UPTO 2016

CRYPTOGAMS

SUB.CODE : 1PGB1

Unit I **Algae** (20 hr)

1. Systematic position and classification by Fritsch
2. Range of Vegetative organization
3. Reproduction and life cycles (Homomorphic, Heteromorphic and Triphasic)- *Dictyota, Laminaria and Polysiphonia*
4. Ecology and Cultivation of Algae
5. Economic importance of Algae – Food, Medicine, Agriculture and Industry

Unit II **Lichens** (15 hr)

Lichens – Habit, Thallus structure, Reproduction, Establishment and growth, Ecology and Environmental monitoring and Economic importance.

Unit III **Bryophytes** (20 hr)

1. Basic adaptations of Bryophytes, Haploid generation's dominance in the life cycle. Sporophytic evolution.

2. Sexual reproduction in Bryophytes with reference to Chromosomes organization in *Sphaerocarpus*. Value of Euchromatin and heterochromatin. Role of specific chromosomes. Sex determination in *Bryum, Mnium*. Differential mitosis in *Marchantia* and sex expression.

Unit IV **Pteridophytes** (20 hr)

1. General features and Life cycle patterns
2. Vascular organization and Stelar evolution
3. Organisation & structure of sporophyte and spore producing organs
4. Gametophytic generations.
5. Heterospory and Seed habit.

Unit V (15 hr)

1. Deviant mechanisms in life cycle – Apogamy, Apospory based on experimental evidences and Totipotency in tissues

2. Evolution/Derivation of sporophytes as shown by Telome concept

PTO

Reference:

1. F.E.Fritsch - Structure and Reproduction of Algae, Volume I and Volume II.
2. C.M.Smith - Crytogamic Botany, Volume I & Volume II
3. N.S.Parihar - Introduction to Embryophyta, Vol. I & Vol.II
4. Rashid - Pteridophytes
5. K.M. Bhatra - A textbook on Algae
6. R.N. Singh - Role of Blue Green Algae
7. Round, Ecology of Algae
8. Ramudar - Bryology of India
9. R.Chopra and P.K. Kumar - Biology of Bryophytes
10. E.V. Watson - The Structure and life history of Bryophytes
11. G.S. Venkataraman - Algal Biofertilizer and rice cultivation
12. Barrengton & Willis - Biology of Lichens
13. M.C. Hale - Biology of Lichens
14. D.C. Smith - The Lichen symbiosis
15. D.L. Hawksworth & D.J. Hill - The Lichen forming fungi

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UPTO 2016

6 hours/week= 90hr

1PGB3

MYCOLOGY, PATHOLOGY AND BREEDING

SUB. CODE : 1PGB3

3606

(25hr) (upto 2016)

Mycology - Unit I

Outline classification of fungi by Alexopoulos & Mims
General characteristics of fungi. Gymnomycota, Mastigomycota and Amastigomycota. Heterothallism, Spore dispersal mechanism, Nutrition in fungi.

(5 hr)

Unit II

Economic aspects of Fungi: Fungal deterioration of Wood, Paper and Leather – Role of fungi in Baking, Brewing and Pharmaceutical industries.

(10hr)

Pathology - Unit III

Classification of plant diseases – symptoms – Host-pathogen interaction – defense mechanisms disease control – disease forecasting.

(30hr)

Unit IV

Symptoms, etiology, disease cycle and control measure of the following crop diseases
Paddy blast
Early blight of potato
Red rot of sugar cane.
Angular leaf spot.
Bunchy top of banana.
Little leaf of brinjal.

(20hr)

Breeding - Unit V

1.Scope and Divisions.
2.Selection: Pureline and Mass selection
3.Hybridization: Procedure and achievements
4.Heterosis: Dominant and overdominant hypothesis
5.Plant introduction: Procedure, Acclimatization, Phytosanitary certificate. Merits and Demerits with examples.
6.Role of Polyploidy and mutation breeding

Reference:

Alexopoulos, C.J – Introductory Mycology
Vashistha, B.R – Botany for degree students.
Chopra, G.L. – A text book of Fungi.
Sir Walker, J.C – Plant pathology
Mehrotra – Plant Pathology
Singh – Introduction to plant disease.
R.K. Chowdry – Plant Breeding
Daniel Sundaraj – Cytogenetics and Plant Breeding
R. Shukla and P. S. Chandel – Cytogenetics, Evolution and Plant Breeding

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M.Sc, BOTANY
PHANEROGAMS
(Taxonomy of Gymnosperms and Angiosperms)
SUB.CODE : 2PGB1

Gymnosperms - Unit I [25hr]

Concept of Progymnosperm. Classification (Coulter & Chamberlain) and distribution of gymnosperms, Salient features of Cycadales, Coniferales and Gnetales with special reference to *Cycas*, *Pinus* & *Gnetum*. Structure, Reproduction and economic importance.

Angiosperms – Unit II [15hr]

a) Comparative account of the following systems of Angiosperm Classification: Bentham & Hooker, Engler & Prantl and Hutchinson.

b) Principles of Nomenclature, ICBN – Various types, Nyms, valid and effective publication.

c) Phenetic and Phylogenetic methods: Numerical taxonomy and Cladistics.

Unit III [20hr]

Study of important taxonomic characters and popular examples of the following natural orders of Bentham and Hooker's classification:

Polypetalae

Nymphaeceae, Brassicaceae, Leguminosae, Cucurbitaceae, Apiaceae

Unit IV [30hr]

Gamopetalae,Monochlamydeae

Rubiaceae, Sapotaceae, Aopcynaceae, Solanaceae, Verbenaceae, Euphorbiaceae.

Unit V : Monocotyledonae

Orchidaceae, Scitaminae, Liliaceae, Arecaceae & Poaceae.

Reference:

1.The Gymnosperms by C.Biswas and B.M.Johri
2.Gymnosperms by S.P. Bhatnagar and Alok mitra
3.An introduction to Gymnosperms by S.C.Datta
4.Paleobotany by Arnold
5.Vasista, College Botany, Vol II
6.Singh, Y and D.K. Jain, Taxonomy of Angiosperms
7.Botany for Degree Students Gymnosperms – P.C. Vasishta.
8.A Text Book of Botany Vol I & II – S.N. Pandey, S.P. Misra, P.S. Trivedi.
9.Taxonomy of Angiosperms – P.C.Vasishta
10.Taxonomy of Angiosperms – Heslop and Harrison
11.Principles of Taxonomy – Stace
12. Taxonomy of flowering plants Vol I & II – Hutchinson
13.Plant Systematics – Gurucharan Singh

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THE MADURA COLLEGE (AUTONOMOUS) MADURAI-11
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UPTO 2010

BIOCHEMISTRY AND BIOPHYSICS ON : NO : 3618
2PGB3[illegible] / 2PGB1(upto2005)
SUB.CODE : 3PGB2 (2006[illegible] 3618

Biochemistry

Unit I

(30 hr)

- ß Carbohydrates: classification, structure and properties of monosaccharides, oligosaccharides and polysaccharides.
- ß Aminoacids: Structure and properties; essential and nonessential aminoacids, non protein aminoacids, unusual aminoacids; biosynthesis of aromatic aminoacids.
- ß Proteins – classification, levels of organization and properties. Ramachandran plot, 3D structure and protein folding
- ß Lipids – classification, properties, synthesis and breakdown of palmitic acid – importance of cholesterol and plant lipids.
- ß Nucleic acids – structure, chemistry and properties of DNA & RNA. Biosynthesis of purines and pyrimidines.

Unit II

(25 hr)

- ß Enzymes – definition, nomenclature, classification and properties; mechanism of enzyme action, Michaelis-Menton equation, Line-Weaver Burk plot; enzyme inhibitors – mechanism; allosteric and coenzymes.
- ß Vitamins – properties, types and biological significance.
- ß Secondary metabolites: A brief account on alkaloids, phenols and terpenoids.

Unit III

(15 hr)

- ß Biochemical techniques – Principles, types and application of the following:
  - ✓ Centrifugation – angular and density gradient
  - ✓ Chromatography – TLC & GLC
  - ✓ Sectrophotometry – UV & Visible spectrum
  - ✓ Electrophoresis - SDS
  - ✓ Radioactivity

Biophysics

Unit IV

(10 hr)

- ß Concept of free energy and work – Enthalpy and Entropy – Laws of thermodynamics.
- ß Redox potential – Redox couple – Redox reaction
- ß Bioenergetics – ATP NADP/NADPH
- ß Mitochondrial and chloroplast bioenergetics.

Unit V

(10 hr)

- ß Photobiology – Nature of light – Electro Magnetic Spectrum - impacts of solar UV radiation in biology.
- ß Bioluminescence – phosphorescence and fluorescence

References

C.W.Jones	Biological Energy Conservation
D.G. Nicholas	Bioenergetics
E. Racker	Mechanism of Bioenergetics
Lehninger	Biochemistry
Corn. R, Stump	Outline of Biochemistry
Plummer	Practical Biochemistry
Ambika Shunmugam	Text Book of Biochemistry
L. Stryer	Biochemistry
S.C. Rastogi	Biochemistry
J.L.Jain	Biochemistry

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Botany **COURSE CODE : 3PGB2 (Upto 2016)**

COURSE TITLE : General Microbiology **QN.NO : 3628**

TIME : 3 Hours **MAX.MARKS :75**

Unit I (25 hr)

Scope, history – contribution of Leeuwenhoek, Lister, Jenner, Koch, Pasteur

Brief account on bacterial classification (major groups only), structure of bacterial cell wall, capsule, cell membrane, flagella, pili, cytoplasmic inclusions, Bacterial endospores, its development and function.

Unit II (10 hr)

Growth of microorganisms – nutritional requirements and types. Growth kinetics: Growth in continuous culture, Batch culture, synchronous growth and diauxic growth. Factors affecting growth

Unit III (25 hr)

Aerobic, anaerobic, ED pathway and fermentation metabolism (homo and heterolactic), peptidoglycan synthesis

Bacterial photosynthesis – oxygenic and anoxygenic light reactions, CO_2 metabolism – reductive TCA cycle and serine pathway

Unit IV (15 hr)

Viruses: introduction, general characteristics, classification. Structure and reproduction of phages (T_7 and lambda) and plant viruses (TMV & CaMV). A brief accounts on viroids and prions

Unit V (15 hr)

Control of microbes – Physical and Chemical methods. Chemotherapeutic agents: Antibiotics – chemical nature, mode of action. Mechanism of resistancy to antibiotics

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PROGRAMME : M.Sc., Botany **COURSE CODE : 3PGB3 (Upto 2016)**

COURSE TITLE : Applied Microbiology **QN.NO : 3629**

TIME : 3 Hours **MAX.MARKS :75**

Environmental microbiology
Unit I (20 hr)

Ecological groups of microorganisms based on O_2 requirement, carbon sources, temperature. Microbial interactions. Extremophiles : physiology, molecular adaptation and applications of acidophiles, alkalophiles, thermophiles and barophiles.

Unit II (20 hr)

Aquatic microbiology: Microflora, Sewage treatment – primary, secondary: oxidation pond, trickling filter, activated sludge and tertiary treatment. BOD, COD.

Soil microbiology: Microflora, siderophores. Biodegradation of pesticides Eg. 2,4 D.

Agricultural microbiology

Unit III (15 hr)

Biofertilizers: Nitrogen fixers: Associative, symbiotic and asymbiotic, Mechanism of nitrogen fixation. Phosphate solubilizers: Mycorhizae – Endo, Ecto and AM fungi Mechanism of phosphate solubilization. Biopesticides: Bacterial, fungal and Viral insecticides.

Food and industrial microbiology

Unit IV (20 hr)

Fermenter – design, operation and types. Dairy industry – Milk microflora and contamination, preparation of yoghurt, cheese.

Beverages – production of beer and wine. Organic acids – Citric acid. Antibiotics – penicillin. Food spoilage, Food preservation methods. Food-borne diseases.

Medical microbiology

Unit V (15 hr)

Clinical features, symptoms, lab diagnosis, prophylaxis and treatment of the following diseases
Bacterial - Tuberculosis
Viral – AIDS & hepatitis,
Protozoan - Malaria
Fungal - Ring worm

Practicals (3PGB2 & 3PGB3)
Cleaning of glasswares

Sterilization methods
Preparation of media
Culturing of microbes
Ubiquitos nature of microbes
Bacterial Staining – a) Simple b) differential c) Capsule d) spore
Growth curve of bacteria (turbidity measurement)
Identification of microorganisms by biochemical tests a) Catalase test b) Indole test c) MR-VP test d) Starch hydrolysis 5) Gelatin hydrolysis
Antibiosis
Isolation of Rhizobium from root nodules
Milk dye reduction test – Methylene blue and Risazurin
Potable water quality test – MPN method

References

Prescot	Microbiology
Pelczar et al	Microbiology
Caldwell	Microbial Physiology and Metabolism
Talero	Microbiology
Patel	Industrial Microbiology
Brock	Biology of Microorganisms
Ingrahm and Ingrahm	Microbiology
Frazier	Food Microbiology
Atlas and Bhartha	Environmental Microbiology
Subba Rao	Agricultural Microbiology

THE MADURA COLLEGE (AUTONOMOUS) MADURAI - 11

PG BOTANY

NON-MAJOR ELECTIVE

APPLIED BOTANY

SUB.CODE : 3PGBNM (3630) ✓ (upto 2016)

ON : NO. 3630 ✓

HORTICULTURE

UNIT I (15 hr)

- Scope, divisions, important research institutes & gardens, plantation crops – influence of climate. Garden types – ornamental (symmetrical and asymmetrical) and kitchen garden
- Pruning and training – bulky organic manures – eg. compost, vermicompost & biofertilizers.

UNIT II (15 hr)

- Propagation methods – advantages & limitation of sexual & vegetative methods – cutting – stem, leaf & root; Grafting – approach & cleft; Layering eg: simple & air. Budding - T & patch
- Value addition to the raw materials – a brief account eg. jams & pickles

FORESTRY

UNIT III (10 hr)

- Introduction, definition and importance – Types of forests,
- Agroforestry and Social Forestry
- Deforestation and Afforestation
- Conservation – Wildlife sanctuaries, National Parks

UNIT IV (10 hr)

Major and Minor forest products

- Major products – Timber (Teak and Rose wood) – Plywood – Paper industry

Minor products – Gums, Dyes and Aromatic oils (Brief account only)

ETHNOBOTANY

UNIT V (10 hr)

- Introduction, subdivision, tribals of Tamilnadu – ethnobotanical contributions by Paliyan and Irula tribes
- Important medicinal plants – *Withania, Ravuolfia, Gymnema, Ocimum and Curcuma*

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(UPTO 2016)

BIOSTATISTICS AND BIOINFORMATICS

SUB.CODE : 4PGB1(/ 4PGB2 (3636) ON: ND: 3636

Biostatistics

Unit I (15 hr)

Definition and Scope – Descriptive and Inferential statistics, Populations, Samples, Variables, Parameters, Collection of data, Sampling methods, Organizing the data into summary tables and Graphing the data.

Unit II (30 hr)

Measures of central tendency – arithmetic mean, mode and median. Measures of dispersion – Mean deviation and Standard deviation and standard error. Probability – addition and multiplication theorems – normal distribution and binomial distribution. The analysis of variance (oneway and twoway). Correlation and Regression – Tests of significance (t, F) – χ^2 test and its applications.

Bioinformatics

Unit III (5 hr)

Definition, Objectives, Basic components of computers – Internet, website.

Unit IV (20 hr)

Genome and Proteome analysis:
Genomics: Structural, functional and comparative genomics. Tools in genomics – isolation of genes. Genome sequencing – Maxam - Gilbert method, Sanger method. Genome mapping; Genome analysis - Microarray. Proteomics: Structural and functional proteomics, Tools - Proteomic analysis - 2D PAGE, MS MALDI-TOF.

Unit V (20 hr)

Databases, Importance, types, Database entries, Sequence formats, Database record, DBMS Types, SQL.
Nucleic acid sequence databases – EMBL, DDBJ, BLAST, FASTA, GSDB.
Protein sequence databases – Primary, PIR, SWISS-PROT, TrEMBL, SCOP, CATH; Composite databases, Secondary databases; Specialized analysis Packages – GCG, EGCG, Staden, Lasergene, Sequencher, Vector packages, Synergy, CINEMA.

References

Salil Bose	Biophysics and Biostatistics
Stephen and Ruth Benstein	Elements of Biostatistics I
Stephen and Ruth Benstein	Elements of Biostatistics II
Gurumani	Biostatistics
S.Ignacimuthu	Basic bioinformatics
S.C.Rastogi et al.,	Bioinformatics
David W.Mount	Bioinformatics
Jonathan Pevsner	Bioinformatics and Functional genomics
Jean Miller and Wiley	Bioinformatics A Beginners guide
Leske	Bioinformatics
Liefler	Proteomics

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PLANT PHYSIOLOGY

SUB.CODE : 4PGB2 ( ) / 4PGB1 ( ) (3638) (UPTO 2016)

ON: NO: 3638

Water Relations

Unit I

(10 hr)

Water relations – physiochemical properties of water, theories on membrane permeability, diffusion, osmosis, and imbibition – plasmolysis and deplasmolysis – significance; water potential – definition, water potential gradient, soil-plant-air-continuum.

Absorption of water: Types of soil water; water absorbing parts of plants. mechanism of water absorption; active and passive absorption; significance.

Ascent of sap – Transpiration pull theory.

Unit II

(20 hr)

Mineral salt absorption: mechanism of mineral salt absorption theory, passive absorption theory, apoplastic, Mass flow theory, Donnan equilibrium; Active absorption theory – symplast, carrier concept theory, protein lecithin and cytochrome pump hypothesis.

Transpiration: Types, significance, Mechanism of stomatal opening and closing – theory of starch, glycolate, K+ions. Antitranspirants and guttation.

Metabolism

Unit III

(15 hr)

Photosysnthesis – Excitement and ground state, electromagnetic spectrum, Photosynthetic apparatus- PS I & PS II, Reaction centre, components of cyclic and noncyclic reactions - "Z" scheme, Emerson enhancement and Red drop effect. CO_2 assimilatory pathways. C_3, C_4 (three types NADP-ME, NAD-ME & PCK types). CAM pathway – interrelation and differences.

CONTD . . 2

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(upto 2016)

BIOTECHNOLOGY

SUB.CODE : 4PGB3 ([redacted]) (3640) QN: NO: 3640

6 hour/week =90hr

(5 hr)

Unit I

Scope – definition, multidisciplinary approach, important areas of biotechnology – National organizations related to biotechnology.

(20 hr)

Unit II

Recombinant DNA technology – molecular tools – nomenclature and characteristics of Restriction enzymes, ligases and DNA modifying enzymes.

Plasmid vectors – Properties and classification - pBR 322, pUC 18. lambda (gt 10) and M13 Phage vectors, cosmids (pJB 8), Yeast vectors – cloning genes using above vectors. Genomic library and cDNA library – construction, screening libraries by colony, Plaque hybridization.

(20 hr)

Unit III

Isolation, purification of genomic DNA, plasmid DNA from bacteria, plants and chromosomes. Agarose gel electrophoresis – Southern, Northern and Western blotting; PCR- types and applications.

(30 hr)

Unit IV

Agrobacterium and genetic engineering in plants - Ti Plasmid (Octopine and Nopaline) – Disarmed Ti plasmid vectors – Ri plasmid. Gene maps and expression of T-DNA. Incorporation of T-DNA into the nuclear DNA of plant cells – role of virulent genes. Plant Viral vectors - Caulimo and Gemini viruses vectors.

Methods of gene delivery – electroporation, biolistics, microinjection and liposome mediated.

Micropropagation – somatic hybridization, cybrids, artificial seeds and somaclonal variation.

Transgenic plants – Herbicide resistant plants, Virus resistant plants,

Development of Bt cotton, Golden rice and Flavr Savr Tomato.

IPR, Patent right – a brief account.

Contd . . . 2

PROGRAMME : M.Sc., Botany **COURSE CODE : 17P1BMC1**
COURSE TITLE : Cryptogams **QN.NO : 8901**
TIME : 3 Hours **MAX.MARKS :75**

Unit I Algae

A brief history. Systematic classification by Fritsch. Indian phycologist. Range of thallus organization. Reproduction and life cycle patterns of algae - Cyanophyceae, Chlorophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae. Ecology, cultivation, economic importance of algae.

Unit II Lichens

Dual nature. Habitat. Types of association. Growth forms and thallus structure - leprose, crustose, foliose and fruticose. Vegetative propagules. Reproduction - ascohymenial & ascolacunar lichens. Fruiting bodies - hamathecium types. Ecology and Environmental monitoring & economic importance of lichens.

Unit III Bryophytes

Basic adaptations. Indian bryologists. Thallus organization. Liverworts, hornworts & mosses. Life cycle - gametophytic and sporophytic evolution. Reproduction in bryophytes – vegetative, asexual and sexual methods. Chromosomal organization in *Spherocarpus. S*ex determination in *Bryum* and *Mnium*.

Unit IV Pteridophytes

General features. Life cycle patterns. Vascular organization and stelar evolution. Land plant adaptation. Organization and structure of sporophyte and spore producing organs. Gametophytic generation. Heterospory and seed habit.

Unit V

Deviant mechanisms in life cycle - Apogamy, Apospory based on experimental evidences. Spore germination pattern. Evolution / deviation of sporophyte as shown by telome concept.

REFERENCES

1. Hale, M.E., The Biology of Lichens, 1983, Edward Arnold, London.
2. Lawrey, J.D., Biotic interaction in lichen community development; A-Review, 1991, Lichenologist.
3. Nash, T.H., Lichen Biology, 1996, Cambridge University Press, Cambridge.
4. Rashid, A., An Introduction to Bryophyta, 2000, Vikas Publishing House Pvt. Ltd., New Delhi.
5. Sharma, O.P., Text Book of Algae, 2007, Tata McGraw Hill Publishing House Pvt. Ltd., New Delhi.
6. Parihar, N.S., An Introduction to Embryophyta Bryophyta, 2013, Surjeet Publications, New Delhi.

PRACTICALS

1. Critical examination of algal samples of different classes like Cynaophyceae, Chlorophyceae, Phaeophyceae, Rhodophyceae etc.,
2. Cultivation and maintenance of at least three fresh water algae.
3. Micropreparation of all the classes of lichens.
4. Critical examination and identification of bryophytes and pteridophytes at class level.
5. Study of fossil (*Rhynia, Lepidodendron, Lepidophyllum* and *Lepidocarpon*).
6. Students must be taken for field study.

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P1BMC2**
COURSE TITLE : Phanerogams **QN.NO : 8902**
TIME : 3 Hours **MAX.MARKS :75**

Unit I Gymnosperms

General features and phylogeny. Classification by Coulter & Chamberlain. Progymnosperms. Salient features of Cycadales, Coniferales and Gnetales with special reference to structure, reproduction and life cycle of *Cycas*, *Agathis* and *Gnetum*. Economic importance of Gymnosperms.

Unit II Angiosperms

Taxonomy- introduction, brief history, components and hierarchial stages. Functions and importance of Herbaria and Botanical gardens. Taxonomic documentation - Floras, Monographs and Revisions relevant to India. Plant indentification - Keys - dichotomous, single access and multi access. Modern Taxonomy - Biometrics - cluster analysis, phenogram, cladogram. Computer aided taxonomy - Construction of phylogenetic trees - UPGMA and PARISMONY analysis.

Unit III

Botanical nomenclature - Principles and rules of ICN, Ranks and names, binomial system, sources of botanical names, typification, nyms, retention and rejection and valid publication. Classifications - artificial, natural and phylogenetic, outline of Bentham & Hooker and APG-IV classifications (order level) with their merits and demerits.

Unit IV

Studies on vegetative, floral characters and economic importance of the following families: Magnoliaceae, Brassicaceae, Meliaceae, Myrtaceae, Apiaceae, Asteraceae, Sapotaceae, Apocynaceae , Verbenaceae.

Unit V

Amaranthaceae, Aristalochiaceae, Hydrocharitaceae, Orchidaceae, Cannaceae, Liliaceae, Aricaceae, Commelinaceae and Poaceae.

REFERENCES

1. Lawrence, G.H.M., Taxonomy of vascular plants,1951., Macmillan, New York.
2. Singh, V. and Jain, D.K., Taxonomy of Angiosperms, 1981, Rastogi Publications.
3. Jones, Jr. and Samuel, B, Plant Systematics, 1987, McGraw- Hill International, New York.
4. Gurucharan Singh, Plant Systematics, 2000, Scientific Publication, Jodhpur.
5. Sharma, O.P., Taxonomy of Aniosperms, 2002, McGraw-Hill Publication, Ltd. New Delhi.
6. Pullaiah, T., Taxonomy of Angiosperms, 2004, Regency Publication, New Delhi.

PRACTICALS

1. Observation of morphological features of plants discussed in the syllabus.
2. Dissection and description of the families in the syllabus.
3. Students to be practiced computer aided taxonomy- construction of phylogenetic tree using UPGMA, PARISMONY etc.,
4. Students to be taken for study trips.
5. Submission of herbarium/plant photo album, field reports and records for evaluation.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Botany **COURSE CODE : 17P1BMC3**
COURSE TITLE : Mycology and Plant Pathology **QN.NO : 8903**
TIME : 3 Hours **MAX.MARKS :75**

Unit I Mycology

General features - occurrence and distribution. Classification of fungi by Alexopoulus and Mims (1979). General characteristics of Gymnomycota, Mastigomycota and Amastigomycota. Thallus organization - modifications of mycelium - cell structure and fruit bodies.

Unit II

Fungal nutrition - mode of nutrition (saprophytic & parasitic) - nutritional requirement - culture media - natural substrates of fungi - biotrophic, semi - biotrophic and necrotrophic. Mode of growth - culture of fungi - homothallism and heterothallism in fungi - homokaryons and heterokaryon.

Unit III

Reproduction and life cycles – para-sexual cycle - reduction in sexuality - fungal genetics. Spore dispersal mechanism. Physiological specialization. Economic importance of fungi in baking, brewing and pharmaceutical industries. Deterioration of wood, paper and leather.

Unit IV Plant pathology

Classification of diseases. Symptoms of plant diseases. Stages in disease development – deposition, penetration and infection. Dissemination of pathogens. Defense mechanism of plants. Disease control – cultural, biological and chemical methods (copper fungicide and organo phosphorous). Disease forecasting.

Unit V

Symptom, etiology, disease cycle and control measures of the following diseases:
Fungal - paddy blast and red rot of sugarcane. Bacterial - angular leaf spot of cotton and citrus canker. Viral - leaf curl of papaya and yellow mosaic disease of bhendi. Mycoplasma - little leaf of brinjal.

REFERENCES
MYCOLOGY

1. Burnet, J. H., The Fundamentals of Mycology, 1971, ELBS Publications, London.
2. Alexopoulus, C. J and Mims, C. W., Introductory Mycology, 1979, Wiley Eastern Ltd., New York.
3. Bessey, E. A., Morphology and Taxonomy of Fungi, 1979, Vikas Publishing House, New Delhi.
4. Bold, H. C. *et al.*, Morphology of Plants and Fungi, 1980, Harper and Row Publishing, New York.
5. Sharma, P. D., The Fungi, 1987, Rastogi and Co., Meerut.
6. Mehrotra, R. S and Aneja, K. R., An Introduction of Mycology, 1990, Wiley Eastern, New Delhi.
7. Alexopoulos, C. J., Mims, C. W and Black well, M, Introductory mycology (4th ed), 1996, John Wileyx sons Inc., USA.
8. Carlile, M. J., Watkims, S. C and Graham, The Fungi, 2001, Academic press, a Harcourt Science and Technology Campus. London, UK.
9. Vashista, B. R and Sinha, A. K., Botany for Degree Students – Fungi, 2007, S. Chand and Co.

PATHOLOGY

1. Singh, R. S.,Plant Diseases, 2003, Oxford & IBH publications, New Delhi. Pp. 686.
2. Mehrotra, R. S and Aggarwal, A., Plant Pathology, 2003, Tata McGraw- Hill Publishing Company Ltd. Pp. 846.
3. Singh, R. S., Plant Diseases, 2005, Oxford & IBH Publications, New Delhi. Pp. 720.
4. Arumugam, N. Kumaresan, V and Regland, A., Fungi & Plant pathology. 3rd edition, 2016, SARAS Publications. Nagarkoil. Pp. 1- 468,

PRACTICALS

Mycology

1. Isolation of fungi from various sources.
2. Culture of fungi - Pure culture
3. Slide culture techniques.
4. Isolation of fungi from cow dung.
5. Observation of fruit bodies and other structure of fungi.

Pathology

1. Observation of symptoms of plant diseases.
2. Herbarium preparation.
3. Observation of stages of pathogenic fungi in the infected plant.
4. Protocol for controlling of fungal pathogen

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P2BMC4**
COURSE TITLE : Developmental Botany **QN.NO : 8907**
TIME : 3 Hours **MAX.MARKS :75**

Unit I Embryology-Pre-fertilization events

Flower –Definition. Structure of tetra-sporangiate anther. Development of anther wall layers (epidermis, endothecium, middle layers, tapetum); microsporogenesis and microgametogenesis. Pollen wall layers – pollen kit. Pollinium. Structure, types and development of ovule. Megasporogenesis. Megagametogenesis. Embryosac development and its types. Pollination – types.

Unit II Fertilization and post fertilization changes

Self incompatibility – homomorphic and hetermorphic. Causes and methods to overcome incompatibility. Pollen – pistil interaction, types of stigma and style, events on stigmatic surface, pollen tube growth. Entry of pollen tube into the ovule and embryosac. Double fertilization and triple fusion. Structure and development of dicot embryo (*Capsella*) and monocot embryo (*Najas*). Endosperm and its types. Components of seeds and fruits. Classification, importance and dormancy of seeds. Seed germinations – epigeal and hypogeal. Apomixis – Nonrecurrent, recurrent and adventives. Polyembryony.

Unit III Anatomy

Tissues - Meristem: Types and theories on meristems – shoot apical meristem - Histogen theory and Tunica corpus. Root apical meristem - Korper-kappe theory. Permanent tissue: simple and complex. Secondary structure of dicot stem and root. Anomalous secondary structure – *Boerhaavia, Bougainvillaea, Amaranthus, Mirabilis* and *Dracaena*.

Unit IV Morphogenesis

Concept of morphogenesis as a package of development; components – cell division, division planes, their importance; cellular determinants of division planes – cytoskeleton, Pre Prophase Band in orienting karyokinesis and cell plate. Xylogeny – role of light and gravity, role of auxins and enzymes, cambium activity and lignifications (Experiments in *Syringa vulgaris*). Differences in phloem ontogeny.

P.T.O.

Unit V Development of organs

Vegetative meristem: Phyllotaxy, zone of foliar inhibition in apices, signals involved foliar inhibition**.** Development of angiosperm leaf with specific reference to petiole, lamina and leaf tip.Reproductive meristem – Determinate growth and differentiation. ABC model for ontogeny of flower.Polarity and development: Polarity in cuttings, unicellular coenocytes, eggs, spores and transport.Regulation of development: General nature of developmental process, environmental controls, nucleocytoplasmic interactions, genes and development.

REFERENCES

1. Donald Alexander Johansen, Plant Embryology, 1950, California Botanica Company, MASS, U.S.A.
2. Sant Saran Bhojwani and Bhatnagar, S.P., Embryology of Angiosperms, 2008, Vikas Publishing Ltd., Delhi.
3. Nair, P. K. K., Pollen morphology of angiosperms, 1970, Vikas Publishing Ltd., New Delhi.
4. Elizabeth Cutter, Plant Anatomy, 1969, Edward Arnold Publication, London.
5. Fahn, A, Plant Anatomy, 1967, Pergamon Press.
6. Katherine Esau, Anatomy of seed plants, 1979, Wiley Eastern Ltd. New Delhi.
7. Burgess, Plant Cell and Development, 1985, Jeremy Cambridge University Press, Sydney.
8. Graham C. F and Wareing P. F., Developmental control in plants and animals, 1984, Blackwell Scientific Publications, Edinburgh.
9. Mascarenhas, A. F., Handbook of Plant Tissue Culture, 1988, IARI, New Delhi.
10. Kalyan Kumar De, Plant Tissue Culture, 1992, New central book agency (P) Ltd. New Delhi.

PRACTICALS

1. Dissection of mono and dithecous anthers.
2. Pollen morphology observations.
3. Germination of pollens from different species.
4. Haploid production and embryo culture.
5. Dissection of pollinium and embryo – dicot and monocot.
6. Study of root apex, stem apex of living aquatic specimens.
7. Primary structure of stem and root.
8. Secondary structure of stem and root.
9. Leaves – isobilateral and dorsiventral.
10. Nodes – uni, tri and multilacunar.
11. Vegetative division in onion root tips (Mitosis), reproductive divisions (Meiosis).
12. Callus induction in paddy grains / onion leaf on MS media.
13. Callus maintenance by application of chemical pressure.
14. Differentiation - root (Auxin) and shoot (Cytokinin).

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P2BMC5**
COURSE TITLE : Environmental Biology **QN.NO : 8908**
TIME : 3 Hours **MAX.MARKS :75**

Unit I Ecosystem Ecology

Principles, sub-divisions, atmosphere, micro-climate, components, ecotone, edge effects, ecological niche, ecotypes, ecads, and ecosystem stability. Ecological factors - biotic - allelopathy; abiotic - light, fire, soil, temperature. Ecosystems - structure, function, producers, consumers and decomposers; Energy flow, food chains, food webs, ecological pyramids. Structure and function of ecosystems - aquatic – e.g., estuaries; terrestrial - grassland. Ecological succession – concept, causes, effects and climax. Biogeochemical cycles - C, N, O, P, S and H_2O.

Unit II Applied Ecology

Environmental Pollution - causes, effects and control measures of air, water, land, noise and nuclear pollution. Global scenario of acid rain and smog, ozone depletion, urban sprawl, green house effect, climate change and global warming. Environmental impacts of major development projects - Tehri dam and Kudankulam nuclear power plant.

Environmental Xenobiotics – definition, direct, indirect and pharmaceutical sources, fate and effects. Bioremediation, biosparging and bioaugmentation. Applications, special features and limitations of bioremediation. Phytoremediation - definition, application and Techniques. Environmental policies and legislation in India.

Unit III Toxicology & disaster management

Introduction, classification, occurrence, source and effects. Atmospheric toxins - carbon monoxide and sulphur oxides. Heavy metal toxicity - lead & chromium. Chemical toxicants - industrial and agricultural wastes, bioaccumulation and pollution indicators. Disaster management - flood, earthquake, tsunami, cyclone and landslides.

Unit IV Biodiversity

Introduction, concept, definition, scope and constraints. Levels of biodiversity. Loss of biodiversity - factors and causes. Biodiversity of India and world. Hotspots. Mega diversity centres. Role of CITES and IUCN, Red Data Book and threatened categories. Conservation of Biodiversity- *in-situ* and *ex-situ*. Cryopreservation, Gene bank, Germplasm, Sacred groves, Biosphere Reserves, National parks and Sanctuaries. Organizations for conservation - CHIPKO, Green peace, WWF and UNEP. Role of remote sensing (RS) and geographic information system (GIS) in Ecology.

Unit V Phytogeography

Definition, origin of earth - Pangaea, Eurasia, Gondwanaland. Wegner's theory of continental drift, role of plate tectonics. Plant distribution - continuous and discontinuous. Endemism, types, age and area hypothesis and causes of endemism. Vegetation types of India.

P.T.O

REFERENCES

1. Nwankiti, O. C, Geography of Man and his Environment, 1981, Nigel Smith Books. Ashtead, UK.
2. Odum, E.P., Fundamentals of Ecology, III Edition, 1991, Saunders & com.
3. Dash, M.C., Fundamentals of Ecology, 1993, Tata McGraw Hill, New Delhi.
4. Subrahmanyam, N.S. and Sambamurty, A.V.S.S, Ecology, 2000, Narosa Publishing House. New Delhi.
5. Agarwal, K.C., Fundamentals of Environmental Biology, 2001, Nidhi Publishers. Bikaner, India.
6. Krishnamurthy, K.V., An advanced text book on Biodiversity, 2003, Principles and Practice. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
7. Kumar, U and Asija, M.J., Biodiversity Principle and Conservation, 2003, Saraswati Purohit for Student edition, Jodhpur.
8. Kaushik, A and Kaushik, C.P., Perspectives in Environmental Studies (4^{th} Ed.), 2004.
9. Asthana, D.K. and Asthana, M., A text book of Environmental studies, 2006, S. Chand & Co. Ltd. New Delhi.
10. Sharma, P.D., Ecology and Environment, 2009, Rastogi publications.
11. Rajagopalan, R, Basics of Environmental studies, 2009, Oxford University Press.
12. Pawan Kumar, B. and Mona Saad, A. Z.,Eco-toxicology & Eco-technology, 2013, Discovery Publishing house.
13. Hussain, M., Environment and Ecology: Biodiversity, Climate Change and Disaster Management for Civil Services Examination, 2015, Access publishing.

PRACTICALS

1. Morphological and anatomical features by typical xerophytes phylloclade - *Opuntia, c*ladode - *Casuarina*, succulent - *Bryophyllum* and hydrophytes - *Hydrilla.*
2. Vegetation study by quadrat method.
3. Vegetation study by line transect.
4. Estimation of dissolved O_2 in water samples by Winkler's method.
5. Comparison of chemical characteristics – moisture content, carbonate content, nitrate content, base deficiency and pH of the soil samples using rapid tests.
6. Estimation of CO_2 in water samples.
7. Biodiversity - Marking locations in India and world map – Hot spots, mega diversity centers.
8. Marking locations of endemic species, biosphere reserves, vegetation, climate, national parks and, wild life sanctuaries.
9. Visit to RS & GIS centers.
10. Field visit to natural ecosystem and identification of trophic levels, food webs and food chain, plant diversity-species & community.
11. Field visit to study the biotic components of pond ecosystem.

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P2BMC6**
COURSE TITLE : Biochemistry **QN.NO : 8909**
TIME : 3 Hours **MAX.MARKS :75**

Unit I

Carbohydrates: Classification, mono, oligo and polysaccharides - structure, physical and chemical properties: Aldoses and ketoses, muta rotation. Monosaccharides - Trioses, Tetroses, Pentoes and Hexoses. Glugoneogenesis (synthetic pathways).

Unit II

Amino acids and proteins - Essential and Non-essential amino acids. Classification of aminoacids - (based on structure). Physical and Chemical properties of aminoacids. Proteins – Classification. Four levels of structural organization (Primary, Secondary, Tertiary and Quarternary). Urea cycle. Synthesis of aromatic amino acids.

Unit III

Lipids – Classification - simple, complex and derived. Functions, saturated and unsaturated fattycids, Triacylglycerols. Structure, properties and Functions of phospho lipids, glycolipids. α – oxidation and β-oxidation of fatty acids. Biosynthesis of long chain fatty acids - Palmitate.

Unit IV

Enzymes - Nomenclature, IUB system of enzyme classification, properties, enzyme kinetics. Km value, Michaelis- Menton constant, Lineweaver- Burk model, Active sites - Salient features, enzyme Inhibition, coenzymes, Mechanism of enzyme action - Lock and Key model and induced fit model. Regulation of enzyme action.

Unit V

Nucleic acids - Chemistry of DNA and RNA - e.g. mRNA and tRNA. Biosynthesis of purine and pyrimidine ribonucleotides.Types, structures and biological significance of vitamins and alkaloids.

P.T.O

REFERENCES

1. Zubay, G, Biochemistry, 1998, Macmillan Publishing Co, New York.
2. Lehninger, A. L., Nelson D. L and Cox, M. M., Principles of Biochemistry, 1993, Worth Publishers, New York.
3. Stryer, Biochemistry 1994, Freeman & Co, New York.
4. Jain, J. L., Fundamentals of Biochemistry (5^{TH}Edn). 2001, S.Chand & Company, New Delhi.

PRACTICALS

1. Estimation of glucose.
2. Estimation of protein.
3. Estimation of Lipid.
4. Estimation of DNA.
5. Estimation of RNA.
6. Paper chromatography.
7. Thin layer chromatography.
8. Column chromatography.
9. Determination of pKa value.
10. Nitrate reductase activity.
11. Agarose gel electrophoresis.
12. Qualitative test for carbohydrate, protein and lipid.
13. Estimation of starch.
14. Amylase activity.
15. Isoelectric point.

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P3BMC7**

COURSE TITLE : Genetics, Cell and Molecular Biology **QN.NO : 8913**

TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVES:

To understand the basic tenets of inheritance and variations of traits of organisms from one generation to other.

LEARNING OUTCOME:

Learners can accomplish principles of inheritance, functional compartmentalization of a cell and expression aspects of genes

Unit I

Meiosis and its significance in inheritance. Mendelian laws: law of segregation and law of independent assortment with examples. Multiple alleles. Pleiotropy. Gene interactions – complementary genes and epistasis. Linkage and crossing over. Chromosome mapping. Sexlinkage, sexlimited and sexinfluenced traits. Population genetics: gene pool and gene frequency – Hardy-Weinberg law.

Unit II

Structure and chemistry of plant cell organelles. Organelle genetics – leaf varigation in plants, cytoplasmic male steritilty in maize. Metabolic defects in yeast.

Unit III

Central dogma of molecular biology. DNA as the genetic material – experimental proofs. Topology of nucliec acids, chromosome structure in prokaryotes and eukaryotes. C- value paradox, DNA denaturation kinetics. Replication of DNA in prokaryotes and eukaryotes.

Unit IV

Gene structure and Gene expression – transcription in prokayotes and eukaryotes. Post transcriptional modifications, translation in prokayotes and eukaryotes. Regulation of gene expression in prokaryotes (Operon concept – lac, ara and trp) and eukaryotes – (rbcl gene in plants), RNAs in gene regulation – RNAi, siRNA and miRNA.

Unit V

Mutation and its types – mutagens and molecular basis of mutation, DNA repair mechanisms. Natural gene transfer mechanisms in bacteria – Transformation, Transduction and Conjugation. Recombination mechanisms – homologous, site specific and transposition.

P.T.O

Reference

1. Deroberties E.D and De Robertis E.M.F. 2002. Cell and molecular biology 8th edition. Lee and Fab international edition, Philadelphia.
2. Lewin B. 2000. Gene VII, Oxford University Press, Newyork, USA.
3. Karp, G. 1999. Cell and molecular biology. Concept and experiments. John Wiley and Sons, Inc, USA
4. Powar C.B. 2003. Cell Biology. Himalaya Publishing House.
5. Verma P.S and Agarwa, V.K,Genetics. 2004. S.Chand Publications
6. Monroe Strickburger. 1985. Genetics, 3rd Edition, Macmilan Publishers
7. Gardener EJ *et al.*,2008. Principles of Genetics. 8th Edition. Wiley-India student edition.
8. David Friefieder.2002. Essentials of Molecular biology, 4th Edition, Jones and Barlett Publishers, Massachusetts.
9. https://WWW.news-medical.net.
10. https://WWW.elsevier.com.

Practical's

1. Solving problems in genetics given in the syllabus
2. Chromosome mapping in eukaryotes.
3. Population genetics
4. Illustration of different types of microscopes
5. Illustration of specimen preparations for Electron microscope observations.
6. Illustration of cell organelles
7. Karyotyping and Idiograms
8. Bacterial transformation and conjugation

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P3BMC8**
COURSE TITLE : Microbiology **QN.NO : 8914**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVES:

To perceive the structure and reproduction of organisms and to gauge their influence on the standard of living of human beings.

LEARNING OUTCOME:

It enables the graduates with high knowledge and research abilities to further develop various techniques related with microbial world

UNIT I

Bacteria : Salient features, Ultrastructure and Exomorphology. Structure of cell wall and capsule.

Viruses: – General characteristics, classification of viruses based on nucleic acids –structure and reproduction of Bacterial viruses (T7 and lambda phages) plant viruses (TMV &CaMV). Brief account on phycoviruses and mycoviruses.

UNIT II

Bacterial growth phases –generation time – synchronous growth –diauxy growth.

Respiratory metabolism : ED pathway –reverse TCA—gluconeogenesis.

Fermentation –homo and hetero lactic. Bacterial photosynthesis –photobacteria –pigments—Oxygenic and anoxygenic –C3 cycle.

UNIT III

Control of microbes Physical and chemical methods –chemotherapuetic agents –antibiotics (chemical nature and Mode of action) –mechanism of resistance to antibiotics.

UNIT IV

Aquatic microbiology : Microbial flora –sewage treatment (primary ,secondary and tertiary)

Agricultural microbiology : Bio fertilizers –nitrogen fixation (symbiotic and asymbiotic)

– phosphate solubilization –mycorrhizae (Ecto-, Endo- and VAM). Biopesticides (bacterial , fungal and viral).

P.T.O

UNIT V

Food –Microbial flora- contamination and spoilage of vegetables, meat and milk – methods of food preservation. Pasteurization.

Fermentor – design and operations; production of cheese, ethanol, citric acid and penicillin.

Clinical features- symptoms, lab diagnosis, prophylaxis and treatment of Tuberculosis and AIDS.

REFERENCES:

1. Purohit ,S.S.2012. Microbiology and applications. Student edition, Jodhpur, India.
2. Dubey, R.C. and Maheswari, D.K. 2010. A text book of microbiology. S. Chand & company, New Delhi.
3. Pelezar, M.J., Chan,E.C.S and Kreig,N.R.1993. Microbiology – concepts and applications . McGraw Hill, Inc. Newyork.
4. Powar ,C.B. and Daginawala ,H.F.2001.General microbiology, Himalaya publishing house, Mumbai. Vol.II
5. Sharma ,P.D. 2005. Environmental biology. Narosa publishers , New Delhi.
6. Rao, A.S.2001. Introduction to microbiology. Prentice Hall of India, New Delhi.
7. Casida ,L.E. 1997. Industrial microbiology. New publishers, New Delhi.
8. Kumar ,H.D and Swati kumar .1999. Modern concepts of microbiology,Vikas publishing House ,New Delhi.
9. Subha Rao,N.S. 2000. Soil microbiology. Oxford & IBH publishers ,New Delhi.
10. https://en.m.wikipedia.org.
11. WWW.highveld.com.

PRACTICALS:

1. Cleaning of glasswares.
2. Sterilization methods .
3. Preparation of media.
4. Culturing of microbes.
5. Ubiquitos nature of microbes.
6. Bacterial staining –a) Simple b) Differential c) Capsule d) Spore.
7. Growth curve of bacteria (turbidity measurement)
8. Identification of microorganisms by biochemical tests a) Catalase test b) Indole test.c) MR-VP test d) Starch hydrolysis e) Gelatin hydrolysis.
9. Antibiosis.
10. Isolation of Rhizobium from root nodules.
11. Milk dye reduction test-Methylene blue and Risazurin.
12. Potable water quality test –MPN method.

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P3BME1**
COURSE TITLE : Forestry and Economic Botany **QN.NO : 8915**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVES:

1.To understand the various concepts and procedures of forestry
2. To prepare students to face competitive exams.

LEARNING OUTCOME:

Ensured minimum requirement of forest covers on the earth by either grooming students to take part in the NGOs or as implementing officers in forest department.

UNIT - I

Introduction- Forests: definitions and types in India. Afforestation, reforestation and regeneration. Silviculture: General principles; physical, physiological and ecological factors influencing vegetation. Natural and artificial regeneration of forests; Nursery beds, polybags, water budgeting, grading and hardening of seedlings, establishment and tending.

Systems: Clear felling, uniform shelter wood selection, copices and conversion systems. Management of temperate and subtropical forests with reference to choice of species, enrichment methods, intensive mechanized methods, aerial seeding and thinning.

UNIT- II

Mangrove and cold desert characteristics and management of species. General concept of tree improvement methods and techniques. Traditional and recent advances in tropical silvicultural research and practices. Silviculture of *Casuarina equisetifolia* and *Tectona grandis*.

UNIT- III

Agroforestry and Social / urban forestry: Objectives, Scope, necessity, selection of species and utillisation as food, fodder and fuel security. Watershed management.

Forest management: Objectives, principles and techniques. Stand structure and dynamics, sustained yield and regulation of yield. Site-specific planning and strategic planning, monitoring and governance. A brief account on forest working plan. Impact of forest fires, human activities like mining, construction and developmental projects. Forest protection against fire, insects-pests and landslides. A brief account on tribology and participation of tribes on forestry programmes.

UNIT-IV

Forest utilization and Legislation: Direct and indirect benefits of forests; Timber and Non-Timber forest produces (NTFPs). Timber: Forest harvesting practices, logging and extraction principles and techniques. Wood seasoning, storage and sale. General account on plywoods, pulp-paper and rayon. NTFP's: gums, resins, oil seeds, bamboos and medicinal plants.

Forest Laws, necessity and general principles. Indian Forest policy of 1894, 1952 and 1990. National forest policy, 1988; Indian Forest Act, 1927, Forest conservation Act, 1980; Wildlife protection Act, 1972. Biological diversity act, 2002; national biodiversity authority rules, 2003.

UNIT V

Economic botany:- Botanical name, Tamil name, English name, Family, morphology of the useful parts and uses of the following:

1. Cereals: paddy, pearl millet and finger millet.
2. Pulses: pigeon pea, cow pea and black gram.
3. Nuts: Almonds, Cashew and ground nut.
4. Vegetables: Root: Tapioca, radish &carrot.
   Stem: potato, onion& tomato
5. Fruits: Mango, sour orange &guava.
6. Fibres: Cotton, flak and jute
7. Wood: Teak, Indian rosewood & Red sandalwood
8. Fatty oils : Sunflower, gingely & coconut
9. Essential oils: Sandal wood, khus & eucalyptus.
10. Spices & condiments: Pepper, cardamom & chilli.
11. Beverages: non -alcoholic: Coffee, tea& cocoa

REFERENCES:

1. Sagreiya, K.P. 1967. Forest and Forestry 1967, National book trust, India.
2. Negi, S.S. 1966. Hand book of forestry. International book distributors, New Delhi.
3. Negi, S.S. 1988. Elements of general silviculture. International book distributors, New Delhi.
4. Sageriya, K.P. 1982. Forests and Forestry. National book trust, New Delhi.
5. Gupta, R. 2018 Popular master guide, Indian forest service, Forestry paper I & paper II, Main guide Edition.
6. Bala kathiresan, S. Essential of forest management, Natraj publishers, Dehradun.
7. Pandey, B.P. 1978. Economic botany. S. Chand & company Ltd, New Delhi.
8. Verma.V.2009. Text book of Economic botany. Ane books Pvt. Ltd, New Delhi.
9. https:// WWW.forestry.ubc.ca
10. https:// WWW.botany.org.

PRACTICALS

Forest mensuration & remote sensing: methods of measuring diameter, girth, height and volume of trees; yield calculation, forest cover monitoring through remote sensing; geographic information systems for management & modeling. Forest surveying, maps & map reading. Collection of plant products as per the syllabus.

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P3BNM1**
COURSE TITLE : Food Science **QN.NO : 8918**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVE:

To make the available knowledge of various food items and their importance to students whose major study of interest is not botany.

LEARNING OUTCOME:

Prepared the students to be competitive for the entry level food science positions in private and public sectors and also for an advanced degree in a food science and technology programmes.

Unit I

a. Definitions: Food - food science – nutrients – nutrient status – mal nutrition – under nutrition – over nutrition – balanced diet – calorie – hunger – hidden hunger – appetite -- obesity – health – organic food – junk food. Importance of food to stay fit for a healthy life.

b. Nutritional classification of foods – energy yielding – body building – protective foods.

c. Cooking methods**:** Moist and dry heat methods – merits and demerits.

Unit II

a. Cereal and cereal products: Composition and nutritive value of rice, wheat, maize and locally available millets – e.g., kambu, raagi, thinai, saamai and varagu.

b. Pulses and Nuts: Composition and nutritive value – factors affecting cooking quality of pulses. Germination of whole grams (sprouts).

c. Fats and oils: Types and sources (plant and animal), nutritive value of common fats and oils, reuse of oils, smoking temperature, rancidity of fat, LDL – HDL – transfats – omega 3 fats. Importance of oil extraction through traditional methods (marasekku oils)

d. Dietary fibre – sources and nutritional significance.

e. Minerals, vitamins and trace elements: Sources, deficiency and excess of the following: Sodium (Na), Potassium (K), Phosphorous (P), Iron (Fe), Zinc (Zn), Selenium (Se), Iodine (I); Vit. A, B, C, D, E and K.

f. Water – Need, daily requirements and water balance.

Unit III

a. Vegetables and Fruits: Classification, nutritive value and general account of changes during cooking of vegetables and storage.

b. **Milk and milk products:** Composition and nutritive value, milk products – butter, cheese, curd, ghee, paneer and ice cream

c. **Egg and fleshy foods:** Composition and nutritive value of egg, fish and poultry (chicken).

d. **Beverages**: Composition and nutritive value, Non- alcoholic e.g: coffee and tea, aerated drinks and alcoholic beverage - wine .

e. **Spices and condiments** used in Indian cookery and their medicinal uses – spices - turmeric, tamarind, black cumin, pepper, fenu greek, ginger, coriander, mint and condiments - asafoetida, cardamom, cinnamon, cloves, nutmeg, fennel, mace, poppy seeds (kasa kasa).

Unit IV

Preparation of : 1. Raagi halwa 2. Ulundankali 3. Kambu porridge 4. Sesame balls 5. Peanut chikkies.

Unit V Basic concepts of diet therapy: Therapeutics adaptations of normal diet – palaeo and warrior diet.

a. Healthy foods for weight management and food guide pyramid.
b. Importance of proper sleep.
c. Sanitation and hygiene in food and kitchen.

References

1. Srilakshmi, B. 2018. Food science. New age international publishers.
2. Sunetra Roday. 2012. Food science and nutrition. Oxford Publishers.
3. Srilakshmi, B. 2010. Nutrition Science. New Age International Private Limited.
4. Subhangini A Joshi.1992. Nutrition and Dietetics. Hill Publishing company.
5. Deepak Mudgil and Sheweta Barak Mudgil. 2015. Objective food science and technology. Scientific publishers. Jodhpur
6. Vaclavik, V. and Christian E.W. 1998. Essentials of food science. Springer publications, US. p 417.
7. https:// www.wholehealthsource.blogspot.com
8. https:// www.foodsciencesecrets.com

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P4BME2**
COURSE TITLE : Plant Physiology **QN.NO : 8920**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVES:

1.To thoroughly understand the various principles governing the functional aspects of plants.
2. To help students to think, design and execute and experiment

LEARNING OUTCOME:

Ensured that the students can achieve an upto date level of understanding and competence that will serve as a lasting and practical basis for the carrier (research, industry etc.) as well as teaching.

Unit I

Thermodynamic concept – free energy and driving force – Active and passive modes.
Basic processes: Diffusion – simple and facilitated. Osmosis – Active systems – pumps, ATPases. Water potential – components, cell water potentials and its value. Water uptake, root hair, passive and active modes, relative water potentials of roots and soil; rainy days vs dry season.

Unit II

Mineral nutrition: Essential and non-essential elements - major, minor and trace elements – deficiency symptoms. Mechanism of mineral salt absorption; active – cytochrome pump theory; passive – Donnan's equilibrium. Mycorrhizae and their role in absorption of mineral salts. Translocation of organic solutes – Munch's mass flow hypothesis. Mechanism of loading and unloading of phloem. Source and sink relationship and determining factors.

Unit III

Metabolism. **Photosynthesis**: Chloroplast as a photosynthetic machinery. Light reactions – Light harvesting complexes, photolysis, non-cyclic and cyclic electron transport, photophosphorylation. Hill reaction – NADP reduction. Dark reactions – Calvin cycle (C3), significance and tracing the path of C in C3. Hatch and slack (C4) pathway, Kranz anatomy, RUBISCO. CAM pathway. Alternative to C4 pathway – NAD^+ - ME and PCK type. Light and CO_2 compensation point.
Respiration. Site, types and phases of respiration. Glycolysis, Citric acid cycle (TCA), mitochondrial electron transport and ATP synthesis; oxidative phosphorylation (chemi-osmotic theory). Alternative oxidases, photorespiratory pathway. Energy budget of glucose metabolism.
Nitrogen metabolism. Nitrate and ammonium assimilation and amino acid biosynthesis.

Unit IV

Stress and reproductive biology: Response of plants to abiotic stress - heat, water, salinty and metal. Discovery and role of growth hormones – auxins, gibberellins, cytokinins, ABA and ethylene.

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Unit V

Sensory photobiology: Structure, function and mechanism of phytochromes, cryptochromes and phototropins - tropic movement – thigmotropism; nastic – nyctinastic. Photoperiodism - circadian rhythm - biological clock – Vernalization. Senescence and seed dormancy.

References

1. Malik, C. P. 2014. Plant Physiology. Kalyani publishers.
2. Barton, W. 2007. Recent Advances in Plant Physiology. Read books publishers.
3. Verma, J. and Verma, K. 2005. A text book of Plant Physiology. Emkay publications.
4. Mukherji, S. and Ghosh, A. K. 2009. Plant Physiology. New central book agency publications.
5. Salisbury, F. B. and Ross, C.W. 2006. Plant Physiology. CBS publishers, New Delhi.
6. Taiz, L. and Zeiger, E. 2006. Plant Physiology. Sinauer Assoicates Inc., Publishers. Sunderland, U.S.A.
7. Bajracharya, D. 1998. Experiments in Plant Physiology. A laboratory manual. Narosa Publishing house.
8. Devlin, R. M. 1969. Plant Physiology, Holt, Rinehart & Winston & Affiliated East West Press (P) Ltd., New Delhi.
9. Noggle, R. and Fritz. J. 1989. Introductory Plant Physiology. Prentice hall of india.
10. https://www.plantphysiol.org;
11. https://www.academic.oup.com

Practicals:

1. Cell as an osmotic system.
2. Determination of water potential of plant tissue by tissue weight method.
3. Demonstration of mechanism of opening and closing of stomata.
4. Effect of different organic solvents on the permeability of plasma membrane.
5. Selective ion uptake by roots.
6. Selective ion uptake by plants.
7. Plant nutrition and mineral deficiencies.
8. Estimation of total chlorophyll and carotenoids.
9. Estimation of anthocyanins.
10. Separation of chloroplast pigments by paper chromatography.
11. Demonstration of starch formation during photosynthesis.
12. Evidence for the presence of chlorophyll in non-green leaves.
13. Light microscopic method to see flourscence emission from chlorophyll a.
14. Experiment on $C_3$and C_4 plants by leaf anatomy.
15. Experiment on $C_3$and C_4 plants by Starch test.

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PROGRAMME : M.Sc., Botany **COURSE CODE : 17P4BME3**
COURSE TITLE : Biotechnology **QN.NO : 8921**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVES:

1. To impart current knowledge with recent developments in recombinant DNA technology and crop improvement of biotechnology.
2. To impetus students to give training to inculcate advanced technical skills in Plant Tissue Culture and Molecular Cloning experiments.

LEARNING OUTCOME:

The significance of the course is to emphasize the students to apply the explored knowledge and skills in applied fields of biotechnology.

Unit I

An introduction and a brief history- Origin and Definition- Scope- Inter and Multidisciplinary approaches and avenues of biotechnology - important areas- National and International Institutions.

Plant tissue culture- Concept of Cellular Totipotency, Nutritional requirements- Media-Lab design- Cell Suspension Culture and Biotransformation- Callus Culture.

Unit II

Micropropagation, stages, pros and cons- Production of virus free plants- Organogenesis- Somatic embryogenesis and embryoids production- Somaclonal variations- Somatic hybridization- Anther Culture and Haploid production- Synthetic Seeds- Cryopreservation.

Unit III

Recombinant DNA technology- Molecular tools- Nomenclature and Characteristics of Restriction Enzymes, DNA Polymerase and DNA Ligases- Cloning Vectors Plasmids, pBR 322, and Blue script vectors- M13 vectors and Lambda vectors- YACs.

Genomic Library and cDNA Construction- Cloning of *Insulin* gene in *E. coli*- Forensic Sciences- Antisense RNA technology- Plant edible vaccines- Plantibodies- Biodegradable plastics- Gene knockouts and Gene therapy.

Unit IV

Cloning Methodologies, Insertion of Foreign DNA into Host Cells; Transformation- Gene isolation and characterization-Thermo Cycler and Principle reactions of PCR, Thermostable enzymes- PCR and its types, Significances- RAPD & RFLP- Primer Designing- Probe preparation and Radioactive DNA labeling - Southern, Northern and Western blotting.

Unit V

Biology of *Agrobacterium* species- Basis for Crown gall formation- Ti Plasmid and Ri Plasmid features- Structure of Transferred DNA- Process of T-DNA transfer, integration and expression- Disarming of *Agrobacterium*- Construction of Co-integrate vectors and salient features of Binary vectors- Use of 35S and Ubiquitin promoters, Genetic markers, Reporter genes.

P.T.O

Production of Transgenic plants for pest resistance (*Bt* genes) - Fungal resistance (Chitinase genes) and Herbicide resistance (*ppt* genes). Physical methods of gene delivery, Particle bombardment- Metabolic Engineering (Golden rice) - Gene Silencing and Targeting- Bioethics and Bio-safety of GM crops. Intellectual Property Rights, Patents– GATT and TRIPs.

Reference:

1. Slater, A., Scott N.W. and Fowler, M.R. 2003. Plant Biotechnology, The Genetic Manipulation of Plants. Oxford University Press, New York.
2. Gupta, P.K.1999. Elements of Biotechnology. Rastogi Publishers, India.
3. Chawla, H.S.2000. Introduction to plant biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Gamborg, O.L and Phillips, G.C. 2005. Plant Cell Tissue & Organ Culture. Narosa Publishing House, New Delhi.
5. Kalyan Kumar, D.2008. An Intoduction to Plant Tissue Culture. New Central Book Agency, Kolkata.
6. Old, R.W and Primrose, S.B .1985. Principles of Gene Manupulation-An introduction to genetic engineering. Blackwell Scientific Publication. London.
7. Brown, T.A.2001. Gene cloning and DNA analysis. Blackwell Science Ltd. USA.
8. Reece, R.J.2004. Analysis of Genes and Genomes. John Wiley & Sons, Ltd. UK.
9. Citovsky *et al*., 2004. *Agrobacterium* T-DNA integration molecules and models- A review. Trends in Genetics Vol. 20(8).
10. https://WWW.bio.org
11. https://WWW.ncbi.nlm.nih.gov

Practicals:

1. Isolation of Chromosomal DNA (Lysis method) & Plasmid DNA (Minipreparation method) from bacteria
2. Extraction of total genomic DNA from Plants (CTAB method).
3. Agarose Gel Electrophoresis & Staining, Visualization of DNA.
4. Transfer of pUC in to *E. coli* and selection of blue and white colonies on X-gal IPTG substrate.
5. Demonstration of Triparental mating and Cloning experiments
6. Medium preparation-Surface Sterilization and Explants Preparation- Inoculation
7. Micropropagation (Nodal and Shoot tips), Callus Culture & Somatic Embryogenesis using carrot explants.
8. Cell Suspension Cultures using Friable callus
9. Demonstration- Protoplast isolation(physical and enzymatic) and *in- vitro* cultures
10. Demonstration -Synthetic seeds production *in-vitro*
11. *Agrobacterium*- mediated genetic transformation of tobacco leaf disc (Agroinfection-Co-cultivation- GUS Histochemical assay- Molecular Characterization)
12. Demonstration of PCR, RAPD, RFLP & Blotting techniques.
13. Vector genomic maps: pBR322,pUC18, pOK 233, pCAMBIA 2300, 2301 & 1301)

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011
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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Botany **COURSE CODE : 17P4BMC9**

COURSE TITLE : Biostatistics and Bioinformatics **QN.NO : 8922**

TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVE:

1. To focus statistical techniques to analyze the biological data
2. To apply information technology to analyze the biological information

LEARNING OUTCOME:

Equipped the students to carry out research projects in the field of biology

UNIT-I

Introduction; definition , characteristics, scope, importance and limitations . Terms of statistics: population ,sample ,data ,parameters, attributes and variables. Descriptive and inferential statistics. Steps in designing an experiment ; sampling methods in the collection of data ; frequency distribution ; Tabulation , diagrammatical and graphic presentation of data.

UNIT-II

Measures of central tendency (Arithmatic mean ,mode and median) Measures of dispersion (mean deviation and standard deviation). Probability, definition ,importance , explanation and application in biology. Probability distribution (Normal & Binomial).Correlation :types and scatter diagram method .Regression : Aim, equation and co –efficient; Tests of significance F and x2 tests; A brief account on test of hypothesis.

UNIT III

Definition and objectives of bioinformatics; Basic components of computers (CPU, RAM,ROM, Processes) –Internet, website.

UNIT IV

Genome organization - Genome analysis ---gene sequencing methods (Maxam & Gilbert; Sanger method) ; proteome analysis (2D PAGE, MALDI-TOF); Biological Data bases --- types----- classification ---- Nucleic acid data bases (GenBank, EMBL, DDBJ) ----Protein data bases (SWISS-PROT, TrEMBL, PIR, GSDB,SCOP, CATH) ---- literature data bases (PUBMED, AGRICOLA) ; Bioinformatics servers ---- NCBI, GENOMENET

UNIT V

Sequence analysis tools (FASTA, BLAST) ----- Sequence alignment (Local & Global; Pair wise & Multiple) ----Genetic algorithm (Needleman—Wunch ; Smith & Waterman) --- Scoring matrices (PAM & BLOSUM) ---- Phylogenetic analysis --- phylogenetic trees (Clustal W); Molecular visualization tool (RASMOL) --- prediction of protein structure. A brief account on drug designning

P.T.O

Refernces:

1. Rajadurai,M. 2010.Bioinformatics- a practical manual. PBS Book Enterprises. pp.158
2. Mani,K and Vijayaraj,N. 2002. Bioinformatics for beginners. Kalaikathir Achchagam. Coimbatore. Tamil Nadu. India.pPp275.
3. Attwood,T.K., Parry-Smith, D.J. and Phukan,S.2008. Introduction to bioinformatics.. Pearson Education Pvt.Ltd.,. New Delhi. India.pp218
4. Attwood,T.K.and Parry-Smith, D.J.2002. Introduction to bioinformatics..Pearson Education Pvt.Ltd.. New Delhi. India.pp1-237
5. Malcom Campbell,A and Heyer,L.J.2004. Discovering, Genomics, Proteomics and Bioinformatics. Pearson Education Pvt.Ltd.. New Delhi. India.pp352
6. Gomase,V.S and Chokhale,N.J. 2009. Proteomics. Himalaya Publishing House.pp360
7. Bal, H.P.2007. Bioinformatics-Principles and Applications . Tata MaGraw-Hill Publishing Company Ltd. New Delhi. India.pp217
8. Arumugam, N, Gopi,A, Meena,A, Sunderalingam,R and Kumaresan,V.2014. Biostatistics, Computer applications and Bioinformatics.Saras Publication . Nager koil, Tamil Nadu, India. pp 458
9. Khan, I.A. and Khanum, A 1994. Fundamentals of Biostatistics ,Ukaaz publications , Hyderbad , Andhrapradesh –India .
10. Pranab kumar Banerjee,2004, Introduction to Biostatistics (A Text book of Biometry). S. Chand & Company Ltd.Ram nagar , New Delhi.
11. https://WWW.biostat.washington.edu
    https://WWW.omicsonline.org.

Practicals:

1. Calculation of standard deviation for different plant sample –leaf length& pod length.
2. Chi –square test and students “t” test.
3. Problems on probablity
4. Graphic representation of data.Bioinformatics:
5. Component of computer.
6. Creation of table & graph using Ms office.
7. Sequence aligniment using BLAST.

8 Analysis structure of nucleic acid & protein using Rasmol.

9 Construction of phylogenetic tree.

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Botany **COURSE CODE : 21P1BMC1**

COURSE TITLE : Plant diversity-I **QN.NO : 12801**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives

1. To gain knowledge on the characteristic features, classification and distribution of algae, fungi, lichens and bryophytes.
2. To understand the methods of reproduction and life cycle of algae, fungi, lichens and bryophytes.
3. To enumerate the ecological and economic importance of algae, fungi, lichens and bryophytes.

UNIT	CONTENT	CLO	K LEVEL	HOURS
1	Algae: Introduction; criteria for algal classification; classification by Fritch; Algal habitats - freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae. ultra structure of prokaryotic and eukaryotic algal cells and their components - cell wall, protoplasm, eye spots, chloroplast, pyrenoid, nucleus. origin and evolution of sex in algae	1	Up to K4	15
2	Thallus organization, pigmentation, reserve food material, flagellation- life cycle patterns and phylogeny for the following major classes: Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae., fossil algae. economic importance of algae: food and feed - single cell protein - industrial products (Agar-Agar, carrageenan, alginic acid, vitamins and biofuel) – medicinal values and Diatomaceous earth. algal cultivation methods.	2	Up to K4	15
3	Fungi: General features; occurrence and distribution; mode of nutrition in fungi; culture of fungi. classification of fungi by Alexopoulos and Mims, 1979; general characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Phylogeny and interrelationships of major groups of fungi. homothallism and heterothallism. homokaryon and heterokaryon. reproduction, life cycle types, parasexual cycles.	3	Up to K4	15
4	Mycelial modifications; fruiting bodies- spore dispersal mechanism-physiological specialization and degeneration of sex in fungi. Economic importance of fungi; as medicines and in industries. Lichens: Introduction – classification of lichens – distribution – interrelationship – phycobionts – mycobionts – thallus organization – vegetative propagules- reproduction – lichens as indicator of pollution – economic importance of lichens.	4	Up to K4	15
5	Bryophytes: General features, distribution, classification (Watson, 1971), general characters of major classes. Hepaticopsida, Anthocerotopsida and Bryopsida. range of vegetative structure, evolution of gametophytes and sporophytes. Reproduction – Vegetative, asexual and sexual, spore dispersal mechanisms in bryophytes; ecological and economic importance of bryophytes. Origin and interrelationships, Fossil bryophytes.	5	Up to K4	15

Books for study

1. Alexopoulos, C. J. (1996) Introductory Mycology. Wiley Publishers, ISBN: 9780471522294.
2. Cooke, M. C. (2017) Fungi: Their Nature and Uses. Historical Books Ltd., London, ISBN: 978-1545335581
3. Bilgrami, K. S. (2010) A Textbook of Algae. CBS Publisher & Distributors, New Delhi, ISBN: 978-8123900490
4. Edwardlee, R. (2008) Phycology, 4th Edition, Cambridge University Press, London, ISBN: 0521682770.

5. Barsanti, L. and Guadtieri, P. (2014) Algae: Anatomy, Biochemistry and Biotechnology, 2nd Edition, CRC Press, ISBN: 1439867321.

Books for references:

1. Ahmadjian, V. and Hale, M. E. (1973) The Lichens. Springer Verlag, Berlin. ISBN: 978-0-12-044950-7
2. Johri, R. M., Lata, S. and Tyagi, K. (2012). A Textbook of Bryophyta. Dominant Publishers & Distributors Pvt., Ltd., New Delhi. ISBN: 9789384207335.
3. Suresh Kumar (2014) Textbook of Bryophyta. K.K. Publication, New Delhi, ISBN: 978-8184115093
4. Stephenson, S. L. (2010) The Kingdom Fungi: An Introduction to Mushrooms, Molds and Lichens, 1st Edition, Timber Press, ISBN: 0881928917.
5. Schofield, W. B. (2001) Introduction to Bryology, 1st Edition, The Blackburn Press, ISBN: 1930665261.

Web Resources:

1. https://www.easybiologyclass.com/?s=algae
2. https://www.britannica.com/search?query=fungi
3. https://www.britannica.com/science/lichen

Rationale for Nature of the Course:

Demonstration and field visit to areas of mass cultivation of algae and fungi of nutritional, pharmaceutical, industrial and ecosystem restoration interests.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

Observation of morphology and scientific identification of species of the respective plant divisions
Analyzing the ecological and economic significance of algae, fungi, lichens and bryophytes

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).
Documenting the ecological and utility aspects of lichens and bryophytes

CLOs	CLO Statement	Knowledge Level
	Students will be able to know, understand, apply and analyse	
CLO -1	the vegetative and reproductive morphology; classification and phylogeny of lower algae	Up to K4
CLO -2	the ecology, exclusive cellular components and economic importance of algae	Up to K4
CLO -3	the general characters, culture methods, classification, phylogeny and economic importance of fungi	Up to K4
CLO -4	the some special considerations of fungi and thallus organizations, reproduction and economic importance of lichens	Up to K4
CLO -5	the salient features, major classes, ecology and economic importance of bryophytes	Up to K4

Mapping Programme Specific Outcomes with Course Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	1	1	2	2	2
CLO-2	2	2	2	3	2
CLO-3	2	3	3	2	3
CLO-4	3	3	3	3	3
CLO-5	3	3	3	2	3

3-Advance application, 2- Intermediate level, 1- Basic level

Lesson Plan

Unit	Description	Hrs	Mode
I	a) Introduction to algae	2	Chalk and talk PPT, LMS and Group discussion
	b) Classification classification by Fritch	2	
	c) Thallus organization, pigmentation	3	
	d) Reserve food material, flagellation	2	
	e) Life cycle patterns and phylogeny for the Cyanophyceae, Chlorophyceae	2	

	f) Xanthophyceae, Bacillariophyceae g) Phaeophyceae and Rhodophyceae.	2 2	
II	a) Algal habitats - freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae. b) Ultra structure of prokaryotic and eukaryotic algal cells and their components - cell wall, protoplasm, eye spots, chloroplast, pyrenoid, nucleus. c) Origin and evolution of sex in algae, fossil algae. economic importance of algae: food and feed - single cell protein - industrial products (Agar-Agar, carrageenan, alginic acid, vitamins and biofuel)- medicinal values and Diatomaceous earth. d) Algal cultivation methods.	5 3 5 2	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
III	a) General features; occurrence and distribution mode of nutrition in fungi b) Culture of fungi. classification of fungi by Alexopoulos and Mims, 1979; c) General characters of major classes: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. d) Phylogeny and interrelationships of major groups of fungi. e) Homothallism and heterothallism. homokaryon and heterokaryon. f) Reproduction, life cycle types, parasexual cycles. economic importance of fungi; as medicines and in industries.	2 3 2 2 3 3	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
IV	a) Mycelial modifications; fruiting bodies b) Spore dispersal mechanism- physiological specialization and degeneration of sex in fungi. c) Lichens: Introduction- classification of lichens d) Distribution – interrelationship- phycobionts – mycobionts e) Thallus organization –vegetative propagules f) Reproduction – lichens as indicator of pollution g) Economic importance of lichens.	2 2 2 2 2 3 2	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
V	a) Bryophytes: General features, distribution b) Classification of Bryophytes (Watson, 1971) c) general characters of major classes. Hepaticopsida, Anthocerotopsida and Bryopsida. d) Range of vegetative structure, evolution of gametophytes and sporophytes. e) Reproduction – Vegetative, asexual and sexual, f) Spore dispersal mechanisms in bryophytes g) Ecological and economic importance of bryophytes h) Origin and interrelationships, Fossil bryophytes.	1 1 2 3 3 3 2	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion

PG Botany Blue Print

Test	10 marks	As per table below
Assignment	5 marks	K4
Seminar	5 marks	K4
Quiz	5 marks	K4

Learning Outcome Based Education (LOBE) & Assessment
Formative – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2 (K2,K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1 (K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

Learning Outcome Based Education (LOBE) & Assessment
Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MC Qs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2 (K2&K2)	1 (K3)
3	CLO 3	Up to K4	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
No. of Questions to be asked			10			5	10	5
No. of Questions to be answered			10			5	5	3
Marks for each question			1			2	5	10
Total Marks for each section			10			10	25	30

Distribution of Section- wise marks with K Levels in the summative examinations

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	**16**	13.33	**35%**
K2	2	4	10	10	**26**	21.66	
K3	4	2	10	20	**36**	30.00	**30%**
K4	2	-	20	20	**42**	35.00	**35%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

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RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Botany **COURSE CODE : 21P1BMC2**

COURSE TITLE : Plant diversity-II **QN.NO : 12802**

TIME : 3 Hours **MAX.MARKS :75**

Course Objectives

1. To acquaint with the classification, phylogeny, evolutionary trends and life cycle of Pteridophytes and Gymnosperms.
2. To understand the salient features of fossil forms of Pteridophytes and Gymnosperms.
3. To learn the concept of Palaeobotany and economic importance of fossil plants.

UNIT	CONTENT	CLO	K LEVEL	HOURS
I	Pteridophytes: General features and classification (Reimer's, 1954) - Telome concept- life cycle and its origin of Pteridophytes - deviation mechanisms – apogamy and apospory - range of morphology, structure, reproduction and evolution of gametophytes and sporophytes. Fossil Pteridophytes – a brief account on *Rhynia, Lepidodendron, Sphenophyllum* and *Calamites.*	1	Up to K4	15
II	Vegetative and reproductive morphology of living Pteridophytes – general characters of the following orders: psilophytales, lycophytales, equisetales, polypodiales and marsileales. stelar evolution – structure, development and evolution of sorus - heterospory and origin of seed habit - economic importance.	2	Up to K4	15
III	Gymnosperms: General characters – origin of gymnosperms – classification by Sporne, 1965 - salient features of fossil gymnosperms- pteridospermales, bennettitales, pentoxylales, cycadales, cordaitales and coniferales	3	Up to K4	15
IV	General account, distribution, morphology, anatomy, reproduction and phylogeny of cycadales, coniferales and gnetales- economic importance - woods of gymnosperms.	4	Up to K4	15
V	Palaeobotany: Concepts of palaeobotany - geological time scale – fossillization- impressions, compressions, incrustation, casts, molds and petrifications – age determination and methods of study of fossils – carbon dating- role of fossils in oil exploration – palaeopalynology –Birbal Sahni's contributions.	5	Up to K4	15

Books for study:

1. Sporne, K.R. 1970. The morphology of Pteridophytes (The structure of Ferns and Allied Plants), Hutchinson University, London.
2. Pandey, B.P. 1998. A Text Book of Botany Vol. II. S Chand, NewDelhi.
3. Stuart WN (1998). Paleobotany and Evolution of Plants, New York Publications.
4. Parihar, N.S (1967). An introduction to Embryophyta vol. II. Pteridophyta. Central Book Depot, Allahabad.
5. Sporne, K.R (1976). Morphology of Pteridophytes. B.I. Publishers, New Delhi.
6. Smith, G.M. (1955). Cryptogamic Botany. Vol. III. McGraw Hill, New Delhi.
7. Rashid A (2013) An introduction to Pteridophyta – Diversity, Development and Differentiation (2ndedition),Vikas Publications.

Books for Reference:

1. Johri , RM, Lata S , Tyagi K (2005), A text book of Gymnosperms, Dominate pub and Distributer, NewDelhi
2. Vastishta PC Sinha AK Anikumar (2006). Pteridophyta (Revised edition), S. Chand and Company, Pvt. Ltd. New Delhi.
3. Vastishta PC Sinha AK Anikumar (2006). Gymnosperms (Revised edition), S. Chand and Company, Pvt. Ltd., New Delhi.
4. Rashid A (2013) An introduction to Pteridophyta – Diversity, Development and Differentiation (2ndedition),Vikas Publications.

Web Resources:

1. https://www.britannica.com/search?query=Gymnosperms
2. https://www.easybiologyclass.com/classification-of-gymnosperms-by-sporne-short-notes/
3. https://www.britannica.com/plant/plant/Evolution-and-paleobotany
4. https://indiabiodiversity.org

Rationale for Nature of the Course:

Identification of the members of pteridophytes and gymnosperms by observing their characteristic vegetative and reproductive morphology and by referring appropriate manuals/floras.
Conducting field study trip to their natural habitats and to visit vendors of these plant resources to understand their economic values
To document the utilization aspects of these plant divisions at the global level.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

Comparative vegetative and reproductive morphological studies of pteridophytes and gymnosperms
Tracing the evolutionary lineages of living and fossil members these plant divisions with reference to floristic geological time scale
Prospecting the utility of pharmaceutical and timber resources for utilitarian values

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).

Course Learning Outcomes:

CLOs	CLO Statement	Knowledge Level
Students will be able to know, understand, apply and analyse		
CLO -1	the general features, classification, evolution and economic importance of Pteridophytes	Up to K4
CLO -2	the comparative characteristics of Orders of Pteridophytes	Up to K4
CLO -3	the salient features, origin and classification of gymnosperms	Up to K4
CLO -4	the anatomy, reproduction, phylogeny and economic importance of gymnosperms	Up to K4
CLO -5	the concept of paleobotany, geological time scale, fossilization methods and study of fossils	Up to K4

Mapping Programme Specific Outcomes with Course Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	1	2	3	1	2
CLO-2	2	1	3	2	2
CLO-3	3	3	3	3	3
CLO-4	3	3	1	2	3
CLO-5	3	3	2	3	3

3-Advance application, 2- Intermediate level, 1- Basic level

Lesson Plan

Unit	Description	Hrs	Mode
I	a) Pteridophytes: General features and classification (Reimer's, 1954) b) Telome concept- life cycle and its origin of Pteridophytes - deviation mechanisms – apogamy and apospory - range of morphology	2 5	Chalk and talk PPT, LMS Quiz, Video lectures and Group

	c) Structure, reproduction and evolution of gametophytes and sporophytes d) Fossil Pteridophytes – a brief account on *Rhynia, Lepidodendron, Sphenophyllum* and *Calamites.*	5 3	discussion
II	a) Vegetative and reproductive morphology of living Pteridophytes b) General characters of the following orders: psilophytales, lcophytales, equsetales, polypodiales and marsileales. c) Stelar evolution – structure, development and evolution of sorus d) Heterospory and origin of seed habit - economic importance.	4 6 2 3	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
III	a) Gymnosperms: General characters – origin of gymnosperms b) Classification by Sporne, 1965 c) Salient features of fossil gymnosperms- pteridospermales, bennettitales, pentoxylales, cycadales, cordaitales and coniferales.	3 5 7	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
IV	a) General account, distribution, morphology, anatomy, reproduction and phylogeny of Cycadales b) Coniferales and gnetales c) Economic importance - woods of gymnosperms.	6 6 3	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
V	a) Palaeobotany: Concepts of palaeobotany - geological time scale b) Fossillization- impressions, compressions, incrustation, casts, molds and petrifications – age determination and methods of study of fossils c) Carbon dating- role of fossils in oil exploration – palaeopalynology –Birbal Sahni's contributions.	5 5 5	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion

Course Designer: Dr. P. Kannan, Assistant Professor

PG Botany BluePrint

Test	10 marks	As per table below
Assignment	5 marks	K4
Seminar	5 marks	K4
Quiz	5 marks	K4

Learning Outcome Based Education (LOBE) & Assessment Formative – Blue Print

Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2 (K2,K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1 (K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

Learning Outcome Based Education (LOBE) & Assessment Summative Examination – Blue Print

Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K-Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2 (K2&K2)	1 (K3)

3	CLO 3	Up to K4	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
No. of Questions to be asked			10			5	10	5
No. of Questions to be			10			5	5	3
Marks for each question			1			2	5	10
Total Marks for each section			10			10	25	30

Distribution of Section- wise marks with K Levels in the summative examinations

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	**16**	13.33	**35%**
K2	2	4	10	10	**26**	21.66	
K3	4	2	10	20	**36**	30.00	**30%**
K4	2	-	20	20	**42**	35.00	**35%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Botany **COURSE CODE : 21P1BMC3**

COURSE TITLE : Plant Anatomy, Embryology and Morphogenesis **QN.NO : 12803**

TIME : 3 Hours **MAX.MARKS :75**

Objectives

1. To gain knowledge on the structure and functional development of plant cells and tissues.
2. To differentiate the normal and anomalous secondary growth in Dicots and Monocots.
3. To understand the formation and development of embryo and their applications for crop improvement.
4. To understand the critical steps in the differentiation of tissues and organs.

UNIT	CONTENT	CLO	K LEVEL	HOURS
1	**Plant Anatomy:** Meristems – characters, classification and theories – Apical cell theory, shoot apical meristem (SAM), root organization – root apical meristem (RAM). Secondary structure of dicot stem and root. Identification of common timbers - Heart wood and sap wood-strength, ability, grains, texture and defects. Anomalous secondary growth in Dicots and Monocots (Boerhaavia, Bougainvilla, Amaranthus, Mirabilis and Dracaena).	1	Up to K4	15
2	**Embryology of Angiosperms:** Development of microspores and megaspores – types and factors involved. Development of micro gametophyte – pollen wall development - vegetative and generative cells; pollen viability test. Development of megagametophyte – structure and types of ovule. Development of monosporic, biosporic and tetrasporic types of embryosac and their cellular organization. Endosperm – Origin, types, structure, development. Haustorial endosperms	2	Up to K4	15
3	Pollen-Pistil interaction and fertilization, types of stigma and style events on stigmatic surface, pollen tube growth, guidance and entry into ovule and embryo sac. Double fertilization – significance. Incompatibility – interspecific – homomorphic and heteromorphic, Causes and methods to overcome incompatibility. Classification of embryo development in Dicots and Monocots. Polyembryony – causes – Apomixis, Apospory. Their role in crop improvement programmes and seed development. Biochemical and physical factors in fruit development. Parthenocarpy. Prospects and significance of embryo, pollen and endosperm culture.	3	Up to K4	15
4	**Morphogenesis:** Concept of morphogenesis as a package of development; components – cell division, division planes, their importance; Cytoskeleton, pre-prophase band in orienting karyokinesis and cell plate. Origin, Structure, development and ontogeny of xylem and phloem. Role of sucrose in Vascular tissue differentiation. Vascular Cambium – Types, divisions, arrangement and seasonal activity, factors affecting cambial activity.	4	Up to K4	15
5	Leaf ontogeny – initiation, apical, intercalary, marginal and adaxial growth, plate meristem and development of vascular tissues, plastochronic index, zone of foliar inhibition in apices. Transfer cells – Structure, development and functions. Classical concept of flower; Floral anatomy and its role in classification, ABC model of ontogeny of flower. Plant galls - types, structure and development. Role of polarity in cell differentiation and symmetry (Polarity in cuttings, unicellular coenocytes, eggs and spores).	5	Up to K4	15

Books for study

1. Agarwal, S. B. 1990 Embryology of Angiosperms - a fundamental approach. Sahitya Bhawan, Agra.
2. Clowers, F. A. L. 1961 Apical Meristems. Blackwell Scientific Publication, Oxford.
3. Bhojwani S. S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd., New Delhi
4. Cutler, D.F. 1978, Applied plant Anatomy, Orient Longman Publishers, New Delhi
5. Dwivedi, J. N. 1998 Embryology of Angiosperms. Rastogi and Co., Meerut.
6. Easu, K. 1953 Plant Anatomy. John Wiley & Sons Inc., New York.
7. Easu, 1987. The Anatomy of seed plants. Wiley Eastern Ltd., New Delhi
8. Fahn, A. 1989 Plant Anatomy,Pergamon press, Oxford, New York.
9. Fosket, D.E. 1994. Plant Growth and Development – a molecular approach. Academic Press.
10. Johri, B.M. 1984 Embryology and Angiosperms. Springer Verlag. Berlin

Books for reference

1. Maheshwari, P. 2015. An Introduction to the Embryology of Angiosperms, Scholar Select Publishers.
2. Metcalfe and Chalk 1950 Anatomy of the Dicotyledons and Monocotyledons. Vol. I and II. Clarendon Press, Oxford, UK.
3. Pandey , A.K., 1997. Introduction to Embryology. CBS Publishers and Distributors , New Delhi
4. Pandey, B. P. 1989 Plant Anatomy. S. Chand and Co. Ltd., New Delhi.
5. Pandey, S.N. and Chadha , A. 2000. Embryology. Vikas Publishing House Pvt. Ltd., , New Delhi
6. Paula J. Rudall, 2007. Anatomy of Flowering Plants: An Introduction to Structure and Development (3rd Edition), Cambridge University Press.
7. Ray F. Evert, 2006. Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function, and Development. John Wiley & Sons.
8. Shivanna, K. R. 2003 . Pollen Biology and Biotechnology. Oxford and IBH publishing house, New Delhi.
9. Singh, V., Pande, P. C. and Jain, D. K. 1987 Anatomy of Seed Plants. Rastogi Publications, Meerut. Embryology

Rationale for Nature of the Course:

Enumerating the sources and quality of fibres and timbers

Visiting the crop improvement centers to acquaint with the modern techniques

Activities having direct bearing on Skill development / Employability / Entrepreneurship

Observation of internal morphology of different habits of angiosperms adopting hand and microtome sectioning of different dimensions(T.S, RLS and TLS), differential staining, tissue maceration and permanent slide preparations.

Analyzing the fibre and timber quality of the plants of interests

Undertstanding and applications of conventional crop improvement techniques

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).

Course Learning Outcomes:

CLOs	CLO Statement	Knowledge Level
Students will be able to know, understand, apply, and analyse		
CLO -1	the characteristics and classifications of meristems, theories on apical meristems, secondary and anomalous secondary structures of stem and root	Up to K4
CLO -2	The micro and megasporogenesis; development of male gametophyte, ontogeny of types of embryosac and endosperms	Up to K4
CLO -3	The pollen pistil interactions, double fertilization, classification of embryo development and polyembryony	Up to K4
CLO -4	the components of morphogenesis like cell division, cytoskeleton, cambial activity and xylem and phloem differentiation	Up to K4
CLO -5	the development of leaf, flower and galls; and role of polarity in plant developement	Up to K4

Mapping Programme Specific Outcomes with Course Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	1	2	3	1	2
CLO-2	2	1	3	2	2
CLO-3	3	3	3	3	3
CLO-4	3	3	1	2	3
CLO-5	3	3	2	3	3

Lesson plan

Unit	Description	Hours	Mode
I	Meristems – characters, classification and theories – Apical cell theory, shoot apical meristem (SAM), root organization – root apical meristem (RAM). Secondary structure of dicot stem and root. Identification of common timbers - Heart wood and sap wood-strength, ability, grains, texture and defects. Anomalous secondary growth in Dicots and Monocots (Boerhaavia, Bougainvilla, Amaranthus, Mirabilis and Dracaena).	5 5 5	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
II	Development of microspores and megaspores – types and factors involved. Development of micro gametophyte – pollen wall development - vegetative and generative cells; pollen viability test. Development of megagametophyte – structure and types of ovule. Development of monosporic, biosporic and tetrasporic types of embryosac and their cellular organization. Endosperm – Origin, types, structure, development. Haustorial endosperms.	5 5 5	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
III	Pollen-Pistil interaction and fertilization, types of stigma and style events on stigmatic surface, pollen tube growth, guidance and entry into ovule and embryo sac. Double fertilization – significance. Incompatibility – interspecific – homomorphic and heteromorphic, Causes and methods to overcome incompatibility. Classification of embryo development in Dicots and Monocots. Polyembryony – causes – Apomixis, Apospory. Their role in crop improvement programmes and seed development. Biochemical and physical factors in fruit development. Parthenocarpy. Prospects and significance of embryo, pollen and endosperm culture.	5 5 5	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
IV	Morphogenesis: Concept of morphogenesis as a package of development; components – cell division, division planes, their importance; Cytoskeleton, pre-prophase band in orienting karyokinesis and cell plate. Origin, Structure, development and ontogeny of xylem and phloem. Role of sucrose in Vascular tissue differentiation. Vascular Cambium – Types, divisions, arrangement and seasonal activity, factors affecting cambial activity.	8 4 3	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
V	Leaf ontogeny – initiation, apical, intercalary, marginal and adaxial growth, plate meristem and development of vascular tissues, plastochronic index, zone of foliar inhibition in apices. Transfer cells – Structure, development and functions. Classical concept of flower; Floral anatomy and its role in classification, ABC model of ontogeny of flower. Plant galls - types, structure and development. Role of polarity in cell differentiation and symmetry (Polarity in cuttings, unicellular coenocytes, eggs and spores).	4 3 3 5	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion

PG Botany BluePrint

Test	10 marks	As per table below
Assignment	5 marks	K4
Seminar	5 marks	K4
Quiz	5 marks	K4

Learning Outcome Based Education (LOBE) & Assessment
Formative – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2 (K2,K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1 (K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

Learning Outcome Based Education (LOBE) & Assessment
Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K-Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2 (K2&K2)	1 (K3)
3	CLO 3	Up to K4	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)
No. of Questions to be asked			10			5	10	5
No. of Questions to be answered			10			5	5	3
Marks for each question			1			2	5	10
Total Marks for each section			10			10	25	30

Distribution of Section- wise marks with K Levels in the summative examinations

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	**16**	13.33	**35%**
K2	2	4	10	10	**26**	21.66	
K3	4	2	10	20	**36**	30.00	**30%**
K4	2	-	20	20	**42**	35.00	**35%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Botany **COURSE CODE : 21P1BME1**

COURSE TITLE : Organic Farming **QN.NO : 12804**

TIME : 3 Hours **MAX.MARKS :75**

Objective:

1. To gain knowledge on various aspects of organic farming.
2. To understand the relevance of organic farming, its advantages and short comings against conventional high input agriculture.
3. To create awareness on the importance of organic farming in the present scenario and its impact on environment and human health.

Unit	Content	CLO	K level	Hours
I	Importance of organic farming**:** Introduction- Definition – Scope – principles and concepts – history of organic farming – Indian and global scenario – Agro-biodiversity: importance and measures to preserve traditional biodiversity – pre requisites for Organic farming. Green revolution – definition – impacts, Natural resources and their management.	1	Up to K4	15
II	Organic sources of nutrients – on farm and off farm sources – organic waste recycling methods- compost – compost making – *In situ* and *ex situ* manuring – soil and crop management – inter cropping, crop rotation, green manures, cover crops, mulching – bio fertilizers.	2	Up to K4	15
III	Indigenous practices of organic farming**-** role of livestock – cow in organic farming – Panchagavya – Dasagavya – Amirthakaraisal – preparation – properties – general effects on crops.	3	Up to K4	15
IV	Organic certification**:**– NPOP guidelines – Certification agencies in India – crop production standards – Quality considerations – labeling and accreditation process – marketing and export opportunities – APEDA.	4	Up to K4	15
V	Bio-intensive nutrient management: application of Effective micro organism (EM) technology – phosphate rich organic manure (PROM). Weed management in organic farming – organic crop protection methods. Organic rice production – economic evaluation – benefits – organic enterprises.	5	Up to K4	15

Books for the study

1. Organic Farming Theory &Practice – Scientific publishers ,Palaniappan SP. and K.Annadurai. 2010.
2. Organic Farming Manual- Storey Publishing , Ann Larkin Hansen- 2010
3. Organic Farming –Voyageur Press, 2014.

Books for Reference

1. Arunkumar Sharma 2008. A Hand book of organic Farming. Agrobios Publishers.
2. Dahama, A.K.2009. Organic Farming for Sustainable Agriculture, Agrobios publishers.
3. Palaniappan SP. and K.Annadurai. 2008. Organic Farming: Theory and Practice. Scientific Publishers.
4. Veeresh, G.K. 2010. Organic Farming, Cambridge University Press, India.

Web Resources

https://www.conserve-energy-future.com/organic-farming-benefits.
https://en.wikipedia.org/wiki/Compost
https://rodaleinstitute.org/why-organic/organic-farming-practices/composting
https://www.britannica.com/topic/organic-farming
https://www.biologydiscussion.com/essay/bio-fertilizers-types-and-importance-of-bio-fertilizers/1901

Rationale for Nature of the Course:

Meeting the demand and necessity of balanced nutrients, due to population explosion, by adopting eco-friendly approaches.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

Understanding the facts and prospects of agrobiodiversity, organic farming, organic certification, biointensive nutrient management

Pedagogy:
Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).

Course Learning Outcomes:

CLOs	CLO Statement	Knowledge Level
Students will be able to know, understand, apply, and analyse		
CLO -1	The importance, scope, principles, concepts and Indian and global scenario of organic farming; green revolution, agroforestry and natural resources management	Up to K4
CLO -2	The organic sources of nutrients, organic waste recycling, manuring methods and crop management	Up to K4
CLO -3	The Indigenous practices of organic farming and its effects on crops	Up to K4
CLO -4	The Quality considerations, marketing and export opportunities of organic farming	Up to K4
CLO -5	The bio intensive nutrient management, weed management, rice production in organic farming	Up to K4

Mapping Programme Specific Outcomes with Course Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CLO-1	3	2	2	1	1
CLO-2	3	2	1	3	1
CLO-3	2	2	1	3	3
CLO-4	1	1	1	2	3
CLO-5	2	2	1	2	3

3-Advance application, 2- Intermediate level, 1- Basic level

Lesson Plan

Unit	Description	Hrs	Mode
I	a) Introduction and Scope of organic farming b) history of organic farming c) Indian and global scenario d) Agro-biodiversity e) preserve traditional biodiversity f) Green revolution g) Natural resources and their management.	2 2 2 2 3 2 2	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
II	a) Organic sources of nutrients b) organic waste recycling methods c) compost making d) *In situ* and *ex situ* manuring e) Soil and crop management f) inter cropping, crop rotation g) green manures h) mulching – bio fertilizers.	2 2 2 2 1 2 2 2	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion

III	a) Indigenous practices of organic farming- b) role of livestock c) cow in organic farming d) preparation and properties of Panchagavya e) Dasagavya f) Amirthakaraisal	3 2 1 3 3 3	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
IV	a) Organic certification:– NPOP guidelines b) Certification agencies in India c) Crop production standards d) Quality considerations e) labeling and accreditation process f) marketing and export opportunities – APEDA.	3 2 2 3 2 3	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion
V	a) application of Effective micro organism (EM) technology b) Phosphate rich organic manure (PROM). c) Weed management inorganic farming d) Organic crop protection methods. e) Organic rice production	3 3 3 3 3	Chalk and talk PPT, LMS Quiz, Video lectures and Group discussion

PG Botany BluePrint

Test	10 marks	As per table below
Assignment	5 marks	K4
Seminar	5 marks	K4
Quiz	5 marks	K4

Learning Outcome Based Education (LOBE) & Assessment
Formative – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B (Either/or Choice)	Section C (Open Choice)
			Short Answers			
			No. of Questions	K- Level		
1	CLO x	Up to K3	2	K2,K3	2 (K3&K3)	2 (K2,K3)
2	CLO y	Up to K4	3	K2, K2, K3	2 (K4&K4)	1 (K3/K4)
No. of Questions to be asked			5		4	3
No. of Questions to be answered			5		2	2
Marks for each question			2		5	10
Total Marks for each section			10		10	20

Learning Outcome Based Education (LOBE) &
Assessment Summative Examination – Blue Print
Articulation Mapping-K Levels with Courses Learning Outcomes (CLOs)

Units	CLOs	K- Level	Section A		Section B		Section C (Either/or Choice)	Section D (Open Choice)
			MCQs		Short Answers			
			No. of Questions	K- Level	No. of Questions	K- Level		
1	CLO 1	Up to K2	2	K1 & K1	1	K1	2 (K1&K1)	1 (K2)
2	CLO 2	Up to K3	2	K2 & K3	1	K1	2 (K2&K2)	1 (K3)
3	CLO 3	Up to K4	2	K2 & K3	1	K2	2 (K3&K3)	1 (K3)
4	CLO 4	Up to K4	2	K3 & K4	1	K2	2 (K4&K4)	1 (K4)
5	CLO 5	Up to K4	2	K3 & K4	1	K3	2 (K4&K4)	1 (K4)

No. of Questions to be asked	10			5	10	5
No. of Questions to be answered	10			5	5	3
Marks for each question	1			2	5	10
Total Marks for each section	10			10	25	30

Distribution of Section- wise marks with K Levels in the summative examinations

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (Either/or)	Section D (Open Choice)	Total Marks	% of Marks without choice	Consolidated
K1	2	4	10	-	**16**	13.33	**35%**
K2	2	4	10	10	**26**	21.66	
K3	4	2	10	20	**36**	30.00	**30%**
K4	2	-	20	20	**42**	35.00	**35%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

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THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

(AFFILIATED TO MADURAI KAMARAJ UNIVERSITY)

RE-ACCREDITED (3rd Cycle) WITH "A" GRADE BY NAAC

PROGRAMME : M.Sc., Botany **COURSE CODE : 21P1BNM1**

COURSE TITLE : Medicinal Botany **QN.NO : 12807**

TIME : 3 Hours **MAX.MARKS :75**

Objectives

- To gain knowledge on indigenous and traditional medicinal systems
- To understand the medicinal plant diversity and their conservation.
- To know the medicinally important phytochemicals and their extraction methods.

Unit	Content	CLO	K level	Hours
I	Introduction - Historical background - scope; Indigenous medicinal systems in India - Siddha, Ayruveda, Unani, homeopathy - ethnomedicine. Needto preserve traditional knowledge systems	1	Up to K2	6
II	Importance of Indian medicinal plants - bioprospection - hotspots-endemic medicinal plants - importance of medicinal plants of Tamil Nadu; Senna, Gymnema, Curcuma, Catharanthus, Aloe and Gloriosa.	2	Up to K2	6
III	Phyotchemicals and their types, extraction and purification methods of plant constituents - medicinal importance of alkaloids, glycosides, flavonoids and volatile oils	3	Up to K2	6
IV	Collection and harvest technology of medicinal herbs - factors responsible for deterioration of medicinal drugs-storage, processing - packaging of crude drugs.	4	Up to K2	6
V	Conservation of medicinal plants - in sit and ex situ methods - centres of medicinal plant conservation in India - IBPGRI, CIMAP-CDRI, NBGRI, TBGRI and TAMPCLOL.	5	Up to K2	6

Rationale for Nature of the Course:

Gained knowledge on indigenous medicinal systems and the medicinal plant diversity

Skill on extraction of phytochemicals and conservation of medicinal plants

Activities having direct bearing on Skill development / Employability / Entrepreneurship

Industrial visit to acquaint with the skills on extraction methods.

Pedagogy:

Chalk and Talk, PPT, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Labs & Learning Management System (CANVAS).

Course Learning Outcomes:

CLOs	CO Statement	Knowledge Level
Students will be able to know, understand, apply, and analyse		
CLO -1	the indigenous and traditional medicinal systems in India	**Up to K2**
CLO -2	the medicinal plant diversity with important medicinal plants	**Up to K2**
CLO -3	the extraction methods of various phytochemicals	**Up to K2**
CLO -4	the practical skills on collection and storage of crude drugs	**Up to K2**
CLO -5	the methods of conservation of medicinal plants and contributions of medicinal plant centres of India	**Up to K2**

Mapping

	PSO1	PSO2	PSO3	PSO4	PSO5
CLO1	2	3	1	1	3
CLO2	1	3	1	3	3
CLO3	2	1	1	2	2
CLO4	3	3	1	2	3
CLO5	2	2	1	3	3

Lesson Plan

Unit	Description	Hours	Mode
I	Introduction - Historical background - scope; Indigenous medicinal systems in India - Siddha, Ayruveda, Unani, homeopathy - ethnomedicine. Needto preserve traditional knowledge systems.	2 2 2	Chalk and talk PPT, LMS and Group discussion
II	Importance of Indian medicinal plants - bioprospection - hotspots- endemic medicinal plants - importance of medicinal plants of Tamil Nadu; Senna, Gymnema, Curcuma, Catharanthus, Aloe and Gloriosa.	4 2	Chalk and talk PPT, LMS and Group discussion
III	Phyotchemicals and their types, extraction and purification methods of plant constituents - medicinal importance of alkaloids, glycosides, flavonoids and volatile oils. Biochemical and physical factors in fruit development. Parthenocarpy. Prospects and significance of embryo, pollen and endosperm culture.	3 3	Chalk and talk PPT, LMS and Group discussion
IV	Collection and harvest technology of medicinal herbs - factors responsible for deterioration of medicinal drugs- storage, processing - packaging of crude drugs.	6	Chalk and talk PPT, LMS and Group discussion
V	Conservation of medicinal plants - *in situ* E*x situ* methods - centres of medicinal plant conservation in India - IBPGRI, CIMAP-CDRI, NBGRI, TBGRI and TAMPCLOL.	2 4	Chalk and talk PPT, LMS and Group discussion
	Total	**75**	

Learning Outcome Based Education & Assessment (LOBE)
Blue Print – PG BOTANY NME FORMATIVE EXAMINATIONS (CIA-I & II)
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

CLOs	K- Level	Section A		Section B		Section C	
		Short Answers		(Either/or Choice)		(Open Choice)	
		No. of Questions	K-Level	No. of Questions	K-Level	No. of Questions	K- Level
CLO x	Up to K2	1	K1	1	K2/K2	1	K1
CLO y	Up to K2	2	K1	1	K2/K2	2	K1
No. of Questions to be asked		3		2		3	
No. of Questions to be answered		3		2		2	
Marks for each question		2		7		10	
Total Marks for each section		**6**		**14**		**20**	

Learning Outcome Based Education & Assessment (LOBE)

Blue Print – PG BOTANY NME - SUMMATIVE EXAMINATIONS

Units	CLOs	K- Level	Section A		Section B		Section C Essay
			Short Answers		Paragraph (Either/or Choice)		
			No. of Questions	K- Level	No. of Questions	K- Level	
1	CLO 1	Up to K2	2	K1 & K1	2	1 K2	1 K1
2	CLO 2	Up to K2	2	K1 & K1	2	1 K2	1 K1
3	CLO 3	Up to K2	2	K1 & K1	2	1 K2	1 K1
4	CLO 4	Up to K2	2	K1 & K1	2	1 K2	1 K1
5	CLO 5	Up to K2	2	K1 & K1	2	1 K2	1 K1
No. of Questions to be asked			10			10	5
No. of Questions to be answered			5			5	3
Marks for each question			2			7	10
Total Marks for each section			10			35	30

Distribution of Section-Wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (No Choice)	Section C (No Choice)	Section D (No Choice)	Total Marks	% of Marks (without choice)	Consolidated
K1	10	-	50	-	60	46.15	100
K2	-	70	-	-	70	53.85	
K3	-	-	-	-	-	-	-
K4	-	-	-	-	-	-	-
Total Marks	**10**	**35**	**50**	**-**	**130**	**100.00**	**100**

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