide of given material B (Pteridophyte). Draw well labelled diagrams. Identify giving reasons 15**
3. **Monographic study of given material C (Gymnosperm). Draw well labelled diagrams. Identify giving reasons 20**
4. **1 to 10 spot……. 20**
5. **Viva Voce……. 10**
6. **Sessional……. 20**

TotalS **100**

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
Shivaji Nagar, Bhopal
Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2018-19
M.Sc (Previous) Botany
SEMESTER-II
Practical scheme for Part-I (Based on PG 201 and 202)

M.M-100 **Time 4 Hrs**

1. **Exercise based on Cell Biology……..….. 15**
2. **Exercise based on Cytogenetics…… 10**
3. **Study of Anther / Ovule / Seed…… 15**
4. **Demonstration of Emasculation Tech…… 10**
5. **Spot 1 to 10…….. 20**
6. **Viva-Voce……..... 10**
7. **Sessional and Records……. 20**

Total 100

M.Sc (Previous) Botany

SEMESTER-II

Practical scheme for Part-II (Based on PG 203 and 204)

M.M-100 **Time 4 Hrs**

Exercise –

1 .Exercise based on Physiology (major)…….…… 15
2 .Exercise based on Physiology (minor)……..…… 10
3. Exercise based on ecology (community study)……..... 10
4**. Exercise based on ecological adaptation…… …..……. 15**
5**. Spotting 1 to 10…….…..…..…... 20**
6. Viva-Voce……..…... 10
7. Sessional and Records…….……. 20

……..
Total 100

Sarojini Naidu Govt. Girls P.G. (Autonomous) College
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As Recommended by the Board of Studies
2018-19
M.Sc. SEMESTER- III
Botany Practical Part-I
Practical Scheme
(Practical based on PG 301 & 302)

MM – 100 ***Time :- 4 hrs***

Execises :-

1. Exercise based on Taxonomy
   (Study of given plant up to genus level)----------15
2. Exercise based on Morphology
   (Study of stamens/ carpels/ placentation) ---------- 10
3. Exercise based on Molecular Biology ---------- 15
4. Exercise based on Plant Breeding ---------- 10
5. Spot 1 to 10---------- ---------- 20
6. Viva-Voce ---------- 10
7. Sessional & Record ---------- 20

TOTAL 100

M. Sc. Botany (Semester System)

Third Semester
Practical scheme for Part - II
(Based on course PG 303 & 304)

Time :- 5 hrs. ***MM - 50***

Exercises :-

1. Exercise based on Physiology---------- 15
2. Exercise based on Biochemistry and Metabolism---------- 10
3. Exercise based on Ecology of
   Food/Forage/Fodder/Medicinal Plants ---------- 15
4. Report on field survey ---------- 10
5. Spot 1 to 10 ---------- ---------- 20
6. Viva-Voce ---------- 10
7. Sessional & Record ---------- 20

TOTAL 100

Sarojini Naidu Govt. Girls P.G. (Autonomous) College

Shivaji Nagar, Bhopal

As Recommended by the Board of Studies

2018-19

M.Sc Botany SEMESTER-IV

Botany Practical Part -I

Practical Scheme

(Practical based on PG 401 & 402)

Time : 4 hrs **Botany Practical-I Scheme (Practical based on PG 401 & 402)**

MM 100 **Time : 4 hrs**

Exercises

1. Exercise based on Biotechnology…… 15
2. Exercise based on Tissue culture …… … 10
3. Exercise based on Applied Botany…… 15
4. Exercise based on Instrumentation …… … 10
5. Spot 1 to 10 …… 20
6. Viva-Voce …… 10
7. Sessionals and Record …….. 20

……

100

Practical Base on the Course Code 403: Elective-I Course Code 404: Elective-II

2018-19

M.Sc Botany SEMESTER-IV

Botany Practical Part -II

Botany Practical Scheme (Practical based on PG 403 & 404)

MM 100 Time : 4 hrs

Exercises

1. Major Exercise based on Elective - I …….. 15
2. Minor Exercise based on Elective - I…….. 10
3. Major Exercise based on Elective - II …….. 15
4. Minor Exercise based on Elective - II…….. 10
5. Spot 1 to 10 …… 20
6. Viva-Voce …… 10
7. Sessionals and Record …….. 20

……

100

SAROJINI NAIDU GOVT. GIRLS P.G. (AUTONOMOUS) COLLEGE
SHIVAJI NAGAR, BHOPAL

Syllabus of Botany

As Recommended by the Board of Studies
2019-20

Sarojini Naidu Govt. Girls' P. G. (Autonomous) College

Shivaji Nagar, Bhopal – 462016

Syllabus

2019-2020

Subject: BOTANY

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Date of submission in Autonomous Examination cell:

Signature H.O.D.

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(As Recommended by the Board of Studies)
2019-20
Theory / Practical
M.Sc. Botany

First Semester

Course No.	Name of the Course	Total
PG 101	Biology& Diversity of Virus,Bacteria & Fungi	70 + CCE 30 = 100
PG 102	Biology and Diversity of Algae	70+ CCE 30 = 100
PG 103	Biology & Diversity of Bryophyta and Pteridophyta	70 + CCE 30= 100
PG 104	Biology and Diversity of Gymnosperms	70+ CCE 30 = 100
PG 105	Practical I – based on Course PG 101 & 102	100
PG 106	Practical II – based on Course PG 103 & 104	100
	Project work related to course Paper	50
	Total	**650**

Second Semester

Course No.	Name of the Course	Total
PG 201	Cell Biology and Genetics	70 + CCE 30 = 100
PG 202	Plant Development & Reproduction	70 + CCE 30 = 100
PG 203	Plant Physiology-I	70 + CCE 30 = 100
PG 204	Plant Ecology-I	70 + CCE 30 = 100
PG 205	Practical I – based on Course PG 201 & 202	100
PG 206	Practical II – based on Course PG 203 & 204	100
	Project work related to course Paper	50
	Total	**650**

M.Sc. Botany

Third Semester

Course No.	Name of the Course	Total
PG 301	Systematic of Angiosperms	70 + CCE 30 = 100
PG 302	Molecular Biology and Plant Breeding	70 + CCE 30 = 100
PG 303	Plant Physiology, Biochemistry and Metabolism	70 + CCE 30 =100
PG 304	**Plant** Ecology-II (Conservation & Utilization of Plant Resources)	70 + CCE 30 =100
PG 305	Practical I – based on Course PG 301 & 302	100
PG 306	Practical II – based on Course PG 303 & 304	100
	Project work related to course Paper	50
	Total	**650**

Fourth Semester

Course No.	Name of the Course	Total
PG 401	Biotechnology and Tissue Culture	70 + CCE 30 = 100
PG 402	Applied Botany & Instrumentation	70 + CCE 30 = 100
PG 403	Elective Paper- I*	70 + CCE 30 =100
PG 404	Elective Paper- II*	70 + CCE 30 =100
PG 405	Practical I – based on Course PG 401 & 402	100
PG 406	Practical II – based on Course PG 403 & 404	100
	Internship Training	**100**
	Total	**700**

Note: Excursion is compulsory for all students (local) in Previous and Final year.

* List of Elective Papers are enclosed.

Signature with date

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Session		**2019-20**
Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 101
		Paper-I
Title of the Paper	(English)	**: Biology & Diversity of Viruses, Bacteria and Fungi**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	**Syllabus**	**Period**
Unit-I	Virus: characteristics, classification and ultrastructure, Isolation and Purification of viruses; chemical nature, replication, transmission of viruses, economic importance of viruses.	9
Unit-II	General characteristics, ultrastructure, nutrition and reproduction, biology and economic importance of Archaebacteria and Eubacteria. General characteristics of Cyanobacteria, Actinomycetes Mycoplasma, Rickettsiae, Chlamydiae.	9
Unit-III	General characteristics, classification of fungi substrate relationship in fungi, reproduction, heterothallism, parasexuality, Economic Importance of fungi (fungi in industries, medicine, as food**,** symptoms & signs of Fungal Diseases in Plants and fungal diseases in Humans - Dermatophytes), fungus as biocontrol agent, mycorrhiza.	9
Unit-IV	General characteristics of Mastigomycotina-Synchytrium, Saprolegnia, Pythium, Phytophthora, Peronospora, Sclerospora. General characteristics of Zygomycotina –Rhizopus, Pilobolus. General characteristics of Ascomycotina-Yeast, Taphrina, Penicillium, Erysiphe, Phyllactinia, Uncinula, Chaetomium, Peziza, Morchella.	9
Unit-V	General characteristics of Basidiomycotina- Puccinia, Melampsora, Ustilago, Agaricus, Geastrum. General characteristics of Deuteromycotina- Alternaria, Curvularia Cercospora, Colletotrichum	9

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of reproductive members of fungi and cynobacteria : Peronospora, Albugo, Mucor, Pilobolus, Yeast, Chaetomium, Morchella, Agaricus, Melampsora curvularia, Polyporus, Phoma, Penicillium, Fusarium, Rhizopus, Asprgillus, Colletotrichum, Nostoc, Anabaena, Gleotrichia, Rivularia, Microcystis, Oscillatoria, Lyngbya.**
2. **Symptomatology of some diseased specimens: White rust, Downy mildew, Powdery mildew, Rusts, Smut, Ergot, Groundnut leaf spot , Red rot of sugarcane, Wilts, Paddy Blast, Citrus canker, Bacterial blight of paddy, Angular leaf spot of cotton, Tobacco mosaic, Little leaf of brinjal, Mango malformation, Leaf curl of papaya.**
3. **Gram staining of Bacteria.**
4. **Sterilization methods, preparation of media and stains.**
5. **Isolation of microbes from soil, water and air.**

SUGGESTED READINGS

- Alexopoulus, C.J. Mims, C. W. and Blackwel, M; 1996: Introductory coO' Mycology, Jbon Wjley & Sons Inc.
- Clifton, A; 1958: Introduction to Bacteria, Mcgraw- Hills Book Co.New Delhi.
- Madigan, M T. Martinko, J. M and Parker Jack; I 997: Brock Biology Of Microorganisms, (8th edition) Prentice Hall, N,J. U.S.A
- Mandahar, C. L.; 1978: Introduction to Plant Viruses. Chand & Co.Ltd. Delhi.
- Mehrotra, RS. and Aneja, RS.; 1998: An Introduction to Mycology. New Age Intermediate Press.
- Rangaswamy, G. and Mahadevan, A; 1999: Diseases of Crop Plants in Indja (4th edjtjon).PrentjceHaJl ofInilia Ltd. New Delbj.
- Webster, J.; 1985: Introduction to Fungi Cambridge University Press. Dubey, R C. & Maheshwari, D. K.; 2005: A Text Book of Microbjology, S. Chand Publisher, New Delh

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Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 102
		Paper-II
Title of the Paper	(English)	**Biology & Diversity of Algae**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General characteristics of Algae; Classification of algae, diversified habitats, thallus organization, cell ultrastructure, reproduction, pigments, reserve foods, types of flagella, Economic importance of Algae.	9
Unit-II	General characteristics of Chlorophyta and Charophyta-Chlamydomonas, Pandorina, Eudorina, Chlorella, Hydrodictyon, Pediastrum, Ulothrix, Cladophora, Draparnaldiopsis, Spirogyra, Zygnema, Bryopsis and Nitella	9
Unit-III	General characteristics of Xanthophyta: Botrydium, Vaucheria. General characteristics of Bacillariophyta: Diatoms (Pennularia). General characteristics of Euglenophyta: Euglena.	9
Unit-IV	General characteristics of Phaeophyta : Ectocarpus, Dictyota, Laminaria, Fucus, Sargassum	9
Unit-V	General characteristics of Rhodophyta: Porphyra, Batrachospermum, Gelidium, Cryptonemia, Rhodymenia, Polysiphonia.	9

SUGGESTED LABORATORY EXERCISES

1. **Morphological study of representative members of Algae**
2. **Algae :- Volvox, Pandorina, Chara, Nitella, Oedogoneum, Spirogyra, Zygnema, Coleochaete, Chaetophora, Hydrodictyon, Ulva, Pithophora , Stigloclonium , Draparnaldiopsis , Clostridium , Cosmarium , Valonia , Vaucharia , Botydium, Dictyota , Padina , Laminaria , Saragassum, Fucus , Cutleria , Porphyra , Batrachospermum , Gracillaria, Polysiphonia**
3. **Study of algae as Biofertilizers, algal bloom.**
4. **Study the role of algae in Eutrophication.**
5. **Culture technique of Algae**

SUGGESTED READINGS

- Smith G. M. Cryptogamic Botany VoL I(1st edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Kumar H. D. 1988: Introduction to Phycology. Affiliated East-West Press Ltd.
- Prescott,G.W.,1969. The Algae:A review . Butler &Tanner Ltd., From & London
- Chapmam & Chapman, The Algae
- Sharma O.P.,The Algae
- Gangulee, H.C. &Car ,A.K. Vol. I&II ,1989, College Botany, Books & allied(P Ltd. , Calcutta
- Fritsch, F.E. , Vol.I, 1965, The Structure and Reproduction of the Algae,The Syndics of Cambridge university Press

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Semester		**I**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 103
		Paper-III
Title of the Paper	(English)	**Biology & Diversity of Bryophyta& Pteridophyta**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit-I	General Characteristics, classification , Morphology, reproduction and life history, distribution, Origin, Evolution& Affinities, Ecology and Economic importance of Bryophytes. Contribution to Bryophyta in India	9
Unit-II	General Characteristics of Hepaticopsida-Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Sphaerocarpus, Pellia, Porella. General Characteristics of Anthocerotopsida-Anthoceros, Notothylas. General Characteristics of Bryopsida-Sphagnum, Polytrichum.	9
Unit-III	General characteristics of Pteridophyta; Classification, origin, telome theory, stelar organization, Homospory, Heterospory and Seed Habits, Reproduction , Indian contribution to Pteridophyta, Paleobotany and Geological Time-Scale, types of fossils.	9
Unit-IV	General characteristics of Psilophyta-Rhynia, Horneophyton, Zosterophyllum, Psilophyton, Asteroxylon, Psilotum, Tmesipteris. General characteristics of Lycophyta- Lycopodium, Protolepidodendron, Lepidodendron, Isoetes, Selaginella.	9
Unit-V	General characteristics of Sphenophyta-Eqisetum, Hyenia, Calamites, Paleostachys, Calamostachys, Sphenophyllum. General characteristics of Pterophyta-Ophioglassum, Osmunda, Gleichenia, Pteris, Lygodium, Marsilia, Salvinia, Azolla.	9

SUGGESTED READINGS

- Smith G. M. Cryptogamic Botany VoLII I(2nd edition)~ TataMcGraw-Hill Publishing Company Ltd. Bombay -New Delhi.
- Brower- 1926: Primitive Land Plants~ Cambridge At the University Press.
- Kashyap- 1972 LiveIWorts of Western Himalayas and Punjab. Researchco Publication.
- Puri P. 1980~ Bryophyta -Morphology, Growth & Differentiation. Atma Ram & Sons, Delhi.
- Chopra & Kumara- 1988: Biology of Bryophyta; Wiley Eastern Ltd.
- Ram Udar; 1970: An Introduction to Bryophyta; Shashidhar Malviya Prakashan.
- Watson; 1968: Structure and life of Bryophyta; Hutchinson & Co. Ltd.
- Campbell; 1939: The evolution of land plants; Stanford University.
- Sporne, K.R. 1991. The Morphology of Pteridophyta
- Parihar N.S. 1996 Biology and Morphology of Pteridophytes, CentralBook Depot. Allahabad.
- Arnold C. A; An Introduction to Paleobotany; Tata Mc Graw –Hill Publishing Co. New Delhi.
- Stewart, W. N. and RathweIL G. W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press.
- Eames A J.; Morphology of Vascular Plants-Lower Groups.Tata Mc Graw -Hill Publishing Co. New Delhi
- Rashid A. 1999; An introduction to Pteridophytes; Vikas Publishing House Pvt. Ltd..
- Gangulee & Kar College Botany Vol II

SUGGESTED LABORATORY EXERCISES

1. **Morphological & Anatomical study of representative members of the Bryophyta:** Riccia, Marchantia, Targionia, Dumortiera, Cythodium, Plagiochasma, Pellia, Porella, Anthoceros, Notothylas, Sphagnum, and Polytrichum.
2. **Morphological & Anatomical study of representative members of the Pteridophyta** :- Psilotum , Isoetes , Lycopodium , Sellagena , Ophioglossum , Osmunda , Lyathia , Marsilea , Salvinia , Azolla , Gleichenia, Dryopteris, Alsophilla, Study of fossil members.

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Class		M.Sc.
Semester		**I**
Subject	(English)	**Botany**
Paper		PG – 104
		Paper-IV
Title of the Paper	(English)	**Biology & Diversity of Gymnosperms**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	General Characteristics and Classification of Gymnosperms, Distribution of Gymnosperms in India, Economic Importance, Evolutionary tendencies in Gymnosperms. Indian contribution to Gymnosperms – Dr. Birbal Sahni, Dr. P. Maheshwari & Dr. M.S. Swaminathan.	9
Unit-II	General Characteristics of Fossil Gymnosperms (Pteridospermales) - Lyginopteris, Medullosa, Glossopteris, Pentoxylon, Caytonia.	9
Unit-III	General Characteristics of Cycadeoidales, Cycadales, Bennettitales-Williamsonia, Cycadeoidea: Cycas, Zamia, Nilssonia.	9
Unit-IV	General Characteristics of Ginkgoales, Cordaitales & Coniferales-Ginkgo biloba, Cordaites, Cedrus, Pinus, Araucaria, Cryptomeria, Thuja, Cupressus Podocarpus, Taxus.	9
Unit-V	General Characteristics of Ephedrales- Ephedra. General Characteristics of Welwitschiales- Welwitschia. General Characteristics of Gnetales- Gnetum.	9

SUGGESTED LABORATORY EXERCISES

1. Monographic study of following :- Cycas , Ginkgo , Cedrus , Abies , Picea , Cupressus , Araucaria , Cryptomeria , Taxodium , Podocarpus , Agathis , Taxus , Ephedra and Gnetum.
2. Study of important fossil gymnosperm from prepared slides and specimens.

SUGGESTED READINGS

- Bhatnagar, S.P. and Moitra, A; 1996: Gymnosperms. New Age International Pvt. Ltd., New Delhi.
- Singh H.; 1978: Embryology of Gymnosperms, Encyclopedia of Plant Anatomy X. Gebruder Bortraeger, Berlin.
- Spome K R; 1991: The Morphology of Gymnosperms; Hutchinson Univ. Library; London.
- Foster A S. & Gifford E. M; Comparative morphology of vascular Plants; Vakils, Feffer, & Simons Private Ltd. Bombay. Chamberlain; Gymnosperms -Structure & Evolution; CBS Publishers & Distributors Delhi.
- Shukla A C. & Mishra S. P.; Essentials of Paleobotany; Vikas Publishing House Pvt. Ltd. Delhi-Bombay-:6angalore-Calcutta-Kanpur .

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Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 201
		Paper-I
Title of the Paper	(English)	**Cell Biology and Genetics**
	(हिन्दी)	कोशिका विज्ञान एवं आनुवांशिकी
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Structure and organization of plant cell, Structure and functions of cell wall, Plasma membrane, Ion carriers, channels and pumps, Receptors, Plasmodesmata, Sites for ATPases.	9
Unit-II	Structure and function of Cell organelles: Chloroplast, Mitochondria, Vacuole, Endoplasmic Reticulum, Lysosomes, Ribosome, Golgi body.	9
Unit-III	Structure and Function of Nucleus ,Nucleosome, Chromosome structure and packaging of DNA, Euchromatin and heterochromatin, karyotype , banding patterns, specialized types of chromosomes.	9
Unit-IV	Cell division, Cell cycle, Programmed cell death, Structural changes in Chromosomes(Duplication, Deficiency Inversion and Translocation), Numerical changes in chromosomes(Aneuploids and Euploids, haploids)	9
Unit-V	Mendel's Laws, Genetics of Mitochondria and Chloroplast polygenetic inheritance, crossing over and linkage, Transposable elements.	9

SUGGESTED LABORATORY EXERCISES

1. Isolation of plant DNA and its quantitaion by a spectrophotometric method.
2. Isolation of RNA and quantitaion by a spectrophotometric method.
3. Demonstration of SEM and TEM.
4. Isolation of Mitochondria and the activity of its marker enzyme, succinate dehydrogenase (SDH).
5. Isolation of chloroplasts and SDS-PAGE. Profile of proteins to demarcate the two submits of Rubisco.
6. Demonstration of Mitosis.
7. To determine Mitotic Index in onion root tip cells.
8. Demonstration of Meiosis (normal) in Tradeshcantia.
9. Demonstration of abnormal meiosis.
10. Demonstration of special types of chromosomes.
11. Preparation of karyotype and Idiogram.
12. Calculation of Nucleo Cytoplasmic Index of onion/garlic root tip with the help of micrometric method.

Section the following Review Journals:-

1. **Annual Review of plant physiology and Molecular Biology.**
2. **Current Advances in Plant Sciences.**
3. **Nature Reviews: Molecular and Cell Biology.**

SUGGESTED READINGS

Lewin, B. 2000, Genes VIL Oxford University Press, New York.

Alberts, B., Bray, D., Lewis, J., Ratf, M., Roberts, K., and Watson, J.D. Molecular Biology of the Cell. Garland Publishing:Inc., New York.

Wolfe, S.L. 1993. Molecular and Cellular Biology, Wadsworth Publishing Co., California, USA

Rost, T. et: aI. 1998.PIant Biology, Wadsworth Publishing Co., California, U.S.A

Krishanmurthy K V. 2000 Methods in Cell Wall Cytochemistry, CRC Press, Boca Raton, Florida U.S.A

Buchanan, B.B. Groissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA

De, D.N. 2000: Plant Cell Vacuoles: An Introduction. CSIRO Publication, ColliJ18W~ Australia.

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Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 202
		Paper-II
Title of the Paper	(English)	**Plant Development & Reproduction**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Organization of the higher plant body: shoot and reproductive meristem, Tissue system, Shoot apical meristem (SAM), Root apical meristem, Lateral meristem. Control of tissue differentiation especially xylem and phloem, Lateral root and root hair.	9
Unit-II	Development of Shoot, Secondary growth in stem, primary and secondary anomaolus structure of stem. Origin, development, differentiation, arrangement, diversity, venation, modification and anatomy of leaves.	9
Unit-III	Flower development, floral organ differentiation, homeotic mutants in *Arabidiopsis* and *Antirrhinum*, Androecium, Microsporangium, Microsporogenesis, role of tapetum, Male gametophytes and their development, Pollen storage,Pollen allergy and Pollen enbryos, Male sterility.	9
Unit-IV	Gynoecium: structure of Megasporangium, Ovule development, Types and development, Megasporogenesis, organization of Embryo sacs, Pollination Mechanisms and vectors, Self incompatibility.	9
Unit-V	Double fertilization: Endosperm development, embryogenesis, storage proteins of endosperms and embryo. Fruit growth: biochemistry and molecular biology of fruit maturation. Seed growth and their dispersal, Polyembryony, apogamy and apomixes.	9

SUGGESTED LABORATORY / FIELD EXERCISES

1. **Effect of gravity, unilateral light and plant growth regulators (PGRs) on the growth of young seedlings.**
2. **Role of dark and light on the expansion of cotyledons and epicotylar hook opening in pea.**
3. **Study of cytohistological zonation in the shoot apical meristem (SAM) in sectioned and double strained permanent slides of suitable plant such as Coleus , Tobacco.**
4. **Study of shoot apices in a monocotyledon in both TS and LS to show the origin and arrangement of leaf Primordia.**
5. **Study of phyllotaxy of various plant species.**
6. **Anatomy of leaf available locally.**
7. **Study of trichomes, glands in few species Osimum , Azadirecta Indica , Plumbago , Eucalyptus etc.**
8. **Study of morphology pollengrains of different species.**
9. **Study of pollen germinations and test for pollen viability using strains**
10. **Study of microsporogenesis and gametogenesis in section of Anthers.**
11. **Pollen storage, pollen pistil interaction, self incompatibility In- vitro pollination.**
12. **Study of monosporic, bisporic and tetra sporic type of embryosac.**
13. **Emasculation , bagging and hand pollination to study pollen germination seed set and fruit development using self compatible and obligate outcrossing systems.**
14. **Suitable seeds and polyembryony in Citrus , Jamun , etc by dissection.**

SUGGESTED READINGS

- Bhojwani,S.S.and Bhatnagar,S.P.2000. The Embryology of Angiosperms(4th revised and enlarged edition). Vikas Publishing House,New Delhi.
- Burgess.J.1985.An introduction to Plant Cell Development.Cambridge University Press, Cambridge.
- Fageri,K.and Van der Pijl,L1979. The Principles of Pollination Ecology .Pergamon Press, Oxford.
- Fahn, A 1 982.Plant Anatomy.(3rd edition).Pergamon Press,Oxford.
- F osket, D .E.1994 .Plant Growth and Development. A Molecular Approach.Academic Press, San Diego.
- Howell, S.H.1998. Molecular Genetics of Plant Development, Cambridge University Press, Cambridge.
- Leins,P., Tucker,S.C.and Endress,P .K.1988.Aspects of Floral Development. J. Cramer, Germany.
- Lyndon, R.F.1990.Plant Development. The Cellular Basis. Unin Hyman .London.
- Murphy, T. M. and Thompson, W. E. 1988 Molecular Plant Development. Prentice Hall, New Jersey.
- Proctor, M. and Yeo,P.1973.The Pollination of Flowers. William Collins Sons, London.
- Raghvan, V .1997 .Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridge.
- RaghVan, V. 1999. Development Biology of Flowering P Jants. Springer-verlag.
- Atwell, B. J., Kriedermann, P.E. and Jurnbull, C.G.N.(eds)1999.PIants in Action: Adaptation in Nature, Perfonnance in Cultivation, MacMillan Education, Sydney, Austr

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Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 203
		Paper-III
Title of the Paper	(English)	**Plant Physiology-I**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Principles of thermodynamics, Free energy and redox potential, Plant water relation, mechanisms of water absorption, water transport through xylem, Transpiration, root-microbe interactions in facilitating nutrient uptake, Mineral nutrition, Membrane transport protein.	9
Unit-II	Phloem transport, Signal transduction, receptors and G-proteins, phospholipids signaling, Role of cyclic nucleotide, calcium-calmodulin cascade.	9
Unit-III	Plant growth regulators and elicitors: Physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, bracinosteroids, polyamines, jasmonic acid, and salicylic acid, Hormone receptors.	9
Unit-IV	Flowering process: Floral induction and development, photoperiodism and its significance, endogenous clock and its regulation, Movement, Phytochrome and cryptochrome, their photochemical and biochemical properties, Molecular mechanism of action of photomorphogenic receptors, Vernalization.	9
Unit-V	Stress physiology: Plant response to biotic and abiotic stress, Water deficit and drought resistance, Salinity stress and resistance, Concepts of freezing, heat stress and oxidative stress.	9

SUGGESTED LABORATORY EXERCISES

1. Radioisotope methodology, autoradiography, instrumentation (GM counter & scintillation counter) and principles involved.
2. Principles of colorimetry, Spectrophotometry and florimetry.
3. Study of physiological stress in terms of Water, light and tempreture.
4. Determine rate of transpiration by Ganong's potometer.
5. Determine rate of transpiration by Gravimetric Method.
6. Demonstration of the effect of light intensity and wind velocity on the rate of transpiration by Ganong's potometer.
7. To Study the comparision between stomatal and cuticular transpiration by Cobalt Chloride Method and Four Leaf Method.
8. To Study the comparision between evaporation and transpiration and find out T/E ratio.
9. Bioassay of plant hormones- auxins, ethylene, GA, ABA and Cytokinin.
10. To study the effect of auxins (IAA/IBA/BAP/NAA) on plant tissue culture.
11. To study the effect of auxins (IAA/IBA/BAP/NAA) on seed germination.
12. To determine stomatal index (SI), stomatal frequency.
13. To demonstrate the presence of Phosphate in plant tissue.
14. To study the effect of Auxin on Shoot /root growth.
15. To study the effect of cytokinin Shoot /root growth.
16. Hydroponic study
17. To compare the rate of transpiration in an ABA treated leaf normal leaf.

Suggested readings

- **Hopkins, W.G. 1995**. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- **Moore, T.C. 1989**. Biochemistry and Physiology of Plant Hormones (second edition). Springer -Verlag, New York. USA.
- **Nobel, P.S. 1999**. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz l and Zeiger E1998** Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Theory / Practical

Session		**2019-20**
Class		M.Sc.
Semester		**II**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG – 204
		Paper-IV
Title of the Paper	(English)	**Plant Ecology-I**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Introduction, division of plant Ecology, Ecosystem component (abiotic and biotic), Factors(light, temperature, water), Population Ecology, Inter and intra specific competition and self regulation. **Biostatistic**s: mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test)	9
Unit-II	Community organization: Concepts of community and continuum, analysis of community (analytical and synthetic characters), Community coefficients, Association (negative and positive associations), Concept of ecological niche, Concept of Biodiversity evolution and differentiation of species , allopatric and sympatric speciation, Ecads and Ecotypes.	9
Unit-III	Ecosystem development and stability: Temporal changes(cyclic and non cyclic), Succession processes & types, Mechanism of succession, facilitation, tolerance and inhibition models, Concept of climax, persistence , Ecological stability concept(resilience and resistance), Ecological perturbation natural and anthropogenic and their impact on plants and ecosystem,Ecosystem restoration.	9
Unit-IV	Fate of energy and matter in Ecosystems: Trophic organization(ecological pyramids) and structure, Food chains & food webs, Ecological energetics, energy flow pathways, Ecological efficiencies, consumption, assimilation and production at trophic level, Primary production measurement methods, Limiting factors, litter fall and decomposition , Recycling pathway relation between energy flow and nutrient cycling ,Global Biogeochemical cycle of C,N,P,S.	9
Unit-V	Major Biomes of the World, Major Vegetation types- Tropical rain forests, Temperate forests, Seasonal forests, Boreal forest, Grasslands, Deserts, Aquatic ecosystems and Wetlands.	9

SUGGESTED LABORATORY EXERCISES

1. To determine minimum size and number of quadrat required for study of vegetation by species area curve method.
2. To determine percentage frequency and frequency classes of various species by quadrate and line transect method using Raunkiaer's Law.
3. To study density and abundance of species.
4. To calculate relative frequency , relative density and relative dominance (or basal area) and determine importance value Index (IVI) of the species.
5. To determine diversity Index or community coefficient for two different vegetation / protected and unprotected grassland.
6. To determine gross and net phytoplankton productivity by light and dark bottle method.
7. To calculate Basal area of tree species found locally.
8. To find out reproductive capacity of the seeds.
9. To study the foliar injuries of plants which are exposed by SO_2.
10. To determine dust deposition on leaves of polluted and non polluted area.
11. To estimate the dissolved oxygen (DO) content in entrophic and oligotrophic water sample by azide modification of Winkler's method.
12. Physical and Chemical analysis of soil.
13. To study water holding capacity, porocity, bulk density of soil.
14. Ecological adaptations: Hydrophyte, Xerophyte, Epiphyte, Parasite etc.
15. To study- Hygrometer , Minimum Maximum Thermometer ,sling Psychrometer , Saci disc , pH meter , Spectrophotometer, Soxhlet apparatus , Kjehldal's apparatus.
16. Biostatistics**:** mean, mode, median, probability, standard deviation, standard errors, correlation and regration, Significance based on small and large sample(t-test and chi square test).
17. To study various Biotic and abiotic components of pond and forest ecosystem.
18. Mapping of Biomes on world map**.**

SUGGESTED READINGS

- Smith. R.L. 1996. Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- Begon. M.. Harper, J.L. and Townsend, C.R. 1996. Ecology. Blackwell Science. Cambridge.
- Ludwig. J. and Reynolds. J.F. 1988. Statistical Ecology. John Wiley & Sons.
- Odum. E.P. 1971. Fundamentals of Ecology. Saunders, Philadelphia.
- Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- Chapman, J.L. and Reiss, M.J. 1988. Ecology: Principles and Applications. Cambridge University Press, Cambridge, U.K.
- Moldan, B. and Billharz, S. 1997. Sustainability Indicators. John Wiley & Sons, New York.
- Treshow. M. 1985. Air Pollution and Plant Life. Wiley Interscience.
- Heywood, V.H. and Watson. R.T. 1995. Global Biodiversity Assessment. Cambridge University Press.
- Mason, C.F. 1991. Biology of Freshwater Pollution. Longman. 'Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .
- Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.

M. Sc. Botany (Semester System)

List of suggested Project work/Dissertation work

The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Inventroization of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR

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Session		**2019-20**
Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG - 301
		Paper-I
Title of the Paper	(English)	**Systemetics ofAngiosperms**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70 + CCE 30 = 100

Unit	Syllabus	Period
Unit-I	Morphology of flower, floral induction and development, morphology of stamens and carpals, carpels evolution, morphology of inferior ovary, placentation: their origin and types.	9
Unit-II	The species concept Taxonomic hierarchy, International Code of Botanical Nomenclature, Taxonomic evidences (morphology, anatomy, palynology, embryology, cytology, phytochemistary). Taxonomic tools(Herbarium, Botanical garden, Taxonomic keys, Taxonomic literature, floras.) Histological, biochemical, cytological phytochemical, serological, and molecular technique.	9
Unit-III	Systems of Angiosperm classification: Origin of angiosperms Phenetic versus phylogenetic system, Cladistics in taxonomy, relative merits and demerits of major system of classification, Plant exploration , invasions and introduction and, World centres of primary and Secondary centers diversity of domesticated plant.	9
Unit-IV	Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae.	9
Unit-V	Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae , Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales, Santanales, Centrospermales, and Hellobiales.	9

SUGGESTED LABORATORY EXERCISES

1. Study of stamens and carpals in various species.
2. Different kinds of placentations
3. Description of various species of a genus, location of Key characters and preparation of Key at generic level.
4. Location of key characters and use of keys at family level.
5. Training for herbarium preparation.
6. Preparation of Herbarium sheet of such plants, wild cultivated medicinal as are available locally.
7. Locally available Families of Dicotyledons: Ranunculaceae, Magnoliaceae, Annonaceae, Papaveraceae Capparidaceae, Portulaceae, Oxalidaceae, Rutaceae, Meliaceae, Rosaceae, Cucurbitaceae, Cactaceae, Rubiaceae Asteraceae, Gentianaceae, Bignoniaceae, Acanthaceae, Lamiaceae, Verbenaceae, Chenopodiaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Moraceae
8. Locally available Families of Monocotyledons: Orchidaceae, Iridaceae, Amaryllidaceae Musaceae, Zingiberaceae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae, General characteristics and phylogeny of Ranales, Amentiferae, Tubiflorales Santanales, Centrospermales, and Hellobiales.

Suggested Reading

Heywood & Moore, D.M; 1984: CWTent concept in Plant Taxonomy Academic Press.

Banson, L.B.;1957; Plant Classification, Health & Co. Boston.

Davis, P.R & Heywood, V.H 1973; Principles of Angiosperms and Taxonomy, Robert E. Kreiger Pub. Co. New York USA.

Eames, AL.; 1961; Morphology of Angiosperms, McGraw Hill, New York.

Lawerence, G.H.M,;1951: Taxonomy of Vascular Plants Macmillan, New York

Naik V.N,:1984: Taxonomy of Angiosperms. Tata McGraw Pub Co. Ltd New Delhi.

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Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-302
		II
Title of the Paper	(English)	**Molecular Biology and Plant Breeding**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Nuclear DNA content DNA structure and forms, DNA replication, mutation, C value paradox, cot curve, and its significance, damage and repair, Restriction Mapping, Multigene families and their evolution.	9
Unit-II	Gene structure and expression, Gene fine structure, cis and trans test of recombination, introns and exons, their significance, Genetics of Bacteria and Virus (genetic transformation, conjugation, transduction, Recombination in Phage), Regulation of gene expression in Prokaryotes and Eukaryotes.	10
Unit-III	RNA synthesis and processing-adding, splicing, polyadenilation, structure and function of different types of RNA, RNA transport.	9
Unit-IV	Genetic code, Protein synthesis–Ribosome structure and site of protein synthesis, initiation complex, factors, elongation, and termination. Post translation modification of protein, protein sorting. Targeting of protein to organelles.	9
Unit-V	Plant breeding,: In situ Hybridization-Concept and techniques. Genetic basis of inbreeding and heterosis, exploitation of hybrid vigor, Cancer oncogene, Apoptosis, Immune innate and adaptive immune system	8

SUGGESTED LABORATORY EXERCISES

1. Isolation of genomic DNA from plant tissue using CTAB (cetyetri methyl ammonium bromide) or any animal tissue.
2. Isolation of DNA & its quantitation by a spectrophometric method.
3. Restriction digestion of plant DNA, its seperation by Agrose gel electrophoresis and visualization by ethidium bromide staining.
4. Isolation of RNA and quantitation by a spectrophotometric method.
5. Separation of RNA by Agrose gel electrophoresis and visualization by Et. Br. staining.
6. Immunological techniques : Ouchterlony method, ELISA & western blotting.
7. Isolation of chloroplats and SDS-PAGE. profile of proteins to demarcate the two subunits of Rubisco.
8. Emasculation technique.

Other experiments based on theory paper

Suggested Readings:

- Alberts, B. Bray, D. Lewis, J. Raff: M. Roberts, K. and Watson,J. D. 1989 Molecular Biology of the Cell (2nd edition). Garland Publishing Inc., New York. U. S. A.
- Karp, G. 1999 Cells and Molecular Biology: Concepts and Experiments John Wiley & Sons, Inc. U. S.A
- Malacinski, G. M. and Freifelder, D. 1998. Essentials of Molecular Biology *(3M* edition). Jones and Barlett Publishers, Inc. London.
- Wolfe, S.L. 1993. Molecular and Cellular Biology, WadsworthPublishing Co., California, USA.
- Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, *K.,* and Watson, J.D. 1999.Molecular Biology of the Cell. Garland Publishing:Inc., New York.
- Rost, T. et al. 1 998.Plant Biology, Wadsworth Publishing Co.,California, U.S.A
- Krishanmurthy K. V. 2000 Methods in Cell Wall Cytochemistry, CRCPress, Boca Raton, Florida U.S.A
- Buchanan, B.B. Gruissem, W. and Jones, RL. 2000. Biochemistry And Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA
- De, D.N. 2000 Plant Cell Vacuoles: An Introduction.CSIRO Publication, Collingwood, Australia.
- Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA
- Lodish H. Bert, A,zipursky, S.L.,Matsudaira, p.,Baltimore, D. and Darnell, J. 2000.Molecular Cell Biology, W.H.Freeman and Co., NewYork, U.S.A
- Twyman, R. M. 2003. Advanced Molecular Biology. Viva Books Private Ltd. New Delhi. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones (second edition). Springer - Verlag, New York. USA.
- Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- Salisbury FB and Ross CW 1991 Plant Physiology IV edition Wdsworth Publishing co. California USA.
- Taiz l and Zeiger E1998 Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997 Plant Metabolism II Ed. Longman England.
- Buchanan, B.B.Gruissem, W. and Jones R.L. 2000. Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-303
		III
Title of the Paper	(English)	Plant Physiology, Biochemistry and Metabolism
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Fundamentals of Enzymology: General aspects, Allosteric mechanism, regulatory and sites, Isoenzyme, Kinetics of enzymatic catalysis, Michaelis-Menten equation and its significance, Mechanism of enzyme action.	9
Unit-II	Photochemistry and Photosynthesis: General concept and Historical back ground, evolution of photosynthetic apparatus, photosynthetic pigment and light harvesting complexes, Photo oxidation of water, mechanism of electron and proton transport, Carbon assimilation, Calvin cycle, Photorespiration and its significance, C-4 cycle, CAM path way, physiological and ecological consideration.	9
Unit-III	Respiration: Overview of plant respiration, Glycolysis, TCA cycle, Electron Transport, Structure, function & synthesis of ATP, oxidative pentose phosphate pathway.	9
Unit-IV	Structure, classification and function of carbohydrates, biosynthesis of sucrose and starch, Structure and function of Lipids, Fatty acid biosynthesis, synthesis of membrane lipids, structural lipids and storage lipids, , and their catabolism, Glyoxilate cycle and alternative oxidases system.	9
Unit-V	Nitrogen fixation, (chemical and biological), Nodule formation, Mechanism of Nitrate uptake and reduction, ammonium assimilation, Sulphate uptake, transport and assimilation. Sulphur metabolism, Vitamins (structure and role).	9

Suggested Laboratory Exercise based on P.G 301 :

1. Principles of colorimetry and Spectrophotometry.
2. Determine rate of respiration in germinating seeds/young buds by Ganong's respirometer.
3. Determine rate of respiration in terms of oxygen utilized by plant material by volume method/ weight method.
4. Determine effect of light intensity / wave length on rate of photosynthesis.
5. Determine effect of Co2 concentration on rate of photosynthesis
6. Extraction of chloroplast pigments from leaves and preparation of the absorption spectrum of chlorophylls and carotenoids by spectrophotometer.
7. To seperate chloroplast pigments by strip paper chromatography/circular paper chromatography.
8. To determine the chlorophyll-a / chlorophyll b ratio in C_3 and C_4 plants by spectrophotometer.
9. Isolation of intact chloroplasts and estimation of chloroplast proteins by spot protein assay.
10. To demonstrate photophosphorylation in intact chloroplasts, resolve the phosphoproteins by SDS-PAGE and perform autoradiography desalting of proteins by gel filtration chromatography embaying Sephadex G-25.
11. Biochemistry of carbohydrates and lipids.
12. Study of structure and formation of Root nodule in leguminous plants
13. Effect of enzyme concentration on enzyme activity e.g. catalase, amylase, acid Phosphatase, nitrate reductase.
14. Effect of substrate concentration on enzyme activity eg. catalase, amylase
15. Demonstration of the substrate inducibility of the enzyme nitrate reductase.
16. Determination of succinate dehydrogenase activity, its kinetics and sensitivity to inhibitors.
17. Separation of isoenzymes of esterase, Peroxidases by native polyacrylamide gel electrophoresis

Suggested readings

- **Hopkins, W.G. 1995**. Introduction to Plant Physiology. John Wiley & ,Sons, Inc., New York, USA.
- **Moore, T.C. 1989**. Biochemistry and Physiology of Plant Hormones (second edition). Springer - Verlag, New York. USA.
- **Nobel, P.S. 1999**. Physiochemical and Environmental Plant Physiology (second edition). Academic Press, San Diego, USA.
- **Salisbury FB and Ross CW 1991** Plant Physiology IV edition Wdsworth Publishing co. California USA.
- **Taiz l and Zeiger E1998** Pant Physiology II Edition. Sinauer Associates Inc. Publisher MS.
- **Dennis DT and Terpin DH Lefevere DD and Layzell DV 1997** Plant Metabolism II Ed. Longman England.
- **Buchanan, B.B.Gruissem, W. and Jones R.L. 2000.** Biochemistry and molecular Biology of plants. American Society of Plants Physiologist, Maryland USA.

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Class		M.Sc.
Semester		**III**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-304
		IV
Title of the Paper	(English)	**Plant Ecology-II (Conservation & Utilization of Plant Resources)**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant biodiversity concept, status in India, and world. World centres of primary diversity of domesticated plants with special reference to Indoburmiese centre and secondary centres.	9
Unit-II	Sustainable development, utilization, of resources from forest, grassland, aquatic habitats, food, fodder, forage, timber and non wood forest products. Threats to quality and quantity of resources due to over exploitation. Speciation and Extinction, IUCN categories of threat. Distribution and global pattern of terrestrial biodiversity, Hot spots and inventory.	9
Unit-III	Strategies for conservation of resources: Social forestry, Principle of conservation, In situ conservation (Sanctuaries, National Parks, Biosphere reserves for wild life conservation), Ex situ conservation(Botanical Garden, Field gene bank, Seed bank, in vitro repositories, Cryo banks).	9
Unit-IV	Pollution and Climate change : Air, Water and Soil pollution(Kinds, sources, quality parameters) and their effects on plants and ecosystem. Green house gases- CO2 , CH4, N2O, CFCs (source, trend and role). Ozone layer and Ozone Hole, Consequences of climate change, (Co2 as fertilizer, Global warming, sea level rise, UV radiation). Bioremediation (Management of Pollution).	9
Unit-V	Resource Monitoring Remote sensing Concepts and tools, Satellite remote sensing ,basics, sensors, Visual and digital interpretation) EMR bands and their application , Indian remote sensing Program Thematic mapping of resources Application of Remote sensing.	9

Suggested Laboratory Exercise -

1. Study of locally available plants.
2. Food crops – Wheat, rise, maize, chickpea, potato tapioca, sweet potato, sugarcane , morphology , anatomy , economic importance.
3. Forage / fodder plants – study of any five important crops of locally available.
4. Textile fibres – cotton, jute, linen, sun hump, cannabis.
5. Maceration technique and staining technique of fibres.
6. Fibres for stuffing – silk cotton or Kapok.
7. Medicinal and aromatic plants:- morphology and importance of Papaver somnifera , Atropa balladona , Catharanthus roseus , Adhathoda vasaca , Rauwolfia serpentina , Withania somnifera , Phyllanthus nurori , Andrographis paniculata , Aloe barbedensis , Mentha arvensis , Rosa , Pogostemon cablin , Viteveris zizanioides , Jasminum grandiflorum , cymbopogon sp. , Rosa , Pandanus odoratissimus .
8. Fire wood and timber yielding plants and Non wood forest products (NWFPs).
9. Morphology and Anatomy of oil yielding tissue and their test (Biochemical or by staining).
10. Prepare an inventory of medicinal and aromatic plants, bamboos and timber yielding plants of your area giving their scientific and local name their important uses appropriate illustrations.
    - Study of live or herbarium specimens or other visual materials to become familiar with these resource.
11. Remote sensing image interpretation.
12. Mapping of natural resourses (water and forest) of M.P.
13. Enlist wild and cultivated varieties of cereal crops of M.P.
14. Study of pollination indicator plants.
15. Water and soil analysis.
16. Study of leaf injury.
17. Cellulose test for natural fibers.

Study of live or herbarium specimens or other visual materials to become familiar with these resource

The student should be taken to one of the following-

1. A protected areas (biosphere reserve- Pachmari, national park or a sanctuary).
2. A wet land.
3. Botanical survey of India (BSI).
4. CSIR Laboratory doing research on plants and their utilization.
5. Botanical Gardens or Museum.
6. FRI Forest Research Centre, Dehradun.

Note **– The students are expected to prepare a brief illustrated narrative of the field survey and scientific visits. After evaluation the grades awarded to students by teachers and should be added to the final assessment of practical examination**.

Suggested Reading

Brady,N.C.1990 The Nature and Properties of Soil MacMillan.
Heywood, V.H. and Watson, R.T. 1995 Global Biodiversity Assessment. Cambridge University Press.
Hill, M.K. 1997 Understanding Environmental Pollution,. Cambridge University, Press.
Kohli, R. Arya, K.S., Singh, P.H. and Dhillon, H.S,. 1994 Tree Directory of Chandigarh, Lovedale Educational, New Delhi.
Kothari A. 1997 Understanding Biodiversity Life Sustainability and Equity.
Orient Longman.Mason, C.F. 1991. Biology of fresh water Pollution Longman.
Nair, M.N.B.et.al.1998Sustainable Management of Non Wood Forest Products.
Faculty of Forestry, University Putra Malasia 434004 PM Serdong Selangor Malaysia

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Session		**2019-20**
Class		M.Sc.
Semester		IV
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		PG-401
Title of the Paper	(English)	Biotechnology and Tissue Culture
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plant cell and tissue culture: General introduction, history, scope, concept of cellular differentiation and Totipotancy. Establishment of lab, aseptic technique and sterilization of glassware. Different types and preparation of media. Ex plant technique of tissue culture, meristem, anther, embryo culture and organogenesis.	9
Unit-II	Somatic Hybridization, Protoplast isolation, Fusion and culture, Somatic cell genetics, application of tissue culture, Artificial seed, Somaclonal variation, Production of Secondary metabolites, cryopreservation, and germplasm storage.	9
Unit-III	Biotechnology Principles and Application of biotechnology in agriculture, horticulture, forestry, food, and industries, health care and immunology, environment biotechnology, and ethics. Intellectual Property Right. Genetic engineering of plants, aims, strategies of Transgenic Agrobcterium, T-DNA, Gene tagging microbial genetic manipulation, genetic improvement of industrial microbes, fermentation technology.	9
Unit-IV	Recombinant DNA technology: gene cloning, principle and technique, construction of genomic and c-DNA library, Vector, Plasmid, DNA synthesis, Polymerase Chain Reaction (PCR), DNA fingerprinting.	9
Unit-V	Genomics and proteomics, molecular markers, Artificial chromosomes, High through put sequencing, genome projects, bioinformatics, microarrays, protein profiling and its significance.	9

Suggested Laboratory Exercise: -

1. To prepare biotechnology lab.
2. Sterilization techniques.
3. Preparation of culture medium.
4. Sterilization of medium.
5. To demonstrate growth characteristics of E.coli using plating method.
6. To demonstrate growth characteristics of E.coli by turbidiometric method.
7. To study the effect of antibiotics on growth of microorganism.
8. To study fermentation techniques.
9. Study of nitrogen fixer & its applications.
10. To prepare tissue culture lab.
11. Stertization techniques.
12. Sterilization of glassware.
13. Preparation of tissue culture medium.
14. Stertization of Explants.
15. Study effect of plant growth hormones (PGR) on tissue culture.
16. To perform the techniques of micro propagation/ somatic embryogenesis /anandroganesis.
17. To perform the techniques of organogenesis.
18. Study of applications of tissue culture.
19. Raising of callus by isolation of an explants from Daucus carota on MS medium
20. Preparation of artificial seeds.

Suggested Reading

Butenko, R.G. 2000 Plant Cell Culture. University Press Of pacific.
Collin, H.A. and Edwards, s. 1998 Plant Cell culture. Bios scientific publishers Oxford. UK.
Callow, J.A. Ford-Lioyd, B.V. and Newbury, H.J.1997 Biotechnology and plant genetic Resources, Conservation and Use.CAB, International Oxon, UK.
Dixon, R.A. 1987 Plant Cell Culture; a Practical Approach. IRL press, Oxford. George, E.F.1993 Plant Propagation by Tissue culture part- 1&2 Exegetics Ltd Edington. UK.
Glick, B.R. and Thompson, J.E. 1993 methods in Plant molecular Biology and Biotechnology Grc Press Boca Raton. Florida.
Primrose, S.B. 1995 Principles of Genome Analysis, Blackwell Science ltd., Oxford,

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2019-20
Theory / Practical

Session		**2019-20**
Class		M.Sc.
Semester		IV
Subject	(English)	Botany
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG 402**
		II
Title of the Paper	(English)	**Applied Botany and Instrumentation**
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Plants used in daily life: plants used in cosmetics, herbal cosmetic products and applications. Plants used in hair care and skin care. Herbal dyes and their uses **.** Herbal beverages. Small scale industries.	6
Unit-II	Aromatherapy: Introduction, History, modern concept of Aromatherapy. Essential oils, Extraction technique by Sohxlate method. Applied aspects of Aromatherapy.	9
Unit-III	Organic Farming and applications, Bio-fertilizers, Vermiculture, Floriculture, Mushroom cultivation technique, Nursery management and applications, marketing strategies, possibilities and loan schemes. Entrepreneurial Development.	10
Unit-IV	Microscopy: Principle and applications. Types of microscopes. Basic knowledge of spectrophotometer, Electrophoresis, Colorimeter, pH meter and Centrifuge.	10
Unit-V	Introduction to computer: fundamentals, MS ,DOS,MS WORD , MS EXCEL usage of Computer in Biology, Sample graph plotting, Net working of Computer, basic need and applications , modern strategies of literature search.Record and presentation of Data and scope.	10

Suggested Practical Exercises-

1. Extraction technique by sohxalate method of essential oils
2. methods of processing of crude plants and their storage.
3. Traditional method of beautification of skin and their application-
   - Cleansing-Alove,Papaya,Lemon etc.
   - Nutritive-Ashwagandha,Ginsing,Nagarmotha etc
   - Bleaching-Amba haldi,Raktachuran,kachur,suganthi etc
   - Anti wrinkle-Manjistha,papaya,suganthiets,Kumari etc

4. Hair care- amla, shikakai, Aritha, Nagarmotha etc.
5. Aromaterapy by –Chameli, Rose, Eucaliptus, Tulsi etc.
6. **Enlist herbal pesticides and herbicides.**
7. Techniques of vermiculture, Mushroom culture, nursery management
8. Perfoma preparation of proposal of marketing of plants
9. Herbal dyes and their uses.
10. Working principle and Practical based on pH meter, Electrophoresis, Spectrophotometer, Centrifuge etc
11. MS office,DOS,MS WORD , MS EXCEL .Usage of Computer in Botany.

Suggested Reading

- Biotechnology-R.C. Dubey
- Biostatistics and Computer Application- Dr. R Goswami
- Mushroom Cultivation-
- Vermiculture-
- Floriculture-
- Aromatherapy -a Complete Guide to the Healing Art- Kathi Kerthi and Mendy Green
- Essential oils for Radiant Health- Susanne Fischer Rizzi 1998
- Beauty through Herbs- Dr. Urjita Jain, Institute of Herbal Science, Mumbai,1997
- Text book of Cosmetology-Harry
- Cosmetic Science and technology-Sagarin C.B.
- The Skin care Book: Simple Herbal Recipes-Kathryn wartrochi, Ist Edition 1996,Paper Gooseberry Hill Publication.
- Natural organic Hair & Skin care :Including A to z Guide to natural & Synthetic Chemicals in cosmetics- ISBN-1990,Aubrey Hampton organic press
- Instrumentation-
- Wealth of India-CSIR New Delhi Publication
- Entrepreneurial Development concept and practices-Dilip Sarwate, Everest Himalaya Publication
- Entrepreneurial Development –S.S.Khan ,S Chand Publication
- Entrepreneurial Development in India- Dr. C. B. Gupta & Dr. N. P. Shrinivasan, S Chand Publication ,4th Edition

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Theory / Practical

Session		**2019-20**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG-403: Elective Paper-I**
		III
Title of the Paper	(English)	
	(हिन्दी)	
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers I

1. **Environmental science**
2. Limnology
3. Industrial microbiology
4. Taxonomy of Angiosperms
5. Applied Mycology
6. Forest Biology, Forest vegetation of India and Management of Forest Resources
7. Plants and Society

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Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**Elective Paper-I**
		III
Title of the Paper	(English)	**PG-403: Environmental Science**
Medium of Instructions (Teaching)		English/हिन्दी/Both (दोनों)
Question Paper Language		English/हिन्दी/Both (दोनों)
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Global distribution and Classification of climate (Koppen's classification); Climatic types and their distribution. Climate of India.Climatic Factors (Light, Temperature, Water) Soil types of India and Soil type of World	9
Unit-II	**Global warming and climate change**: Green house effect; consequences; responsible factors. Environmental Impact Assessment. Environmental management.	9
Unit-III	**Toxicology** : Radiation toxicants - Kinds, sources & biological effects. Chemical toxicants - Sources & biological effects of Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides. Bioremediation : Need , scope & technology .	9
Unit-IV	**Environmental Laws** : Goal, objectives and guiding principles of Environmental Laws; Indian Environmental Laws; National Environmental Policies ; Environmental priorities in India and sustainable development.	9
Unit-V	**Environmental Education and Organization** : Goal, objectives and guiding principles of Environmental Education ; Environmental Education in educational Institutes; Environmental organizations and agencies; Man and Biosphere Programme (MAB).	9

Suggested Practical exercises-

1. **Meteorological recording-**
   Determination of air temperature by Min.-Max. thermometer& humidity by hygrometer,Sling pschrometer .
   Determination of light intensity.
   Determination of clouds by Okta scale.
   Determination of wind velocity.
   Determination of precipitation by Rain Gauge.
   Determination of light penetration by Sachi disc.
2. **Non-conventional Bio-management of waste-**
   1. Planning of Root Zone treatment.
   2. Vermicomposting.
3. **Sampling for physico-chemical properties of water-**
   1. To measure temperature by thermometer.
   2. To measure pH by pH meter/pH indicator.
   3. To determine turbidity by turbidometer.
   4. To determine light intensity by photometer.
   5. To determine DO(dissolved oxygen) in eutrophic & oligotrophic water.
   6. To determine BOD(biological oxygen demand) of pond water.
   7. Determinetion of chloride/fluoride/nitrate/phosphate/hardness.
4. **Sampling for soil analysis-**
   1. To determine Nitrate, Phosphate, Carbonate,Potessium .
   2. To determine water holding capacity of soil.
   3. To determine organic matter content of soil.
   4. To determine bulk density and porosity of soil.

5.Exercises based on pollution-

- To study the foliar injuries of plants which are exposed to SO_2..
- To determine dust deposition on leaves of polluted and non polluted areas.
- To determine pH of plants growing in under polluted and non-polluted areas.
- To study environmental impact of a given developmental activity using checklist as AIE method.

The purpose of above practical exercises is to make the students aware of the issues related to environmental science specially global warming, climate change and impact on nature and for ecological services.

7. Study of Toxicants- Mercury , Lead, Chlorine, DDT, Fluorine, Arsenic & Pesticides.
8. Study of Bioremidiation
9. Study of bioindicators

SUGGESTED READINGS

- **Smith. R.L. 1996.** Ecology and Field Biology. Harper Collins. New York.
- Muller-Dombois. D. and Ellenberg. H.1974. Aims and Methods 01 Vegetation Ecology, Wiley, New York
- **Begon. M.. Harper, J.L. and Townsend, C.R. 1996**. Ecology. Blackwell Science. Cambridge.
- **Ludwig. J. and Reynolds. J.F. 1988**. Statistical Ecology. John Wiley & Sons.
- **Odum. E.P. 1971**. Fundamentals of Ecology. Saunders, Philadelphia.
- **Odum, E.P. 1983**. Basic Ecology. Saunders, Philadelphia.
- Barbour, M.G., Burk, J.H. and Pitts, W.O. 1987. Terrestrial Plant Ecology. Cummings Publication Company, California.
- **Kormondy, E.J. 1996**. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd., New Delhi.
- **Chapman, J.L. and Reiss, M.J. 1988**. Ecology: Principles and Applications. t::ambridge University Press, Cambridge, U.K.
- **Moldan, B. and Billharz, S. 1997**. Sustainability Indicators. John Wiley & Sons, New York.
- **Treshow. M. 1985**. Air Pollution and Plant Life. Wiley Interscience.
- **Heywood, V.H. and Watson. R.T. 1995**. Global Biodiversity Assessment. Cambridge University Press.
- **Mason, C.F. 1991.** Biology of Freshwater Pollution. Longman. 'Hill. M.K. 1997. Understanding Environmental Pollution. Cambridge University Press. .
- **Brady, N.C. 1990**. The Nature and Properties of Soils. MacMillan.
- **Mason, C.F. 1991**. Biology of Freshwater Pollution. Longman. '
- **Hill. M.K. 1997**. Understanding Environmental Pollution. Cambridge University Press. .
- **Kothari, A 1997**. Understanding Biodiversity: Life'Sustainability and Equity. Orient Longman.
- **Kohli, R., Arya, K.S., Singh, P.H. and Dhillon, H.S. 1994**. Tree Directory of Chandigarh. Lovedale Educational, New Delhi.
- **Nair, M.N.B. et. al (Eds) 1998**. Sustainable Management of Non-wood Forest Products. Faculty of Forestry, Universiti Putra Malaysia. 434004 PM Serdong, Selangor, Malaysia.
- **Rodgers, N.A. and Panwar, H.S. 1988**. Planning a Wildlife Protected Area Network in India. Vol. 1. The Report. Wildlife Institute of India, Dehradun.
- **Walter, K.S. and Gillett, H.J. 1998. 1997** IUCN Red List of Threatened Plants. IUCN, the World Conservation Union. IUCN, Gland, Switzerland, and Cambridge,

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Session		**2019-20**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**PG 404: Elective Paper-II**
		IV
Title of the Paper	(English)	
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

The student may opt any one of the following Elective paper (operative in the university/college)

List of suggested Elective papers II

1. Ethnobotany
2. Plant protection
3. Bioinformatics and computer applications and Biostatistics
4. Molecular biology and biotechnology
5. Pollution Ecology

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Session		**2019-20**
Class		M.Sc.
Semester		**IV**
Subject	(English)	**Botany**
	(हिन्दी)	**वनस्पति शास्त्र**
Paper		**Elective Paper- 404**
		IV
Title of the Paper	(English)	**Ethnobotany**
	(हिन्दी)	
Medium of Instructions (Teaching)		English/**हिन्दी**/Both **(दोनों)**
Question Paper Language		English/**हिन्दी**/Both **(दोनों)**
Max. Marks		70+CCE30=100

Unit	Syllabus	Period
Unit-I	Definition and scope of Ethnobotany Historical review and outline idea of archaeoethnobotany. Ethnoecology, Ethnomedicines, Ethnonarcotics, Ethnopharmacology, Ethnotaxonomy, Ethnocosmetics, Ethnolinguistics, Ethnoorthopaedics, Ethnopaediatrics.	9
Unit-II	Preservation of Genetic diversity, plants used in various systems of medicines, Ayurvedic, Unani, Homoeopathic and Allopathic systems. Plants used by villagers and tribal people. Role of ethnobotany in the development of Society.	9
Unit-III	**Ethnobotanical importance of :***Aconitum napellus, Allium cepa, Mentha arvensis, Allium sativum, Nux-vomica, Aloe vera, Ocimum sanctum, Atropa belladona, Azadirchta indica, Piper nigrum, Butea monospera, Pterocarpus marsupium, Terminalia bellerica, Terminalia arjuna, Terminalia chebula , Eugenia aromatica, Eugenia jambolana, Hollarrhena antidysenterica, Withania somnifera, Lawsonia inermis.*	9
Unit-IV	**Ethnobotanical importance of**: Cassia *fistula, Cannabis sativa, Ricinus communis, Emblica officinalis, Santalum album.* Plants in mythology, Taboos and Totems in relation to plants, folklore and folk tales, Wild life protection by tribal, plants domestication by the tribals. Plants in similes and metaphors.	9
Unit-V	Detailed study of the common plants and their parts used in the treatment of following diseases:Expulsion of worms, Skin diseases, Bronchial inflammation and Asthma, Tuberculosis, Urino - genital problems, Amoebic dysentery, Malaria, Rheumatism, Leprosy, Jaundice, Heart diseases, Piles, Leukoderma.	9

PRACTICALS: Laboratory exercises corresponding to theory courses covering all Units.

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The following is the list of the proposed areas of dissertation/ project work. The concerned university and college may encourage the students to undertake project work in collaboration with industrial and research organizations.

1. Plant Biodiversity Assessment
2. Conservation of Endangered Species
3. Investigation of Unexplored Areas and Hotspots
4. Pollution Monitoring
5. Survey of Less-known Economic Plants of India
6. Chromosome Analysis and Indexing of Indian Flora
7. Bioremediation of Xenobiotics
8. Exploitation of Secondary Metabolites
9. Extraction of Allelochemicals
10. Tissue Culture of Economic Plants
11. Assessment of Pollution Toxicity by Bioassay
12. Microbial proteins
13. Enzymes
14. Cosmetic Products from microbes and plants
15. Nutraceuticals from microbes and plants
16. Pharmaceutical Products
17. Ethnobotany
18. Chemotaxonomy
19. Cladistics
20. Protein Profiling
21. DNA Fingerprinting
22. Microarrays
23. FISH (Fluorescent In Situ Hybridization)
24. Mutation
25. Plant Hormones and Growth promoters
26. Bioinformatics
27. Application of PCR
28. Somatic Hybridization
29. Biofertilizers and Bioinoculants
30. Transgenics
31. Exploitation of Rhizospheric microbes including mycorrhizae
32. Recycling of domestic, municipal and industrial wastes
33. Vermicomposting and Biomethanation
34. Environmental Monitoring
35. Assessment of Pollution in different habitats

List of Journals-

1. Indian journal of Multidisciplinary Research-CMRA Kerala.
2. National journal of Life Science.
3. International Journal of Biotechnology.
4. Journal of Biotechnology
5. Pollution Research.
6. Science Reporter.
7. University New- UGC.
8. Acta Botanica.
9. Acta Ecologica.
10. Tropical Ecology.
11. Annual Review of Plant Physiology and Molecular Biology.
12. Current Advance in Plant Science.
13. Nature Review: Molecular and Cell Biology.
14. Indian journal of Biotechnology (NISCAIR New Delhi).

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Under Graduate ANNUAL Pattern of Syllabus of Botany
Syllabus of Botany
(As Recommended by the Board of Studies)
Practical scheme 2019-20(based on Paper I&II)

B.Sc. I Year

M.Marks-50

B.Sc. I Year- Scheme of practical examination based on paper I&II

Time: 4 hrs Marks: 50

Q.1 Algae/Fungi ---------- 05

Q.2 Bryophyta/Pteridophyta---------- 05

Q.3 Gymnosperms---------- 10

Q. 4 Anatomy & Morphology ---------- 10

Q. 5 Spotting (1 to 5) ----------10

Q. 6 Viva----------05

Q. 7 Sessional ---------- 05

Total 50

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(As Recommended by the Board of Studies)
2019-20
Practical Scheme 2017-18

B.Sc. II Year
Practical Exercises + Scheme based on paper I&II

Time: 4 hrs **Marks: 50**

1.	Section Cutting – Root/Stem/Leaf	-	10
2.	Embryology-Anther/Ovule/Placentation	-	10
3.	Exercise based on Ecology	-	10
4.	Exercise based on Phytogeography/National Parks	-	05
5.	Spotting (01 - 05)	-	10
6.	Viva Voce	-	05
7.	Sessionals	-	05
			Total-50

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BOTANY PRACTICAL EXERCISES + SCHEME BASED ON PAPER I & II

B.Sc. III Year

Maximum 50 Marks

Question 1. Exercise based on Physiology.	10
Question 2. Biochemical Test	05
Question 3. Exercise based on Cytology (Smear preparation identification of stages)	10
Question 4. Exercise based on Genetic Problem	05
Question 5. Spotting (1 to 5)	10
Question 6 . Viva-Voce	05
Question 7. Sessional	05

Total	**50**

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Semester Wise Syllabus of Botany
(As Recommended by the Board of Studies)
2019-20
M.Sc Botany (Semester system)
SEMESTER-I
Practical scheme for Part-I
(Based on Course PG 101 and 102)

M.M-100 **Time 4 Hrs**

Exercise –

1. **Prepare a slide of given material A (fungi). Draw well labelled diagrams. Identify giving reasons……. 16**
2. **Bacterial Staining …..... . 10**
3. **Prepare slide of given material B (Algae) , Draw well labelled diagrams. Identify three algae with giving reasons…… 24**
4. **1 to 10 spot……. 20**
5. **Viva Voce…… 10**
6. **Sessional…… .. 20**

Total 100

M.Sc Botany SEMESTER –I
Practical scheme for Part-II
(Based on Course PG 103 and 104)

M.M-100 **Time 4 Hrs**

Exercise –

1. **Prepare a slide of given material A (Bryophyte). Draw well labelled diagrams. Identify giving reasons……. 15**
2. **Prepare a slide of given material B (Pteridophyte). Draw well labelled diagrams. Identify giving reasons 15**
3. **Monographic study of given material C (Gymnosperm). Draw well labelled diagrams. Identify giving reasons 20**
4. **1 to 10 spot……. 20**
5. **Viva Voce……. 10**
6. **Sessional……. 20**

TotalS **100**

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(As Recommended by the Board of Studies)
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M.Sc (Previous) Botany
SEMESTER-II
Practical scheme for Part-I (Based on PG 201 and 202)

M.M-100 **Time 4 Hrs**

1. **Exercise based on Cell Biology……..….. 15**
2. **Exercise based on Cytogenetics…… 10**
3. **Study of Anther / Ovule / Seed…… 15**
4. **Demonstration of Emasculation Tech…… 10**
5. **Spot 1 to 10…….. 20**
6. **Viva-Voce……..... 10**
7. **Sessional and Records……. 20**

Total 100

M.Sc (Previous) Botany

SEMESTER-II

Practical scheme for Part-II (Based on PG 203 and 204)

M.M-100 **Time 4 Hrs**

Exercise –

1 .Exercise based on Physiology (major)…….…… 15
2 .Exercise based on Physiology (minor)……..…… 10
3. Exercise based on ecology (community study)……..... 10
4. **Exercise based on ecological adaptation…… …..……. 15**
5. **Spotting 1 to 10…….…..…….... 20**
6. Viva-Voce……..….... 10
7. Sessional and Records…….……. 20

……..
Total 100

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As Recommended by the Board of Studies
2019-20
M.Sc. SEMESTER- III
Botany Practical Part-I
Practical Scheme
(Practical based on PG 301 & 302)

MM – 100 ***Time :- 4 hrs***

Execises :-

1. Exercise based on Taxonomy
   (Study of given plant up to genus level)----------15
2. Exercise based on Morphology
   (Study of stamens/ carpels/ placentation) ---------- 10
3. Exercise based on Molecular Biology ---------- 15
4. Exercise based on Plant Breeding ---------- 10
5. Spot 1 to 10---------- ---------- 20
6. Viva-Voce ---------- 10
7. Sessional & Record ---------- 20

TOTAL 100

M. Sc. Botany (Semester System)

Third Semester
Practical scheme for Part - II
(Based on course PG 303 & 304)

Time :- 5 hrs. ***MM - 50***

Exercises :-

1. Exercise based on Physiology---------- 15
2. Exercise based on Biochemistry and Metabolism---------- 10
3. Exercise based on Ecology of
   Food/Forage/Fodder/Medicinal Plants ---------- 15
4. Report on field survey ---------- 10
5. Spot 1 to 10 ---------- ---------- 20
6. Viva-Voce ---------- 10
7. Sessional & Record ---------- 20

TOTAL 100

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2019-20

M.Sc Botany SEMESTER-IV

Botany Practical Part -I

Practical Scheme

(Practical based on PG 401 & 402)

Time : 4 hrs **Botany Practical-I Scheme (Practical based on PG 401 & 402)**

MM 100 **Time : 4 hrs**

Exercises

1. Exercise based on Biotechnology…… 15
2. Exercise based on Tissue culture …… … 10
3. Exercise based on Applied Botany…… 15
4. Exercise based on Instrumentation …… … 10
5. Spot 1 to 10 …… 20
6. Viva-Voce …… 10
7. Sessionals and Record …….. 20

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100

Practical Base on the Course Code 403: Elective-I Course Code 404: Elective-II

2019-20

M.Sc Botany SEMESTER-IV

Botany Practical Part -II

Botany Practical Scheme (Practical based on PG 403 & 404)

MM 100 Time : 4 hrs

Exercises

1. Major Exercise based on Elective - I …….. 15
2. Minor Exercise based on Elective - I…….. 10
3. Major Exercise based on Elective - II …….. 15
4. Minor Exercise based on Elective - II…….. 10
5. Spot 1 to 10 …… 20
6. Viva-Voce …… 10
7. Sessionals and Record …….. 20

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100