

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG &PG STUDIES IN BOTANY**

**SCHEME OF EXAMINATION**

**FIRST SEMESTER**

<b>Number &amp; Title of the course</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Min. Aggr. Marks For Passing</b>
<b>(A) THEORY PAPERS</b>			
I Biology & Diversity of Virus, Bacteria and Algae	35	12	
II Biology & Diversity of Bryophytes, Pteridophytes and Gymnosperms	35	12	
III Basic Ecology	35	12	
IV Biochemistry	35	12	
<b>(B) PRACTICALS</b>			
I (based on Course I & II)	50	20	
II (based on course III & IV)	50	20	
<b>(C) INTERNAL ASSESSMENT /</b>			
CCE *4 Written Test based on each course (each of 15 marks)	60	5 in each test	
Project/Assignment/Seminar	50	20	
<b>TOTAL</b>	<b>350</b>	-----	<b>140</b>

\* Candidate has to pass in each test separately

**SECOND SEMESTER**

<b>Number &amp; Title of the course</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Min. Aggr. Marks For Passing</b>	
<b>(A) THEORY PAPERS</b>				
V Taxonomy of Angiosperms	35	12		
VI Resource Utilization and Conservation	35	12		
VII Biology & Diversity of Fungi	35	12		
VIII Biostatistics and Computer Applications	35	12		
<b>(B) PRACTICALS</b>				
I (based on Course V & VI)	50	20		
II (based on course VII & VIII)	50	20		
<b>(C) INTERNAL ASSESSMENT</b>				
CCE *4 Written Test based on each course (each of 15 marks)	60	5 in each test		
Project/Assignment/Seminar	50	20		
<b>TOTAL</b>	<b>350</b>	-----	<b>140</b>	

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**THIRD SEMESTER**

Number & Title of the course	Max. Marks	Min. Marks	Min. Aggr. Marks For Passing	
<b>(A) THEORY PAPERS</b>				
IX Plant Physiology	35	12		
X Genetics & Molecular Biology	35	12		
XI Plant Reproduction & Development	35	12		
XII Biotechnology	35	12		
<b>(B) PRACTICALS</b>				
I (based on Course XI & X)	50	20		
II (based on course XI & XII)	50	20		
<b>(C) INTERNAL ASSESSMENT</b>				
CCE *4 Written Test based on each course (each of 15 marks)	60	5 in each test		
Project/Assignment/Seminar	50	20		
<b>TOTAL</b>	<b>350</b>	-----	<b>140</b>	

\* Candidate has to pass in each test separately.

According to the recommendation of the standing committee dated 05 September, 2011 & approved by Executive Council dated 16 September, 2011 Every student pursuing M.Sc. Botany course will appear in four respective theory papers and two practical examinations in all the semesters except for the UTD students For the UTD students there will be dissertation work in lieu of four theory papers.

**FOURTH SEMESTER ( FOR UTD)**

DISSERTATION	Max Marks	Min. Marks for Passing	Min. Aggr Marks For Passing	
<b>A. Valuation</b>				
(i) Language & Presentation	50	80		
(ii) Review of Literature	50			
(iii) Methodology	50			
(iv) Analysis & interpretation of Result	50			
<b>B. Viva-Voce EXTERNAL</b>	100	60		
<b>C. Viva-Voce INTERNAL</b>	50			
<b>Total</b>	<b>350</b>			<b>140</b>

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**FOURTH SEMESTER ( FOR COLLEGES)**

<b>Number &amp; Title of the course</b>	<b>Max. Marks</b>	<b>Min. Marks</b>	<b>Min. Aggr. Marks For Passing</b>
<b>(A) THEORY PAPERS</b>			
XIII Plant Cell, Tissue & Organ Culture	<b>35</b>	<b>12</b>	
XIV Biotechnology & Genetic Engineering	<b>35</b>	<b>12</b>	
XV Elective I: A / B	<b>35</b>	<b>12</b>	
XVI Elective II: A / B	<b>35</b>	<b>12</b>	
<b>(C) PRACTICALS</b>			
I (based on Course XIII & XIV )	<b>50</b>	<b>20</b>	
II(based on course XV & XVI )	<b>50</b>	<b>20</b>	
<b>(C)INTERNAL ASSESSMENT</b>			
CCE *4 Written Test based on each course (each of 15 marks)	<b>60</b>	<b>5 in each test</b>	
Project/Assignment/Seminar	<b>50</b>	<b>20</b>	
<b>TOTAL</b>	<b>350</b>	<b>-----</b>	<b>140</b>

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**FIRST- SEMESTER**

**COURSE NO. I: BIOLOGY & DIVERSITY OF VIRUSES, BACTERIA AND ALGAE**

**UNIT – I**

Archaeobacteria and Eubacteria: General account, Ultra structure, Nutrition and reproduction, biology and economic importance, Cynobacteria salient features and biological importance.

**UNIT – II**

Viruses: Characteristic and ultra structure of virions, Isolation and purification of viruses, Chemical nature, Replication, Transmission of viruses, Economic importance, Phytoplasma: General characteristics and role in causing plant diseases.

**UNIT III**

Phycology: Algae in diversified habitat (terrestrial, fresh water, marine), Thallus organization, Cell ultrastructure, Reproduction (vegetative, asexual, sexual), Criteria for classification of algae, Pigments, Reserve food, Flagella classification.

**UNIT – IV**

Salient features of the following divisions: Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta and Rhodophyta.

**UNIT – V**

Role of algae in symbiotic associates, Fisheries, Algal blooms, Productivity of algae in fresh water and marine environment, Role of algae in soil fertility.

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**FIRST- SEMESTER**

**COURSE NO. II: BIOLOGICAL DIVERSITY OF BRYOPHYTES, PTERIDOPHYTES & GYMNOSPERMS**

**UNIT I**

General characters & Classification of Bryophytes, Comparative morphological & anatomical studies of Gametophytes and Sporophytes of Marchantiales, Jungermanniales, Calobryales, Anthocerotales, Sphagnales & Funariales. Economic importance of Bryophytes.

**UNIT II**

General characters & Classification of Pteridophytes, Comparative Morphology, Anatomy and Reproduction in Psilophytales, Psilotales, Lycopodiales, and Sellaginellales. Stellar in system in Pteridophytes.

**UNIT III**

Morphology, Anatomy and Reproduction in Equisetales, Ophioglossales, Osmundales & Salviniiales.

**UNIT IV**

Classification of Gymnosperms, Distribution of living Gymnosperms in India, Economic importance of Gymnosperms, Structure & Reproduction in Cycadales and Coniferales with special reference to Cycas, Pinus & Thuja.

**UNIT V**

Structure & Reproduction in Ephedrales Gnetales & Welwitschiales with special reference to Ephedra, Gnetum & Welwitschia.

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**FIRST- SEMESTER  
COURSE NO. III: BASIC ECOLOGY**

**UNIT – I**

Ecology & ecosystem: Definitions, Organization and components, Population ecology density & distribution, Natality, Mortality, Survivorship curves, Age structure & pyramids, Fecundity schedules, Life tables, Population growth exponential and logistic curves, Intra specific competition and self regulation, r-and k-strategists.

**UNIT – II**

Community organization: Concepts of community and continuum, Analysis of community analytical and synthetic characters, Community coefficients and indices of diversity, interspecific association negative and positive associations, Concept of ecological niche, Concepts of biodiversity.

**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 resilience and resistance, Ecological perturbation natural and anthropogenic, Ecosystem restoration.

**UNIT – IV**

Fate of energy in ecosystems: Trophic organization and structure, Food chains & webs, energy flow pathways, Ecological efficiencies consumption, assimilation and production trophic, Primary production methods of measurement, Global patterns, Limiting factors.

**UNIT – V**

Fate of matter in ecosystems: Recycling pathways, Relationship between energy flow and recycling pathways, Nutrient exchange and cycling, Global biogeochemical cycles of C, N, P and S, Physical, chemical and Biological characteristics of soil.

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**FIRST- SEMESTER**

**COURSE NO. IV: BIOCHEMISTRY**

**UNIT - I**

Structure of water and its solvent properties, Acid- bases, pH and buffer, Bi and polyprotic buffer. Free energy and spontaneity of reactions, ATP and other phosphorylated compound with their free energy of hydrolysis, Phosphoryl group transfer, Biological oxidation reductions reaction, Coupled reaction and oxidative phosphorylation, Inhibitors and uncouplers.

**UNIT - II**

Enzyme classification, Specificity, Active site, Enzyme kinetics, Michealis Menton equation, Determination of kinetic parameters, Bi-substrate reaction and their kinetics, Enzyme inhibition and kinetics, Allosteric enzyme. Kinetics and Allosteric regulation of phosphofructo kinase

**UNIT - III**

Structure and chemistry of macromolecules, Proteins, Carbohydrates and Lipids, Protein folding, Structure and chemistry of biomolecules such as antibiotics, Pigments, Vitamins as coenzymes, Lipid analysis by GLC and Mass Spectrometry, Oligosaccharide and Polysaccharide analysis.

**UNIT - IV**

Biosignaling molecular mechanism of signal transduction, Gated ion channels, Nicotinic acetyl choline receptor, Receptor enzyme, The insulin receptor, G- proteins and cyclic AMP membrane transport, Biomembrane, Nutrient transport across membranes, Active and passive diffusion, Symport, Antiport and uniport.  $\text{Na}^+$   $\text{K}^+$  pumps and their metabolic significance.

**UNIT - V**

Chromatographic technique, Paper and TLC , Gel filtration, Ion exchange, Affinity, HPLC, SDS, PAGE, Isoelectric focusing, Western blotting, Protein sequencing, Mass spectrometry, MALDI , TOF, MS.



## Practical

### Practical I (based on Course I & II)

#### Suggested List of Practicals (Course I)

##### **Biology & Diversity of Viruses, Bacteria and Algae.**

1. To prepare liquid and solid media for the growth of microorganisms (Cyanobacteria, Bacteria).  
Nutrient  
broth NAM
2. To isolate & purify microorganism by pure culture techniques.
3. Morphological study of certain Genera of Algae (Green, Brown, Red & Blue-green)
4. Isolation and identification of bacteria from soil and water sample.
5. Isolation and identification of microorganisms on some selective media from soil and water sample. (MacConkey )
6. Microscopic identification of different algal and Cyanobacterial cultures.
7. To identify Gram-positive & Gram-negative bacteria by Gram staining technique.

#### Suggested List of Practicals (Course II)

##### **Biology and Diversity of Bryophytes, Pteridophytes & Gymnosperms**

###### **Bryophytes**

1. To study the morphological and anatomical characters of given material.  
*Marchantia, Riccia, Peltia, Anthoceros, Sphagnum, Funaria and Polytrichum*

###### **Pteridophytes**

2. To study the morphological and anatomical characters of given material.  
*Lycopodium, Ophioglossum, Marsilia, Selaginella, Psilotum, Osmunda, Equisetum, Gleichenia, Salvinia, Isoetes*

###### **Gymnosperms**

3. To study the morphological and anatomical characters of given material.  
*Pinus, Cycas, Thuja*
4. To prepare the slides of given material.  
T. S stem of *Thuja*, V.S of cone of *Thuja*, T.S stem of *Cycas*,  
T.S stem of *Araucaria*, V.S leaf (needle) of *Pinus*.

**Practical II Practical based on Course III & Course IV**

**Suggested List of Practicals (Course III)**

**Basic Ecology**

1. To determine the minimum area of quadrat for phytosociological analysis of grassland.
2. To determine frequency, density and abundance of different species in the grassland.
3. To determine minimum number of quadrates for sampling of grassland.
4. To study community structure of forest.
5. To determine the pH & Dissolve Oxygen of water sample.
6. To determine homogeneity and heterogeneity of grassland vegetation.
7. To determine the pH of soil samples.
8. To determine water holding capacity of the soil.

**Suggested list of practicals (Course IV)**

**Biochemistry**

1. To study working of weighing balance.
2. To study the working of pH meter.
3. Preparation of acetate buffer at pH=5.
4. Prepare Phosphate buffer at pH=8.
5. To prepare tris buffer at pH=9.
6. Estimation of protein by Lowry method.
7. Chromatographic separation by paper and thin layer Chromatography.
8. Qualitative assessment of carbohydrate.
9. Qualitative assessment of lipids.
10. Qualitative assessment of proteins.
11. To prepare standard curve of glucose by anthrone method.
12. To study the effect of substrate concentration on enzyme activity.
13. To study the effect of temperature on enzyme activity.

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**SECOND SEMESTER**

**COURSE NO. V: TAXONOMY OF ANGIOSPERMS**

**UNIT-I**

Principles of Biodiversity & its conservation, Concept of systematic, Identification & nomenclature with special reference to International code of Botanical nomenclature. Taxonomic Category species, Genus & family, Angiosperm classification systems (Bentham & Hooker & Hutchinson).

**UNIT- II**

Herbarium, Herbarium Techniques, Role of botanical gardens, Documentation (Floras, Monographs, Journals, Manuals, Abstracts, Indices & Dictionaries), Keys for identification of plants single access and multi-access, Role of computers and Database in identification.

**UNIT- III**

Modern Taxonomy, Supportive evidence from Anatomy, Embryology, Palynology, Cytology, Phytochemistry including secondary metabolites, Numerical Taxonomy OUT'S coding, Cladistics.

**UNIT- IV**

Comparative study of Angiosperm families, Ranunculaceae & Magnoliaceae, Papaveraceae & Capparidaceae, Oxalidaceae & Meliaceae, Combretaceae & Lythraceae Rubiaceae & Asteraceae, Convolvulaceae & Lamiaceae, Gramineae & Orchidaceae.

**UNIT V**

Importance and nature of plants & their products, Industrial plants, Shisham (*Dalbergia sisoo*), Sagon (*Tectona grandis*), Rubber plant (*Ficus elastica*) Cotton plants (*Gossypium hirsutum*), Semal (*Bombex ceiba*), Flax (*Glycine max*), Kattha (*Acacia catechu*), Neel (*Indigofera tinctoria*), Sindoor (*Melilotus alba*).

Drug Plants, Ashwagandha (*Withania somnifera*), Sarpagandha (*Rauwolfia serpentina*), Adhusa (*Adhatoda vasica*) Amla (*Emblica officinalis*), Neem (*Azadirachta indica*), Punarnava (*Boerhaavia diffusa*) safed musli.

Food Plants, Wheat (*Triticum aestivum*), Rice (*Orriza sativa*) Maize (*Zea mays*), Arhar (*Cajanus cajan*) Chana (*Cicer aurientinum*), Onion (*Allium cepa*) Clove (*Piper longum*) Turmeric (*Curcuma domestica*), Mustard (*Brassica compestris*), Groundnut (*Arachis hypogea*).

Ethnobotany, Plants used by tribals of M.P., Sitaphal, Champa, Bel, Ber, Sal, Achar, Palash, Kachnar, Siris, Arjun, Harra, Bahera, Mehndi, Mahua, Tendu, Latjira, Gular, Anar, Datura.

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**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**SECOND SEMESTER**

**COURSE NO. VI : RESOURCE UTILIZATION AND CONSERVATION**

**UNIT – I**

Major Biomes of the world, Tropical rain & Seasonal Forests, Temperate rain & Seasonal forests, Boreal forests, Grasslands, Deserts, Aquatic Ecosystems wetlands, Lakes & Ponds Streams & Rivers, Marine & Estuarine habitats.

**UNIT – II**

Resource utilization, Status & Utilization of Biodiversity, Sustainable development resources from forest, Grassland and aquatic habitats, Food forage, Fodder, Timber & Non-wood forest products, Threats to quality & quantity of Resources due to overexploitation

**UNIT –III**

Strategies for conservation of resources: Classifications of resources, Principles of conservation, *In-situ* conservation sanctuaries, National parks, Biosphere reserves for wildlife conservation, Habitat conservation practices of conservation for forests ranges, Soil and water.

**UNIT – IV**

Air, Water and Soil pollution, Kinds, Sources, Quality parameters, Effects on structure & function of ecosystems, Management of pollution, Bioremediation, Climate changes sources, Trends & role of greenhouse gases, Effect of global warming on climate, Ecosystem processes & Biodiversity, Ozone layer & Ozone hole.

**UNIT – V**

Resource monitoring, Remote sensing concepts & Tools, Satellite remote sensing basics sensors, Visual & digital interpretation, EMR bands and their applications, Indian remote sensing program, Thematic mapping of resources, Application of remote sensing in Ecology & Forestry.

**SECOND SEMESTER**

**COURSE NO. VII: BIOLOGY AND DIVERSITY OF FUNGI**

**UNIT – I**

Status of fungi in the living world, General features of fungi and fungus like organisms, Recent trends in the classification of fungi, Physiology and growth of fungi, Nutritional and environmental factors affecting growth, Saprotrophs, parasites of mutualistic symbionts, Physiology of reproduction in fungi, Phylogeny of fungi.

**UNIT – II**

Fungal diversity, Major taxonomic groups, Structure, Reproduction, Life cycle and significance of the following representative:

- I) Gymnomycota – Cellular slime moulds (*Dictyostelium*), Plasmodial slime moulds (myxomycetes).
- II) Mastigomycota- *Coelomomyces*, *Langenidium*, *Achlya*, *Phytophthora*, *Peronospra*, *Plasmodiophora*.
- III) Amastigomycota – *Zygomycotina* – *Mucor*, *Synephalastrum*, *Blakeslea*, *Cunninghamella*, *Entomorphthora*.

**UNIT – III**

Fungal diversity contd, Structure, Reproduction, Life cycle and significance of the following representative:

- I Ascomycotina: *Taphrina*, *Emericella*, *Chaetomium*, *Morchella*, *Neurospora*, *Claviceps*. II Basidiomycotina: *Puccinia*, *Melampsora*, *Ustilago*, *Polyporus*, *Lycoperdon*, *Ganoderma*.
- III Deutromycotina: *Fusarium*, *Cercospora*, *Curvularia*, *Beauveria*, *Microsporium*, *Phoma*, *Colletotrichum*.

**UNIT – IV**

Fungal genetics, Life cycle and sexual process in fungi, Structure and organization of fungal genomes (Mitochondrial genes, Plasmids of transposable elements, Virus and viral genes). Genetic variations in fungi nonsexual variations Haploidy, Heterokaryosis, Parasexuality, Sexual variations mating or Breeding systems Homothallium and Heterothallium, Mutation, Physiological specialization, Strain improvement, Sex hormones.

**UNIT – V**

Fungi and Biotechnology, Production of alcoholic beverages, Antibiotics, Organic acids, Ergot alkaloids, The cultivation of fungi for food mushrooms and Myco protein, Mycofoods, Role of fungi in agriculture and forestry, Mycorrhizae and their application, Mycopesticides, Mycotoxins, Conservation of fungi germplasm.

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**SECOND SEMESTER**

**COURSE NO. VIII: BIOSTATISTICS AND COMPUTER APPLICATIONS**

**UNIT – I**

Importance and scope of statistics in experimentation, Measure of central tendency arithmetic, Geometric and harmonic means, Measure of dispersion variance, Standard deviation, Coefficient of variation, Confidence limits of population mean.

**UNIT – II**

Elements of probability, Statistical and Mathematical definitions, Probability distribution function: Normal, Binomial and Poisson distribution.

**UNIT – III**

Tests of significance, Hypothesis and errors, 't' test, Population mean equals a specified value, Test of the equality of two means ( Independent samples & Equal variances), Test of the equality of two means ( Paired samples), 'F'- test, One way analysis of variance ( Sample sizes, Equal and Unequal).

**UNIT – IV**

Chi-square statistics, Test of goodness of fit and test of independence of factors, Simple correlation coefficient, Significance tests, linear regression equation and diagram regression coefficient, Standard error, Significance tests.

**UNIT – V**

History and development of computers, Hierarchy of computers, Computer hardware components and functional structures, Computers software: system and application software.

**PRACTICALS**

**Practical I based on Course V and VI**

**Suggested List of Practicals (Course V)**

**Taxonomy of Angiosperms**

1. To study the plants of following Families.

Ranunculaceae – *Delphinium ajacis*,

Magnoliaceae – *Michelia champaca* Linn.,

Papaveraceae – *Argemone maxicana*,

Capparidaceae – *Cleome gynandra* (Hut-hul)

Oxalidaceae – *Oxalis corniculata*

Meliaceae – *Melia azadirach* (Mahaneem neem),

Lythraceae – *Lagerstroemia parviflora*,

Combretaceae – *Quinsqualis indica*

Rubiaceae – *Ixora coccinea* (Rukmani)

Asteraceae (Compositae) – *Helianthus annus*

Lamiaceae – *Ocimum sanctum* (tulsi)

Convolvulaceae – *Convolvulus microphyllus*

Poaceae (Gramineae) – *Triticum aestivum*

Orchidaceae – *Zeuxine stratecemitica*

2. To study the Ethnomedicinal importance of the following plants–

Arjun (*Terminalia arjuna*), Harra (*Terminalia chebula*),  
Clove (*Syzygium aromaticum*), Mehndi (*Lawsonia inermis*),  
Neem (*Azadirachta indica*), Amla (*Emblica officinalis*),  
Onion (*Allium cepa*), Ashwagandha (*Withania somnifera*),  
Sarpagandha (*Rauvolfia serpentina*), Bahera (*Terminalia  
bellerica*)

2. To prepare the Herbarium of the plants.

**Suggested list of practicals (Course VI)  
(Resource Utilization and Conservation)**

1. To find the pH of the various sample of soil by pH meter.
2. To determine the presence of carbonate in different soil mixtures.
3. To determine the presence of phosphate in soil and water sample.
4. To determine the presence of nitrate in mixture sample.
5. To determine the presence of nitrite in mixture sample.
6. To determine frequency, density and abundance of herbaceous species from local garden.
7. To determine the biomass of plant vegetation.
8. To determine leaf area, dry weight and moisture content of few species of plant from grassland.

**Practical II based on Course VII and VIII**

**Suggested List of Practical (Course VII)**

**Biology and Diversity of Fungi**

1. To study the structure of given fungi by using Camera Lucida.
2. To perform micrometry for measurement of fungal spores and sporangia.
3. To study slide culture technique for observing morphology of fungi.
4. Isolation and identification of fungi from infected leaves of different plant parts.
5. Isolation and identification of fungi from air.
6. Classification and characterization of micro-organism  
*Chaetomium, Neurospora, Melampyora, Ustilago, Alternaria, Mucor, Fusarium, Rhizopus, Curvularia*
7. Morphological study of edible Mushrooms.
8. To cultivate Mushrooms as a source of myco-protein.
9. To examine Antibacterial properties of certain fungal species.

**Suggested List of Practical (Course VIII)**

**Biostatistics and Computer Applications**

1. To find out the average length of the mango leaf by arithmetic, harmonic and geometric mean.
2. To find out the standard deviation and coefficient of variation of the length of leaf.
3. To find out the confidence limit of the length of the leaf.
4. To find out the probability of getting head in 10, 20, 30, 40 & 50 tosses of a fair coin.



**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

5. To test the hypothesis that average pulse rate of biostatistics class students is 72 beats per minute.
6. To calculate the correlation coefficient between length and weight of 10 different pieces of *Parthenium* stem.
7. To find out the prediction or regression equation of the *Parthenium* stem.
8. To study Hardware's & Software's of computer

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**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**THIRD - SEMESTER**

**COURSE NO. IX: PLANT PHYSIOLOGY**

**Unit I**

Mechanism of transport of water inorganic and organic substances, Source and sink relationship, Mineral nutrition & absorption.

**Unit II**

Photosynthesis in plants, Pigments, Photosystem I and II, Mechanism of quantum capture and energy transfer between photosystems, Reduction of CO<sub>2</sub>, C<sub>3</sub>, C<sub>4</sub> and CAM metabolism, photorespiration and its significance.

**Unit III**

Overview of plant respiration, Glycolysis, TCA cycle, Electron transport and ATP synthesis, Pentose phosphate pathway, Glyoxalate cycle.

**Unit IV**

Plant hormone, Mode of action of auxins, Gibberellins, Cytokinin, Ethylene, Abscisic acid, Special features of secondary plant metabolites, Biosynthesis and functions of phenolic acids, Alkaloids.

**Unit V**

Stress physiology, Water deficit and drought resistance, Temperature stress, Salinity stress metal toxicity, Biological clock and its regulation, Photoperiodism and floral induction.

DEPARTMENT OF UG & PG STUDIES IN BOTANY

THIRD - SEMESTER

COURSE NO. X: GENETICS & MOLECULAR BIOLOGY

**Unit I**

Nucleic acid as genetic material (experimental proof) DNA structure A, B & Z forms. Chromosome structure & chromatin organization, Euchromatin & Heterochromatin different models, Nuclear DNA content, C-value paradox, Cot curves, Restriction mapping, Concept & techniques, *In-situ* hybridization.

**Unit II**

Spontaneous & induced mutations, Physical & chemical mutagens types of mutations, Molecular mechanism of mutation, forward, back, Missense, Nonsense, Frameshift and suppresser mutations, Mutations induced by transposons, Site directed mutagenesis, Mechanism of DNA damage & repair, Photorepair, Excision or dark repair,

**Unit III**

Genetics of microorganisms, Transformation, Conjugation & transduction in bacteria, Conjugation mapping, Molecular mechanism of recombination, Role of Rec ABC&D, general & site specific recombination, Independent assortment, Linkage and crossing over.

**Unit IV**

DNA & RNA sequencing, Different methods, DNA replication, DNA polymerases, Topoisomerases, Ligases, Gene transcription, RNA polymerases, Promoters, Transcription factors, Mechanism of transcription, Chain initiation, Elongation, & termination, Post transcriptional processing of RNA, Capping, Adenylation & splicing, Introns & Exons

**Unit V**

Translation of messenger RNA into proteins, Structure & role of t-RNA & ribosomes, Different factors (I, EFTs, RFs), Protein chain initiation, Elongation & termination, Inhibitors of protein synthesis, Gene expression in prokaryotes, Operon concept, Inducer, Repressor, Co-repressor, c-AMP / CRP, co-induction & co-repression. Regulation of lac operon & Tryptophan operons, Attenuation Gene expression in eukaryotes, Britton and Davidsons, Gene battery model, HCP / NHCP Hormones

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**THIRD - SEMESTER**

**COURSE NO. XI: PLANT REPRODUCTION & DEVELOPMENT**

**UNIT – I**

Organization of shoot apical meristem (SAM), Control of tissue differentiation especially Xylem & Phloem, Secretary ducts & Lactifers, Diagnostic features of woods.

**UNIT – II**

Leaf growth & differentiation, Determination of Phyllotaxy, Differentiation of Epidermis including Stomata, Trichomes, & Mesophyl tissue.

**UNIT – III**

Root development, Organization of root apical meristem (RAM), Vascular tissue differentiation, Lateral roots, Root hairs, Root microbes interactions.

**UNIT – IV**

Male gametophyte development, Structure of anther, Microsporogenesis, Pollen germination, Pollination. Female gametophyte development, Ovule development, Megasporogenesis organization of embryo sac, Endosperm development, storage protein of Endosperm & Embryo.

**UNIT – V**

Reproduction, Vegetative & Sexual reproduction, Pollen Pistel interaction and Fertilization, Double fertilization , Seed germination & Seedling growth, Seed dormancy.

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**THIRD - SEMESTER  
COURSE NO. XII: BIOTECHNOLOGY**

**UNIT I**

Biotechnology an Overview, Definition, Perspective and scope of biotechnological processes and products, Biotechnology and Ethics, Introduction, Medical and chemical Biotechnology, Agriculture and Food, Energy and environment and human, Bioethics, Facing problem and finding solutions, Regulating the use of biotechnology, Patenting biotechnology inventions.

**UNIT II**

Genetic Engineering and gene cloning, Introduction of genetic engineering procedure, restriction endonuclease, cloning vehicle, Vectors for animals and plants, Insertion of DNA molecule in to a vector, Direct transformation, Isolation and cloning, Transformation and growth of cells, Selection and screening of particular recombinants, Genomic library, sequencing of DNA, Gene identification and mapping, Analysis of expression of cloned genes, Polymerase chain reaction, Monoclonal Antibodies.

**UNIT III**

Plant cell and tissue cultures, Culture techniques, Protoplast fusion, Direct gene transfer, Microinjections, Nuclear transplantation, Plastid and mitochondrial genes, production of secondary metabolites by immobilized plant cell, Development of disease resistant, herbicide resistant, Salt & drought resistant plant varieties, Microbial Toxins, Introduction, Toxins gene isolation, Genetic engineering of *B. thuringiensis* strains, *Baculovirus* as biocontrol agents.

**UNIT IV**

Culturing microorganisms for the production of biomass, Production of microbial (Bacterial, Cyanobacterial and Fungal) products, Batch culture, Continuous culture, Fed-batch culture, Mass culture, Use of culture system for the production of microbial products, Production of cyanobacterial biomass for food, Feed and health care products, Improvement of microbial strains for industry, Agriculture, Immobilization of microbial cells and enzyme and its applications.

**UNIT V**

Strain improvement, bioreactor design, Reactor types, Application of immobilized cells and enzyme, improvement in bioreactor to control environment of process organism. use of microorganisms in pollution control, Waste treatment, Bioremediation, Biological removal of eutrophic nutrients, Heavy metals, Toxic chemicals (Herbicide, Insecticide and Fungicide and Other Toxicants) from waste water and industrial effluents, Utilization of waste water for the production of food and feed, Biodegradation, Bioleaching of metals, Application of microorganisms from environment

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PRACTICALS

Practical I based on Course IX and X

**Suggested List of Practicals (Course -IX)**

**Plant Physiology**

1. To measure Diffusion Pressure Deficit of Potato cells.
2. To prepare molar, Molal & Normal solution of NaCl and Sucrose.
3. To determine the incipient plasmolysis of cells under different concentration of sucrose solution.
4. Extraction and separation of the chlorophyll pigment from spinach leave by paper chromatography.
5. Separation of anthocyanin pigment by Paper Chromatography.
6. Quantification of pigments from spinach leaves by Spectrophotometer.
7. To determine the stomatal index in different plant species.
8. To study the effect of salt & osmotic stress on plants.

**Suggested List of Practicals (Course X)**

**Genetics & Molecular Biology**

1. Staining technique for chromosomes preparation in plant (Onion plant) and animal cell.
2. To study the mitotic stages in the root of onion (*Allium cepa*) and to calculate the mitotic index.
3. To study the pollen sterility and fertility in buds of *Tradescantia*.
4. To study the effect of UV rays on *E.coli*.
5. To study the effect of dark and light treatment in DNA repair in *E. coli*.

Practical II based on Course XI and XII

**Suggested List of Practicals (Course XI)**

**Plant Reproduction & Development**

1. Slide: -Types of ovule (L.S.)  
Types of placentation  
Anther T.S.  
Dicot embryo, monocot embryo  
Seed coat  
*Lillium* Bud (Early anther)
2. To study the structure of given pollen grain (*Tradescantia*) using camera lucida.
3. To measure the size of given pollen grain.
4. Features of wood
5. Xylem and phloem
6. Phyllotaxy

**Suggested list of practicals (Course XII)**

**Biotechnology**

1. Demonstration:-
  - PCR
  - Spectrophotometer
  - pH meter
  - Centrifuge
  - Photomicrographic Camera
2. To prepare the media for plant tissue culture.
3. Isolation of pathogenic fungi from infected plants/Disease plants (Leaf/ Stem/ root)
4. Identification of unknown microorganism from given plates.
7. Preparation of tissue culture media

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**FOURTH – SEMESTER**

**COURSE NO. XIII: PLANT CELL, TISSUE & ORGAN CULTURE**

**UNIT I**

Plant cell and tissue culture: general introduction, history, scope, concept of cellular differentiation and totipotency

**UNIT II**

Techniques of tissue culture. Organ culture – meristem, anther and embryo. In vitro fertilization.

**UNIT III**

Organogenesis and adventive embryogenesis; fundamental aspects of morphogenesis, somatic embryogenesis and androgenesis. Mechanisms, techniques and utility.

**UNIT IV**

Somatic hybridization, protoplast isolation, fusion and culture, hybrid selection and regeneration; possibilities and achievements and limitations of protoplast research.

**UNIT V**

Application of plant tissue culture; clonal propagation; artificial seeds; production of hybrids, somaclones and somaclonal variation; production of secondary metabolites/ natural products; cryopreservation and germplasm storage.



**COURSE NO. XIV: BIOTECHNOLOGY & GENETIC ENGINEERING**

**UNIT I**

Biotechnology; basic concepts, principles and scope. Intellectual Property Rights – possible ecological risks and ethical concerns.

**UNIT II**

Basic concepts of Recombinant DNA technology; gene cloning – principles and techniques; construction of genomic/ cDNA libraries; choice of vectors; DNA synthesis and sequencing, polymerase chain reaction. DNA fingerprinting

**UNIT III**

Genetic engineering of plants, aims, strategies for development of transgenics (with suitable examples); *Agrobacterium* – the natural genetic engineer; T-DNA and transposon mediated gene tagging; chloroplast transformation and its utility.

**UNIT IV**

Microbial genetic manipulation; bacterial transformation; selection of recombinants and transformants; genetic improvements of industrial microbes and nitrogen fixers; fermentation technology.

**UNIT V**

Genomics and Proteomics; genetic and physical mapping of genes; molecular markers for introgression of useful traits; artificial chromosomes; high throughput sequencing; genome projects; bioinformatics; functional genomics; microarrays; protein profiling and its significance.

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**COURSE NO. XV: A - ETHNOBOTANY**

**UNIT I**

Definition and scope of Ethnobotany Historical review and outline idea of archaeoethnobotany. Ethnoecology, Ethnomedicines, Ethnonarcotics. Ethnopharmacology, Ethnotaxonomy, Ethnocosmetics, Ethnolinguistics, Ethnoorthopaedics, Ethnopaediatrics

**UNIT II**

Preservation of Genetic diversity, plants used in various systems of medicines, Ayurvedic, Unani and Homoeopathic system. Allopathic systems. Plants used by villagers and tribal people, Role of ethnobotany in the development of Society.

**UNIT III**

Ethnobotanical importance of :

*Aconitum napellus, Allium cepa, Mentha arvensis, Allium sativum, Nux-vomica, Aloe vera, Ocimum sanctum, Atropa belladonna, Azadirchta indica, Piper nigrum, Butea monospora, Pterocarpus marsupium, Eugenia aromatica, Terminalia arjuna, Eugenia jambolana, Terminalia bellerica, Hollarhena antidysentrica, Terminalia chebula, Withania somnifera, Lawsonia inermis*

**UNIT IV**

Plants in mythology, Taboos and Totems in relation to plants, folkore and folk tales, Wild life protection in tribal, plants domestication by the tribal. plants in similes and metaphors. Ethnobotanical importance of :

*Cassia fistula, Cannabis sativa, Ricinus communis, Emblica oficinalis, 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 & Asthma

Tuberculosis, Urino - genital problems, Amoebic dysentery Malaria, Rheumatism, Leprosy, Jaundice, Heart diseases, Piles, Leukoderma

**MATA GUJRI MAHILA MAHAVIDYALAYA (AUTONOMOUS), JABALPUR**

**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

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**DEPARTMENT OF UG & PG STUDIES IN BOTANY**

**COURSE NO. –XVI- B – PLANT PROTECTION**

**UNIT I**

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 II**

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 III**

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 Brinjal.  
4. Nematodes: Root knot of vegetables.

**UNIT V**

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 V**

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.).

**PRACTICAL**

**Practical based on course XIII and XIV**

**Suggested list of practicals (Course XIII)**

**Plant cell, Tissue and Organ Culture**

1. Preparation of tissue culture media.
2. Demonstration of Tissue Culture Technique.

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3. Demonstration of protoplast isolation.
4. To study the Anther culture technique.
5. To demonstrate the technique of Somatic Embryogenesis.

**Suggested list of practicals (Course XIV)**

**Biotechnology & Genetic Engineering**

1. To demonstrate Recombinant DNA Technology.
2. To demonstrate the method of DNA Synthesis.
3. To demonstrate the Polymerase Chain Reaction.
4. To demonstrate the technique of DNA Fingerprinting.
5. Demonstration of:-

Spectrophotometer

pH meter

Centrifuge

**PRACTICAL II based on Course XV-A and XVI-B**

**Suggested list of Practical (Course XV-A)**

**Ethnobotany**

1. Study of plants used in Ayurvedic medicine system
2. Study of plants used in homeopathic medicine system
3. Study of plants used in Unani medicine system
4. Study of plants used in Allopathic medicine system
5. Study of common plants and their parts used in treatment of following diseases

Skin, Asthma and bronchial inflammation, Malaria, Jaundice, Leprosy, Rheumatism, Heart diseases

6. Ethnobotanical importance of the following

*Cassia fistula, Cannabis sativa, Ricinus communis, Emblica officinalis, Santalum album*

**Suggested list of Practical (Course XVI-B)**

**Plant Protection**

1. Preparation of P.D.A. media, plates and slants.
2. Isolation of plant pathogens.
3. Plant diseases –  
**Fungal**-Rust, downy mildew, powdery mildew, Smut, Tikka disease

**Viral**- leaf curl of papaya, Yellow vein mosaic of bhindi

**Bacterial**- citrus canker, blight of paddy

**Mycoplasmal-** Little leaf of Brinjal

4. Study of weeds- Parthenium, water hyacinth, cuscuta.
5. Study of insects of Gram, Soyabean, and Teak