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

PROGRAMME : B.Sc., Botany **COURSE CODE : 2SB (Upto 16)**
COURSE TITLE : Mushroom Cultivation **QN.NO : 4516**
TIME : 3 Hours **MAX.MARKS :75**

1. Introduction, prospects of mushroom cultivation in India.
2. Morphology of mushroom – Fruiting
3. Common edible mushrooms of India
4. Types suitable for cultivation in India – Preparation of culture and spawn – cultivation of oyster, paddy straw and white button mushroom
5. Food value of mushrooms – proteins, vitamins, minerals, carbohydrates, fats. Energy value of mushroom, uses of mushroom
6. Mushroom recipes – mushroom sauce, salad, omelette, pickles, soup, chips

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PROGRAMME : B.Sc., Botany **COURSE CODE : 3B (Upto 16)**
COURSE TITLE : Ecology and Biodiversity **QN.NO : 4522**
TIME : 3 Hours **MAX.MARKS :75**

Ecology

Unit I (15 hr)

Introduction, Scope, Basic concepts and Terminologies; Ecological factors eg. Light, fire and soil –(Types and profile). Ecosystem: Structure and Function eg. Pond ecosystem. Food chain and Food web – Ecological Pyramids, Energy flow in ecosystem eg. Fresh water ecosystem.

Unit II (15 hr)

Ecological adaptations: Adaptations in Hydrophytes, Xerophytes and Mangroves. Succession – Definition, General process of succession

Stages in hydrosere.

Unit III (10 hr)

Environmental pollution: Definition, types, sources, effects and control measures of Air, Water and Noise pollution.

Unit IV (15 hr)

Biodiversity: Concepts, Definition and scope of biodiversity – constraints of Biodiversity. Levels of biodiversity – Genetic, species and Ecosystem. Causes for the loss of biodiversity. Conservation - *Ex situ* and *In situ* with examples. Hotspots – Biosphere reserves in Tamilnadu. Sacred grooves – Sthalavrikshas (Brief account only). A brief account on CHIPKO Movement, NBA and Greenpeace movement, IUCN Categories, Red Data Book.

Unit V (5 hr)

1. Biogeographic Realms: Classification of vegetation based on altitude and longitude.
2. Continuous and discontinuous distribution
3. Endemism: types, reasons and theories – Ridley's theory, Willis theory of age and area hypothesis. Endemism in India and Tamilnadu.

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PROGRAMME : B.Sc., Botany | **COURSE CODE : 3SB (Upto 16)**
COURSE TITLE : Herbal Botany | **QN.NO : 4526**
TIME : 3 Hours | **MAX.MARKS :75**

1. Importance of food to human health, balanced diet, role of carbohydrates, fats, proteins and vitamins
2. Indian systems of medicine**:** codified systems: siddha, ayurveda, unani, tibetian non-codified systems: folklore, homeopathy
3. Source, chemical nature and properties of wonder drugs: Cinchona, pepper and foxglove
4. Vernacular name, habit, useful parts and medicinal uses for the following medicinal plants: *Tulsi, Adathoda, Omavalli, Zinger, Amukra, Vettiver, Amla, Naval and Kadukkai*
5. Cultivation, and medicinal uses of *Aloe* and *Vinca*

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PROGRAMME : B.Sc., Botany **COURSE CODE : 3AB (Upto 16)**

COURSE TITLE : Forestry **QN.NO : 4528**

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

UNIT I (20 hr)

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

UNIT II (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)

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

PROGRAMME : B.Sc., Botany **COURSE CODE : 3BNM / 4BNM**

COURSE TITLE : Introduction to Plant World **QN.NO : 4529**

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

Unit I
General features of Bacteria and Viruses.

Unit II
Plant Kingdom
Introduction - General features of plants – Algae to Angiosperms.

Unit III
Cryptogames: General features of Algae – Fungi – Lichen – Bryophytes – Pteridophytes.
Economic importance of Algae, Fungi and Lichens.

Unit IV
General features of Gymnosperms and Angiosperms.

Unit V
Plants in daily life
Botanical names and morphology of useful parts & uses:

1. Cereals – Rice, Maize and Pearl millet.
2. Fruit yielding plants – Apple and Mango
3. Pulses – Red gram and Bitter gram.
4. Timber – Teak and Rose wood.
5. Fiber – Cotton and Jute.

Reference Books

1. Gilbert Smith, Cryptogamic Botany, Mc Graw Hill Book Company, Inc., New York.
2. Peter Bell and Christopher Wood Lock, The Diversity of Green Plants, Edward Arnold Publ. Ltd. London.
3. Tayler, D.J. et al., 1998. Biological Science, Cambridge Univ. Press. London.
4. Raven, R.H. et al., 1990. Wm. Brown Publ.
5. Pezar et al., 2000. Microbiology, Tata Mc Graw Hill Pub. Ltd. New York.
6. Sambamoorthy and Subramanian, Economic Botany, Wilson Healy Pub. Pvt. Ltd. New Delhi.

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THE MADURA COLLEGE (AUTONOMOUS) MADURAI – 11
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UPTO 2016

(upto 2016)

CLASS : B.Sc.,(Botany)
TITLE : BIOCHEMISTRY
TIME : 3 HOURS

Qn.No. : 4530
CODE :4B
MAX.MARKS : 75

Unit I

Proteins-Structure,classification,types and properties.

Unit II

Amino acids – Classification based on structure and properties and significance.

Unit III

Enzymes – Classification, structure and properties, competitive and non competitive inhibitors – types and mode of action.

Unit IV

Carbohydrates –Classification, structure and properties of glucose, sucrose and cellulose.

Unit V

Lipids-Classification, structure and properties of simple, compound and derived lipids.

References

J.Jain- Biochemistry

Satyanarayana, U.-Biochemistry.

Lehninger –Biochemistry.

Conn R. & Stump- Outlines of Biochemistry.

Plummer – Practical Biochemistry.

Practical

1. Colorimeter-Complementary colour, verification of Beer's- Lamberts law.
2. pH meter components, measuring pH of various samples.
3. Paper chromatography.
4. Qualitative test for Proteins, Carbohydrates and Lipids (two tests each.)

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UPTO 2016

Semester I

Code: SBE 2 hour/week – 30 hr

CELL ORGANELLES

4SBC 4534 (UPTO 2016)
Q.No:- 4534

Unit I

Structure and properties of prokaryotic and eukaryotic cells.

Plant cell wall – structure, chemistry and functions.

Unit II

Plasma membrane – structure, model (Fluid mosaic model only), chemistry and functions.

Unit III

Structure, chemistry, functions and semi autonomous nature of Mitochondria and Chloroplast.

Unit IV.

Structure, chemistry, functions of Nucleus. Chromosome – structure, types and Lampbrush chromosome.

Unit V

Cell divisions – Mitosis and Meiosis and their significance.

References

Verma and Agarwall – Cell Biology.

De Roberties – Cell and Molecular Biology.

Powar, C.P. – Cell Biology Vol. I & II.

Raja

THE MADURA COLLEGE (Autonomous), Madurai

Question pattern for UG BOTANY

(Skill Based Elective PAPER – [illegible] CBCS Pattern)

Maximum marks: 75 TIME: 3 hours

Section – A (5 x 2 = 10)

Answer ALL the questions (No choice) each answer not exceeding 50 words.

1.
2.
3.
4.
5.

5×7

Section – B (~~5 x 5~~ = 35)

Answer ANY FIVE questions, each answer not exceeding 300 words.

(Answer any five out of Ten questions. Equal weightage will be given to all chapters)

6.
7.
8.
9.
10.
11.
12.
13.
14.
15.

Section – C (3 x 10 = 30)

Answer 3 out of 5 questions (open choice) each answer not exceeding 1000 words.

(Equal weightage will be given to all chapters)

16.
17.
18.
19.
20.

DEPARTMENT OF BOTA
THE MADURA COLLEGE (AUTO
MADURAI-625 011

QN.NO: 4536 (upto 16) TITLE: Ethnobotany and Biodiversity

SUB.CODE: 4AB

UNIT I (10 hr)

Ethnobotany

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

UNIT II (20 hr)

Biodiversity

- Introduction, Types & importance
- Causes for the loss
- IUCN categories with plant examples
- A brief account on conservation – *In situ* & *Ex situ* methods
- Bioreserves in Tamilnadu

References

1. Jain, S.K – Glimpses of Indian Ethnobotany
2. Maheswari. J – Ethnobotany of Southasia
3. Krishnamoorthy, K.V – Biodiversity
4. CPR Foundation, Chennai – Biodiversity

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TITLE: BIOTECHNOLOGY

SUB:CODE: 5B1 (UPTO 16)

QN.NO:4540

UNIT 1:

Definition, scope and importance, Biotechnology in Developing countries, Commercialization of Biotechnology – Biosafety, IPR, Risks and Hazards.

UNIT 2:

Plant tissue culture, culture media, callus induction & culture, cell suspension culture, organogenesis, Procedure and significance of Somatic hybridization. Isolation and importance of secondary metabolites in plants. Haploid production, somaclonal variation, Micro propagation and their significance.

UNIT 3:

Recombinant DNA technology – Procedure, enzymes(Restriction enzymes, polymerases, DNA modifying enzymes, DNA ligases).Cloning vectors eg: pBR322, pUC18, Ti-plasmids (Octopine & Nopaline)

UNIT 4:

Gene cloning in prokaryotes - techniques of biotechnology: Southern, and western blotting - plaque and colony hybridization – PCR – types and application - DNA finger printing.

UNIT 5:

Gene transfer methods in plants – using Ti-plasmid. Methods of gene delivery- Electroporation, biolistic, microinjection; Antisense RNA technology –Transgenic plants – (Herbicide resistant, Flavr savr tomato, Bt cotton), Biopesticides – *Bacillus thuringiensis* and Baculovirus

References

T.A.Brown - Gene cloning and DNA Analysis

U.Satyanarayana - Biotechnology

Glick and Pasternak - Molecular Biotechnology

B.D.Singh - Biotechnology

R.C.Dubey - Biotechnology

S.N.Jogdand - Gene Biotechnology

Primrose, Twyman and Old - Principles of gene manipulation

P.K.Gupta - Elements of Biotechnology.

Code 5B2 (UPTO 16)

QN.NO: 4542

GENETICS, BREEDING AND BIOSTATISTICS

UNIT 1: GENETICS (10 hr)

History, Heredity and variation; Mendelian Genetics: Mono and Dihybrid crosses; Incomplete dominance and Codominance; Multiple allele inheritance: Self sterility in tobacco. Interaction of genes eg. Comb character in fowl & Complementary genes.

UNIT 2: (25 hr)

Linkage and crossing over: Bateson and Punnett hypothesis, Non-Disjunction, Crossing over – Copy choice and Break exchange theory. Sex linked inheritance: Criss-cross inheritance eg. Color blindness. Multiple gene inheritance: Kernel color in wheat. Population genetics: Gene pool and Gene frequency; Hardy-Weinberg law

UNIT 3: PLANT BREEDING (20 hr)

Aims and applications; Plant breeding institutes. Plant Introduction and Acclimatization; Procedure for Pureline, Mass and Clonal selections. Hybridization techniques. Heterosis – Theories; Role of Polyploidy and Mutation in Plant Breeding.

UNIT 4: BIOSTATISTICS (20 hr)

Data collection, Frequency distribution

Graphic represention of data

Measures of central tendency eg. Mean, mode and median

Measures of dispersion – standard deviation

UNIT 5: (15 hr)

Probability: Distribution – Binomial and normal distribution. Tests of hypothesis eg. χ^2 test. Brief account on correlation and regression analysis; Application of computers in statistics.

References

1. Verma & Agarwal – Genetics
2. Gupta, P.K. – Genetics
3. Kochar, P.L – Genetics and Evolution
4. Shukla and Chandel – Cytogenetics, Evolution and Plant Breeding
5. Sarin – Genetics
6. Stick Berger – Genetics
7. Gardner - Genetics

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QN.NO: 4544

TITLE: Morphology and Taxonomy of Angiosperms

SUB.CODE: 5B3

UNIT 1: Plant Morphology **(20 hr)**

Leaf types – simple and compound; Phyllotaxy – alternate – spiral, distichous; opposite – decussate, superposed, ternate and whorled.

Anthotaxy – Introduction, inflorescence; Racemose – raceme, spike, umbel; Cymose – simple cyme, dichasial, monochasial – helicoid and scorpiod cymes; special types – cyathium, hypanthodium and spadix.

Flower – Parts of a typical dicot and monocot flower.

Fruits: Simple –Fleshy: Berry, hesperidium; Dry: dehiscent – capsule, legume; Dry indehiscent – caryopsis, cypsela. Aggregate fruit – *Annona* & Compound fruit - Jack.

UNIT 2: Plant Classification **(15 hr)**

Types of classification - Linnaeus, Bentham and Hooker and Engler and Prantl system. Modern trends in Taxonomy – Chemotaxonomy, numerical taxonomy and molecular taxonomy.

UNIT 3: Plant Nomenclature **(10 hr)**

History of binomial nomenclature system, ICBN – principles – chronology of codes, typification, nyms, effective and valid publication.

UNIT 4: **(20 hr)**

Study of vegetative and floral characters and economic importance of the following families:

1. Nymphaeaceae 2. Capparidaceae 3. Rutaceae 4. Caesalpiniaceae
5. Cucurbitaceae 6. Apiaceae

UNIT 5: **(25 hr)**

7. Rubiaceae 8. Apocynaceae 9. Convolvulaceae 10. Solanaceae 11. Lamiaceae 12. Euphorbiaceae 13. Orchidaceae 14. Arecaceae 15. Poaceae.

References

1. Lawrence – Taxonomy of angiosperms
2. Sharma, O.P – Angiosperms taxonomy
3. Henry, A.N. – An aid to international code of botanical nomenclature
4. Pandey, B.P – Taxonomy of angiosperms
5. Gurucharand Singh – Plant Systematics
6. Naik, V.N – An Introduction to Angiosperms Taxonomy
7. Radford – Plant Systematics
8. Vashista – Taxonomy of angiosperms

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SUB.CODE : 6B1

QN.NO: 4554 (upto 16)

TITLE: PLANT PHYSIOLOGY

UNIT 1: Plant - Water Relations (15 hr)

Physico-chemical phenomena - diffusion, osmosis, imbibition. Basic concept of water potential. Forms of soil water - Absorption of water – active and passive methods. Transpiration – types, guttation – mechanism of stomatal movement – starch-sugar hypothesis .

UNIT 2: Mineral Nutrition and absorption (15 hr)

Major (Mg, Cu & Fe) and minor (Zn, Ni & Bo)elements – deficiency symptoms; hydroponics; mechanism of mineral absorption – passive – Donnan equilibrium and calcium exchange theory and Active – lecithin carrier theory and Lundegardhs cytochrome theory; Translocation of organic solutes – apoplast and symplast – Munch hypothesis and electroosmosis.

UNIT 3: Photosynthesis (20 hr)

Photosystem I & II, pigments, red drop, Emerson enhancement – light reactions – cyclic and noncyclic; CO_2 assimilatory pathways – C_3, C_4 and CAM and their significance. Photorespiration – role of RUBISCO – glycolate cycle.

UNIT 4: (20 hr)

Respiration – substrates, RQ, aerobic and anaerobic – Glycolysis, Krebs' cycle, ETP. HMP pathway and its significance – N2 fixation– Symbiotic and asymbiotic

UNIT 5: Growth and development (20 hr)

Definition, growth curve, plant hormones – physiological role of auxin, gibberellin and cytokinin; Physiology of flowering - Photoperiodism and vernalization (a brief account); Seed dormancy – causes and methods to overcome.

References

1. Devlin – Plant Physiology

2. Noggle and Fritz – Introductory Plant Physiology
3. Hess - Plant Physiology
4. Salisbury and Ross - Plant Physiology
5. Bidwell - Plant Physiology
6. Taiz and Zeiger - Plant Physiology
7. Jain – Fundamentals of Plant Physiology

Code 6B2 (upto 16)

QN.NO: 4556 TITLE: MICROBIOLOGY

UNIT 1: Bacteriology: (20 hr)

Introduction-, scope and importance. Contributions of Pasteur and Koch.

Structure of bacteria – size and shape; arrangement of cells; structure and chemistry of Gram +ve and Gram –ve bacterial l cell wall, capsule, flagella, pili, plasma membrane, ribosome, nuclear and extra nuclear material.

UNIT 2: Bacterial growth and metabolism (20 hr)

Growth curve and generation time, growth measurements, sporulation, nutritional types.

Bacterial metabolism – photosynthesis – light reaction- oxygenic and anoxygenic – reductive TCA cycle – ED pathway and fermentations.

UNIT 3: (10 hr)

Control measures: physical methods (temperature, pressure and radiations, chemical methods (alcohol, lizol, heavy metals, halogens and antibiotics eg. Cholorompheniсol)

UNIT4: Applications: (20 hr)

Milk products (Yoghurt & Cheese).

Sauerkraut preparation.

Preparation of Bread.

Production of Vinegar.

Sewage treatment.

UNIT 5: Virology (20 hr)

Introduction, properties, morphological variations – classification based on nucleic acids – lytic and lysogenic cycles. A brief account on T_4 phage, TMV & HIV

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 - Soil Microbiology

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Code 6B3 (upto 16)

QN.NO: 4558 (upto 16) BIOTECHNOLOGY-2

UNIT 1: (10 hr)

Fermentation Biotechnology: Fermenter –principle, design, process and types,. Brief account on upstream and downstream processing.

UNIT 2: **(20 hr)**

Industrial & Environmental biotechnology:.

Immobilization of enzymes. Enzyme engineering - use of microbes in the production of ethanol, amylase, antibiotic (Penicillin) - Biogas(methane) and Biofuel (H_2) production, Biodegradation – Bioleaching - Mushroom cultivation - SCP- *Spirulina*

UNIT 3: (20 hr)

Biotechnology in Health Care:

Cloning insulin gene in *E.coli* - DNA vaccines - DNA in the diagnosis of genetic diseases - Gene therapy - Monoclonal antibodies.

UNIT 4: (20 hr)

Bioinformatics:

Definition, objectives, components of computer, internet, website. Genomics – isolation of genes, genome sequence (Maxam-Gilbert), tools in genomics. Proteomics- tools in proteomics.

UNIT 5: (20 hr)

Data bases- importance – nucleic acid sequence – BLAST & FASTA; protein sequence databases – PIR, SWISS PROT- virtual library.

PRACTICALS:

1. Protocol for cloning insulin gene in *E.coli*
2. Mushroom cultivation - Spawn preparation, bedding, harvesting of mushrooms

3. Enzyme immobilization
4. Computer and their accessories – demonstration
5. Study of sequence alignment (pair wise) uses
6. NCBI

References

T.A.Brown - Gene cloning and DNA Analysis

U.Satyanarayana - Biotechnology

Glick and Pasternak - Molecular Biotechnology

B.D.Singh - Biotechnology

R.C.Dubey - Biotechnology

S.N.Jogdand - Gene Biotechnology

Primrose, Twyman and Old - Principles of gene manipulation

Gupta. P.K - Elements of Biotechnology.

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B.Sc

Title : FORESTRY

Code : 6SB (2008 ON) Qn.No. 4566

Skill Based Elective - III

1. Types of forest, Deforestation and afforestation
2. Silviculture - natural and artificial regeneration of forests
3. Conservation of wildlife - wildlife sanctuaries and national parks.
4. Social forestry and agroforestry
5. Minor forest products - gum, resins, dyes, oilgrasses, medicinal plants (Nuxvomica, *Alpinia galanga*)
6. Major forest products: timber, firewood and plywood

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U1BMC1**

COURSE TITLE : Cryptogams **QN.NO : 8801**

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

Unit I Algae

A brief account of phycology - Indian Phycologists - M.O.P. Iyyengar and Desikachary - General characters of algae. Classification of algae by Fritsch . Occurrence, structure, reproduction and life cycle of *Nostoc* (Cyanophyceae), *Caulerpa* (Chlorophyceae), *Sargassum* (Phaeophyceae) and *Polysiphonia* (Rhodophyceae). Economic importance of Algae.

Unit II Lichens

Occurrence, salient features of lichens, types - crustose, foliose and fruticose. Special vegetative structure – Soredia and Isidia. Structure and reproduction of *Usnea.* Economic importance of lichens.

Unit III Bryophytes

Occurrence, general characters, classification of bryophytes by Rothmaler. Structure, reproduction and life cycle of *Riccia* and *Funaria*. Economic importance of Bryophytes.

Unit IV Pteridophytes

Occurrence,general characters. Classification by Smith. Stelar organization. Alternation of generations. Structure, reproduction and life cycle of *Lycopodium* and *Marsilea*.Economic importance of Pteridophytes.

Unit V Palaeobotany

Contribution of Indian Paleobotanist (Birbhal Sahni). Geological time scale. Age determination of fossil by carbon dating. Methods of plant fossilization - compression, impression and petrifaction. Brief account on fossils - *Rhynia* and *Lepidodendron.*

REFERENCES

1. Hale, M. E., The Biology of Lichens, 1983, Edwad Arnold, London.
2. Rashid, A., An Introduction to Bryophyta, 2000, Vikas Publishing House Pvt. Ltd., New Delhi.
3. Sharma, O. P., Text Book of Algae, 2007, Tata McGraw Hill Publishing Pvt. Ltd., New Delhi.
4. Parihar, N. S., An Introduction to Embryophyta Bryophyta, 2013, Surjeet Publications, New Delhi.

PRACTICALS

1. Study of the morphology of above selected genera of all groups.
2. Make micro- slide preparations of aerial and reproductive structures.
3. Submission of records.
4. Study trip for a period of 3-5 days is obligatory.

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THE MADURA COLLEGE (AUTONOMOUS). MADURAI -11
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CLASS : B.Sc., Botany | **SUB. CODE: 17U1BSM1**

TITLE : Horticulture | **QN.NO: 8802**

TIME : 3Hrs | **Max. Marks: 75**

Unit I

Introduction, importance, divisions of horticulture. Soil profile. Fertility of soil, organic and inorganic matters.

Unit II

Garden tools – pick – axe, hoe, crow bar, pruning shears and secateurs. Green house – types, dimensions (sizes) and their accessories.

Unit III

Gardening – types. Ornamental garden and its components. Symmetrical and asymmetrical gardens. Kitchen garden.

Unit IV

Propagation methods - cuttings (drumstick), grafting (sapota) and layering – air (pomegranate) and ground (*Nerium*). Cultural practices of jasmine.

Unit V

Cultural Practices of mango. A brief account on value addition, e.g., ground nut and tomato. Jams, pickles and ketch-up – a brief account.

REFERENCES

1. Manibhushan Rao, K, Text book of Horticulture, 1991, Mac Millan India Ltd., New Delhi.
2. Kumar, N., Introduction to Horticulture, 2010, Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.

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PATTERN OF QUESTION PAPER

Maximum Marks :75 **Passing Minimum : 27**

SECTION – A (10X1=10)

Answer ALL the Questions (Multiple Choice Questions/ Objective Type Questions)

Question No. 1,2 from	Unit - I	Question No. 7,8 from	Unit - IV
Question No. 3,4 from	Unit - II	Question No. 9,10 from	Unit - V
Question No. 5,6 from	Unit - III		

SECTION – B (5X7=35)

Answer ALL the Questions (Either OR Pattern) each answer not exceeding 3 pages.

Question No. 11(a) (OR) Question No. 11(b)	Unit – I	Question No. 14(a) (OR) Question No. 14(b)	Unit – IV
Question No. 12(a) (OR) Question No. 12(b)	Unit – II	Question No. 15(a) (OR) Question No. 15(b)	Unit – V
Question No. 13(a) (OR) Question No. 13(b)	Unit – III		

SECTION – C (3X10=30)

Answer 3 out of 5 Questions (Open Choice) each answer not exceeding 4 pages.

Question No. 16 from	Unit - I	Question No. 19 from	Unit - IV
Question No. 17 from	Unit - II	Question No. 20 from	Unit - V
Question No. 18 from	Unit - III		

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U1BAC1**

COURSE TITLE : Algae, Bryophytes and Pteridophytes **QN.NO : 8803**

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

Unit I Algae

Introduction and various divisions of plant kingdom. General characters, classification as proposed by Fritsch. Structure, reproduction and life cycle of the following: 1.Cyanophyceae - *Nostoc* and 2.Chlorophyceae – *Caulerpa.*

Unit II

Structure, reproduction and life cycle of *Polysiphonia*. Economic importance of Algae.

Unit III Bryophytes

Introduction, general characters, classification of Bryophytes by Rothmaler. Structure, reproduction and life cycle of *Funaria.*

Unit IV Pteridophytes

Introduction, general characters. Classification by Smith. Structure, reproduction and Life cycle of *Selaginella.*

Unit V

Structure, reproduction and life cycle of *Marsilea*. Different types of Stelar variations in Pteridophytes.

REFERENCES

1. Pandey, B. - College Botany, Vol.I& II.
2. C.M.Smith- Cryptogamic Botany, Vol. I & II.
3. R.Chopra and P.K.Kumar-Biology of Bryophytes.
4. Rasid- Pteridophytes.

PRACTICALS

1. Make suitable preparations, description and identification of the types prescribed in Algae, Bryophytes and Pteridophytes.
2. Submission of Records.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U2BMC2**
COURSE TITLE : Anatomy and Embryology **QN.NO : 8804**
TIME : 3 Hours **MAX.MARKS :75**

Unit I Anatomy

Plant tissues – meristems, characteristics. Classification based on origin, position, plane of cell division and function. Apical meristem – organization. Theories – Histogen, Tunica Corpus and Korper-Kapper. Root apex – structure, concept of Quiscent center. Permanent tissues - simple - parenchyma, collenchyma and sclerenchyma; complex tissues - components of xylem and phloem.

Unit II

Primary structure of dicot and monocot stem. Internal structure of dorsiventral and isobilateral leaf. Primary structure of dicot and monocot root. Nodal anatomy – uni – *Justicia*; tri - *Azadirachta* and multilacunar – *Aralia*.

Unit III

Secondary structure of dicot stem and root. Anomalous secondary growth in *Aristolochia*, *Boerhaavia* and *Dracaena*.

Unit IV Embryology

Parts of a typical dicot flower – Structure of mature anther - types and functions of tapetum. Types and structure of ovule - orthotropous, anotropous and camphylotropous. Types of embryo sac – monosporic, bisporic and tetrasporic. Development of *Polygonum* type of embryo sac. Pollination types - anemophily, hydrophily and entomophily.

Unit V

Double fertilization, syngamy, triple fusion and significance. Structure and development of dicot embryo (*Capsella*). Endosperm types – nuclear, cellular and helobial.

REFERENCES:

1. Fahn, A, Plant Anatomy, 1967, Pergamon Press.
2. Cutter, Plant Anatomy, 1969, Experiment and Interpretation, Edward Arnold Publication.
3. Maheswari, Embryology of Angiosperms, 1974, Vikas publishing house.
4. Bhojwani, Embryology of Angiosperms, 1974, Vikas publishing house.
5. Easu, K, Anatomy of seed plants, 1979, Wiley Easter.
6. Pandey, P. B, Plant Anatomy, 2005, S. Chand & Co Ltd., New Delhi.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U2BSM2**
COURSE TITLE : Biodiversity **QN.NO : 8806**
TIME : 3 Hours **MAX.MARKS :75**

Unit I

Introduction, concepts, definition, scope and constraints of biodiversity; levels – genetic, species and ecosystem. Biodiversity resources – agro, marine and coastal.

Unit II

Wealth - Hotspots. Endemism. Endemic centers in Tamil Nadu. Endemic plants of Tamil Nadu.

UnitIII

Causes for the loss of biodiversity. Threatening factors – climatic, anthropogenic; processes and rate of extinction. IUCN categories. Red data book.

Unit IV

Conservation **–** *In situ* – biosphere reserves, national parks and wildlife sanctuaries. Medicinal plant conservation areas (MPCAs). *Ex situ* – theme parks, botanical gardens and seed banks.

Unit V

Organizations – International level – WWF, UNESCO, CITES and CBD; National level – NBA and BMC. National biodiversity strategies and action plan (NBSAPs). Local biodiversity register.

REFERENCES

1. Jeffries, M. J., Biodiversity and Conservation, 1997. Routledge, New York.
2. Biodiversity booklet published by CPR (2004). Environmental Education Centre, Chennai.
3. MOEF (2004). Hand book of Forest Conservation Act, 1980. Guidelines and Clarifications. Ministry of Environment and Forest, Govt. of India, New Delhi.
4. Krishnamurthy, K. V., An advanced text book on Biodiversity, 2009, Principles and Practices, Oxford & IBH Publication Pvt. Ltd., New Delhi.
5. Sharma, P. D., Ecology and Environment, 2009, Rastogi Publication, New Delhi.
6. WWW. IUCN. ORG.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U2BAC2**
COURSE TITLE : Plant Physiology **QN.NO : 8807**
TIME : 3 Hours **MAX.MARKS :75**

Unit I

Diffusion, osmosis, imbibitions and plasmolysis. Absorption of water - active and passive mechanisms. Transpiration – types. Mechanism of stomatal movement - starch and sugar hypothesis and significance.

Unit II

Absorption of minerals (Carrier concept and Cytochrome pump theory). Translocation of Sugar -Munch's Mass flow hypothesis.

Unit III

Photosynthesis-Light reaction: Cyclic and Noncyclic photophosphorylation. CO_2 assimilatory pathways (C_3). Respiration-substrate-RQ-Aerobic respiration - Glycolysis, Kreb cycle and ETS.

Unit IV

Photorespiration - Dual action of Rubisco - C_2 cycle (Glycolate cycle). HMP pathway and its significance. Biological nitrogen fixation - symbiotic.

Unit V

Plant growth hormones - structure and Physiological role of Auxin. A brief account on Photoperiodism and Vernalization.

REFERENCES

1. Noggle and Fritz – Introductory Plant Physiology.
2. Bidwell – Plant Physiology.
3. Jain – Fundamentals of Plant Physiology.

PRACTICALS:

1. Determination of osmotic potential of potato by Chardakov's method.
2. Determination of photosynthetic rate using Wilmott's bubbler.
3. Effect of sodium bicarbonate on photosynthetic rate.
4. Imbibition rate of various seeds.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U3BMC3**
COURSE TITLE : Cell Biology and Biochemistry **QN.NO : 8809**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVE:

To comprehend the life-forms in terms of their cellular structures and general chemicals that are present in them.

LEARNING OUTCOME:

Provided an advanced understanding of the core principles of cell functions and topics of biochemistry and their experimental basis

UNIT-I

Cell as a basic unit. Cell theory. Differences between Prokaryotic & Eukaryotic cells. Ultra structure of plant and animal cell. Structure, chemical composition and functions of plant cell wall, plasma membrane (fluid mosaic model) and cell inclusions (Cystolith and Raphides).

UNIT-II Structure and functions of chloroplast, mitochondrion, ribosome and nucleus. Cell cycle, cell divisions (mitosis and meiosis) and their significance.

UNIT –III

Basic concepts - chemical bonds (hydrogen, ionic and co-valent). Physico-chemical properties and biological significance of Carbohydrates – mono-eg: glucose, di- eg: Sucrose & polysaccharides eg.Starch.

UNIT –IV

Proteins-primary, secondary, tertiary and quaternary levels of organization . Enzymes-classification and mechanism of action (Lock and Key model).

UNIT-V

Lipids: simple (Fats and Oils), compound (Phospholipids) and derived (Cholesterol).

Nucleic acids: Structure and functions of DNA (Watson and Crick model) and RNA (Clover leaf model of tRNA)

P.T.O

REFERENCES:

1.Gerald karp, 1984. Cell biology ,International student edition , McGraw-Hill book company.

2. De Robertis, E.D.P and De Robertis ,E.M.P.2006. Cell and molecular biology 8th edition ,Lippincott.Willams and Wilkins Philadelphia.

3. Rastogi, S.C.1992.,Cell biology,Tata McGraw-Hill,NewDelhi.

4. Satyanaryana and Chakrapaani, U. 2006 Biochemistry Books and Ailled(P) Ltd.

5. Stryer, L. 1988. Biochemistry, WH Freeman & co.,NY.

6. https://WWW.britannica.com .

7. https://WWW.biochemistry.org

PRACTICALS:

1. Cell division – Mitosis (*Allium cepa*) root.
2. Meiosis- Rheo sp flower bud Meristem.
3. Electron Micrographs of various cell organelles-Spotters.
4. Paper Chromatography.
5. Complementary colour.
6. Estimation of Starch.
7. Estimation of Protein.
8. Spotters.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U3BAC3**
COURSE TITLE : Plant Anatomy **QN.NO : 8810**
TIME : 3 Hours **MAX.MARKS :75**

Unit I

Meristem - types, classification and theories - Histogen and Tunica-Corpus.

Unit II

Tissues - definition, types - simple - paranchymatous and sclerenchymatous and complex - xylem and phloem.

Unit III

Primary anatomical structures of a typical dicot stem and root, monocot stem and root.

Unit IV

Vascular cambium - structure and function, seasonal activity, secondary growth in Dicot stem and root. Wood - sap wood and heart wood.

Unit V

Leaf anatomy: A typical dicot leaf E.g, *Nerium* and monocot leaf E.g, Grass.

REFERENCES

1. Esau - Plant Anatomy
2. Fahn - Plant Anatomy
3. B.P.Pandey - Plant Anatomy

PRACTICALS

1. Shoot and Root apex.
2. Primary structure of root and stem.
3. Secondary structure of normal root and stem.
4. Leaf- *Nerium* and Grass.

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THE MADURA COLLEGE (AUTONOMOUS). MADURAI -11
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CLASS : B.Sc., BOTANY **SUB. CODE : 17U3BSA1**

TITLE : HORTICULTURE **QN.NO : 8811**

TIME : 3Hrs **Max. Marks : 75**

Unit I

Introduction, importance, divisions of horticulture. Soil profile. Fertility of soil, organic and inorganic matters.

Unit II

Garden tools – pick-axe, hoe, crow bar, pruning shears and secateurs. Green house – types, dimensions (sizes) and their accessories.

Unit III

Gardening – types. Ornamental garden and its components. Symmetrical and asymmetrical gardens. Kitchen garden.

Unit IV

Propagation methods - cuttings (drumstick), grafting (sapota) and layering – air (pomegranate) and ground (*Nerium*). Cultural practices of jasmine.

Unit V

Cultural Practices of mango. A brief account on value addition, e.g., ground nut and tomato. Jams, pickles and ketch-up – a brief account.

REFERENCE

Kumar, N., Introduction to Horticulture, 2010, Oxford and IBH publishing company, Pvt Ltd, New Delhi.

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PATTERN OF QUESTION PAPER

Maximum Marks :75 **Passing Minimum : 27**

SECTION – A (10X1=10)

Answer ALL the Questions (Multiple Choice Questions/ Objective Type Questions)

Question No. 1,2 from	Unit - I	Question No. 7,8 from	Unit - IV
Question No. 3,4 from	Unit - II	Question No. 9,10 from	Unit - V
Question No. 5,6 from	Unit - III		

SECTION – B (5X7=35)

Answer ALL the Questions (Either OR Pattern) each answer not exceeding 3 pages.

Question No. 11(a) (OR) Question No. 11(b)	Unit – I	Question No. 14(a) (OR) Question No. 14(b)	Unit – IV
Question No. 12(a) (OR) Question No. 12(b)	Unit – II	Question No. 15(a) (OR) Question No. 15(b)	Unit – V
Question No. 13(a) (OR) Question No. 13(b)	Unit – III		

SECTION – C (3X10=30)

Answer 3 out of 5 Questions (Open Choice) each answer not exceeding 4 pages.

Question No. 16 from	Unit - I	Question No. 19 from	Unit - IV
Question No. 17 from	Unit - II	Question No. 20 from	Unit - V
Question No. 18 from	Unit - III		

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U4BMC4**
COURSE TITLE : Ecology **QN.NO : 8812**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVE:

To unravel the myth and mysteries of nature by way of studying structure and dynamism of different organisms with their respective environments.

LEARNING OUTCOME:

Provided a scientific basis for the aims of environmentalism

UNIT I

Ecology – Definition and subdivisions; Factors of environment: Abiotic – Light, temperature and edaphic factors (Soil types and profile)

UNIT II

Biotic interactions : positive – (Symbiosis and Commensalism). Negative-(Parasitism & Allelopathy).

UNIT III

Ecosystem – Definition, structure and functions of Pond ecosystem, Role of producers, consumers and decomposers. Energy flow, food chain and food web. Ecological pyramids and succession (hydrosere).

UNIT IV

Ecological resources and risks: depletion & sustainability. Renewable and non-renewable sources of energy. Climate change & global warming. Plastic wastes.

UNIT V

Environmental Pollution: Air & Water Pollution - Definition, causes, effects & control measures.

References:

1. Odum, E.P. 1991. Fundamentals of Ecology, III Edition, Saunders & com.
2. Dash, M.C. 1993. Fundamentals of Ecology. Tata McGraw Hill, New Delhi.
3. Sharma, J.P. 2004. Environmental studies. Laxmi publications (P) Ltd., New Delhi.
4. Gopal, B. and Bharadwaj, B. 1979. Elements of Ecology, Vikas Publishing House Pvt. Ltd.
5. Willings, W. D. 1964. Plants and Ecosystem. Wasworth Publishing Co.,
6. www.web-ecology.net
7. www.ecology.com

Practicals:

1. Vegetation study – quadrate method.
2. Study of the morphological and anatomical adaptations of locally available hydrophytes, xerophytes, mesophytes and halophytes to correlate their habitat.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U4BSM3**
COURSE TITLE : Crop Diseases **QN.NO : 8814**
TIME : 3 Hours **MAX.MARKS :75**

OBJECTIVES:

To analyze various agents responsible for disease development on crops

LEARNING OUTCOME:

Students learned the impact of diseases on crop yield and the management of crop diseases to achieve maximum yield. This will pave the way for the students to adopt the agriculture practices efficiently

UNIT I

Introduction-major and minor crops – Productivity and loss - Diseases and disorders. Classification of diseases (Endemic, Epidemic, Sporadic) – Symptoms (Hypertrophy, Hypotrophy & Necrotic).

UNIT II

Fungal diseases: symptoms, etiology, disease cycle and control measures of Paddy blast and Red rot of sugar-cane.

UNIT III

Bacterial diseases: symptoms, etiology, disease cycle and control measures of Angular leaf spot of Cotton and Citrus canker.

UNIT IV

Symptoms, etiology and disease cycle of Bunchy top of Banana (Viral disease) an Little leaf of Brinjal (Mycoplasma disease).

UNIT V

Disease management – cultural practices - Chemical methods (copper fungicides) - Biological methods.

REFERENCES:

1. Singh, R. S. 1998. Plant diseases. Oxford & IBH Publishing Co Pvt. Ltd. New Delhi.pp.1-680
2. Arumugam, N.,Kumaresan,V and Ragland, A. 2016. Fungi & Plant Pathology. Saras Publication, Kottur, Nagerkoil, Kanyakumari Dist.
3. Bhatarchia,U.K.2006.Plant Pathology.Kalyani Publishers. New Delhi.pp1-323.
4. WWW.health247.com.
5. https://WWW.agric.Wa.gov.au

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U4BAC4**

COURSE TITLE : Gymnosperms and Angiosperms **QN.NO : 8815**

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

Unit I Gymnosperms

Introduction, general features and economic importance of Gymnosperms.

Unit II

Structure, reproduction and life cycle of *Cycas*.

Unit III Angiosperms

Leaf - Simple and Compound. Phyllotaxy - a) Alternate b) Opposite c) Ternate d) Whorled.

Inflorescence: Racemose – raceme and spike. Cymose – cyme and monochasial.

Unit IV

Flower - Description of a typical dicot (e.g., *Hibiscus*) and monocot flower (e.g., Grass). Floral diagram & floral formula.

Unit V

Taxonomy - Vegetative, floral characters & Economic importance of Fabaceae, Cucurbitaceae and Poaceae.

REFERENCES

1. B.Pandey- College Botany, Vol. III
2. S.P.Bhatnagar and Alokmirta- gymnosperms.
3. Lawrence- Taxonomy of Angiosperms.
4. Sharma, O.P- Angiospems of Taxonomy.
5. B.P.Pandey- Taxonomy of Angiosperms.

PRACTICALS

1. Make suitable preparations, description and identification of the types prescribed in Gymnosperms.
2. Observation of morphological features of plants discussed in the syllabus.
3. Dissection and description of the families discusses in the syllabus.
4. Submission of Records

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U4BNM1**
COURSE TITLE : Plants and Human Welfare **QN.NO : 8817**
TIME : 3 Hours **MAX.MARKS :75**

Unit I

Introduction, vernacular names, botanical names, morphology of useful parts and uses of the following: Cereals and millets - Rice, Maize and Pearl millet. Legumes - Black gram and Red gram. Fruits - Gooseberry and Mango; Vegetables - Bhendi and Onion.

Unit II

Plants and plant products of Industrial value; fibre - cotton and jute, timber - teak and rose wood, rubber - *Hevea*, fatty oils e.g., sesame; essential oils - khus oil and lemongrass. Dyes – *Acacia* and Indigo. Sugar – sugarcane. Gums - gum arabic. Resins - *Abies*.

Unit III

Medicinal plants - Introduction, vernacular names, botanical names, morphological useful parts and uses of the following - Turmeric, *Aloe vera*, Tulsi, *Adadhoda.*

Unit IV

Spices and Condiments - Introduction, vernacular names, botanical names, morphological useful parts and uses of the following – clove, black pepper, cardamom, garlic and curry leaf.

Unit V

Beverages - Introduction, vernacular names, botanical names, morphology of useful parts and uses of the following - e.g Tea, Coffee and Cocoa.

REFERENCE

Pandey, B. P., Economic Botany, 1978, S. Chand & Company Ltd., New Delhi.

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PROGRAMME : B.Sc., Botany | **COURSE CODE : 17U5BMC5**

COURSE TITLE : Phanerogams | **QN.NO : 8818**

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

Objective:

- To introduce the learner to the salient features and broader diversity of vascular plants
- To give the technical knowledge to identify gymnosperms
- To help the students to appreciate the enormity of variants in flower producing plants.
- To facilitate then to categorize angiosperms into Dicotyledonae (Polypetalae, Gamopetalae and Monochlamydae) and Monocotyledonae
- To help them gain an idea on popular systems of classification (Natural and Phylogenetics)

Learning Outcome:

- Student may gain the identification skill and can understand the importance of phanerogams.

Unit I

Gymnosperms

Concept of progymnosperms. Classification – Coulter and Chamberlain(1917). Salient features of Cycadales, Coniferales and Gnetales. Structure, reproduction and life cycle of *Cycas*, *Cupressus* and *Gnetum*. Economic importance of Gymnosperms.

Unit II

Plant Morphology

Leaf types – simple and compound; phyllotaxy : alternate, opposite, ternate and whorled. Anthotaxy : RACEMOSE – simple raceme, spike, umbel; CYMOSE – simple cyme, dichasial and helicoids; SPECIAL TYPES – cyathium and hypanthodium. Technical description of a flower. Fruits : SIMPLE - fleshy e.g. berry and hesperidium ; dry – e.g. capsule, legume and caryopsis. AGGREGATE – e.g. *Annona*; COMPOUND– e.g. Jack fruit.

Unit III

Angiosperms

Plant Systematics and taxonomy – objectives, goals and aims. Hierarchical stages and categories. Contribution to Indian Botany by J.D. Hooker and J.S. Gamble. Systems of classification – Linnaeus, Bentham & Hooker and Engler & Prantl. Nomenclature – polynomials and binomial system. ICN – principles, typification and nyms.

Unit IV

Studies of Families

Study of vegetative, floral characters and economic importance of the following families:

1. Nymphaeaceae 2. Capparidaceae 3. Rutaceae 4. Zygophyllaceae 5. Leguminosae
6. Cucurbitaceae 7. Aizoaceae

P.T.O.

Unit V Studies of Families

8. Rubiaceae 9. Apocyanaceae 10. Convolvulaceae 11. Solanaceae 12. Acanthaceae
13. Euphorbiaceae 14. Orchidaceae 15. Poaceae

References

1. Gurucharan Singh (2005). Plant Systematics, 2nd ed. Scientific Publication, Jodhpur.
2. Jones, Jr. and Samuel, B (1987). Plant Systematics. McGraw- Hill International, New York.
3. Lawrence, G.H.M (2012). Taxonomy of vascular plants. Scientific publishers. India.
4. Pullaiah, T and Karuppusamy, S (2018). Taxonomy of Angiosperms. 4th ed. Regency Publication, New Delhi
5. Singh, V. and Jain, D.K. (1981). Taxonomy of Angiosperms. Rastogi Publications. India
6. Sharma, O.P (2017). Taxonomy of Angiosperms. McGraw-Hill Publication, Ltd. New Delhi.
7. https://WWW.theplantlist.org
8. https://WWW.sscstudycentre.files.wordpress.co
9. www.csdl.tamu.edu

Laboratory Studies

1. Observation of morphological features of plants discussed in the syllabus.
2. Dissection and description of the floral features of families in the syllabus.
3. Field trip for a minimum of three days
4. Submission of herbarium/plant photo album, field reports and records for evaluation.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U5BMC6**

COURSE TITLE : Genetics Breedings and Biostatistics **QN.NO : 8819**

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

Objective:

- To understand the physical basis and patterns of inheritance and the interactions at levels of alleles and genes.
- To gain knowledge on the necessity of breeding techniques.
- To apply statistics in various interpretive aspects of biology.

Learning Outcome:

- Students will have a genetic perspective about diseases and disorders.
- Students will acquaint with the techniques involves the production of hybrid crops.
- Students can interpret the research results using biostatistics

Unit I

Concepts:inheritance, variation, gene, genome, phenotype and genotype. Mendelian laws: Law of segregation and law of independent assortment. Codominance, incomplete dominance and multiple alleles. Gene interactions: Complementary; Epistasis – dominant and recessive.

Unit II

Linkage and crossing over - mechanisms. Sex determination in *Melandrium.* Sex - linked inheritance, eg.colour blindness in man. Multiple gene inheritance e.g. Kernel colour in wheat. Cytoplasmic inheritance, eg. Antibiotic resistance in *Chlamydomonas*. Population genetics: Gene pool, Gene frequency and the importance. Hardy –Weinberg law.

Unit III

Plant breeding – objectives; procedures: Selection methods : Mass selection , Pure –line selection and clonal selection; Hybridization procedure, Heterosis. Plant introduction and acclimatization. Polyploidy and its type . Mutation breeding: Mutagens – Physical and chemical. Quarantine law. Plant breeding institutes in India.

Unit IV

Biostatistics: objectives, population and samples. Types of data; Data collection, sampling methods, frequency distribution, Graphical and diagrammatic representation of data, Measures of central tendency, Measures of dispersion e.g. standard deviation.

Unit V

Probability distribution: normal and binomial distribution. Tests of hypothesis: Students 't' test. Chi-square test. ANOVA – one way. Applications of computer in biostatistics – SPSS software.

References

1. Chaudhary R.S, (1994), Introduction to plant breeding, Oxford and IBH publishing company .
2. Darbeshwar Roy (2012), Plant breeding: A Biometrical approach. Alpha Science international publisher.
3. Gardener EJ *et al.*, (2008). Principles of Genetics. 8th Edition. Wiley-India student edition.
4. Khan, I.A. and Khanum, A (1994). Fundamentals of Biostatistics, Ukaaz publications, Hyderbad, Andhrapradesh –India.
5. Monroe Strickburger, (1985). Genetics, 3rd Edition, Macmilan Publishers
6. Pranab kumar Banerjee, (2004), Introduction to Biostatistics (A Text book of Biometry). S. Chand & Company Ltd.Ram nagar, New Delhi.
7. Verma P.S and Agarwal V.K, (2004) Genetics.. S. Chand Publications
8. https://podcasts.ox.ac.uk/evolution-genome.
9. https://biologydiscussion.com/plantbreeding

Practicals

1. Solving problems in mono and dihybrid crosses, multiple alleles, incomplete and codominance, complementary gene interactions, sex-linked inheritance.
2. Calculation of standard deviation for different plant sample –leaf length& pod length.
3. Chi –square test
4. Problems on probability

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U5BMC7**

COURSE TITLE : General Microbiology **QN.NO : 8820**

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

Objective:

- To inculcate knowledge on fundamentals of microorganisms
- To learn the structural organization, morphology and reproduction of microbe

Learning Outcome:

- Know on historical perspective of microbiology
- Basic knowledge on different structure of microbes

Unit I : BACTERIA

Introduction: Scope and importance; Five kingdom concept of microbes; Contributions of Pastuer and Koch. Outline classification of bacteria as in Bergeys manual; General characteristics of bacteria; Ultra structure of bacteria; colony morphology, size and shape; structure of cell wall: Gram positive and Gram negative; capsule; cell membrane and appendages. Economic importance of bacteria.

Unit II: FUNGI

Introduction; structure of mycelium and its modifications; Classification by Alexopoulus and Mims (19); General characteristics of Gymnomycota, Mastigomycota and Amastigomycota; Modes of nutrition; Economic importance of Fungi

Unit III: **VIRUSES**

Viruses: General characteristics- classification of viruses based on nucleic acids & structure; Lytic and lysogenic cycles; Structure and reproduction of T_4, TMV and HIV.

Unit IV: **MICROBIAL PHYSIOLOGY**

Bacterial growth phases; generation time; modes of nutrition; Respiratory metabolism: ED pathway - reverse TCA - gluconeogenesis. Fermentation: homo and heterolactic;

Bacterial photosynthesis : photobacteria ; pigments ; oxygenic and anoxygenic.

Unit V: **CONTROL OF MICROBES (10 hr)**

Physical methods: Temperature, filtration, irradiation.

Chemical methods: Alcohols, halogens, iodine, Heavy metals and antibiotics (Penicillin).

References

1. Dubey, R.C. and Maheswari, D.K. (2010). A text book of microbiology. S. Chand and company, New Delhi.
2. Pelezar, M.J., Chan, E.C.S and Kreig , N.R. (1993). Microbiology - concepts and Applications. McGraw Hill, Inc. Newyo.
3. Powar, C.B. and Daginawala, H.F. (2001). General microbiology, Vol. II Himalaya publishing house, Mumbai.
4. Purohit, S.S. (2012). Microbiology and applications. Student edition, Jodhpur, India
5. Tortara, G., Funke, B.R. and Case, C.L. (2009). Microbiology. 9th edition. Dorling Kindersley (India) Pvt Ltd. Noida

Practicals

1. Cleaning of glass wares.
2. Preparation of media.
3. Ubiquitous nature of microbes.
4. Culture techniques - Streak plate and Spread plate.
5. Bacterial staining –a) Simple b) Gram
6. Biochemical test- Amylase activity and Indole production.
7. Antibiotic sensitive test

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U5BME1**
COURSE TITLE : Applied Microbiology **QN.NO : 8821**
TIME : 3 Hours **MAX.MARKS :75**

Objective

- To understand the critical role played by microbes in different environments, agriculture industries and medicine.

Learning Outcome:

- Students will aim at culturing novel stains of microbes to meet the demands in industries , agriculture and medicine

Unit- I: Food microbiology

Microbial flora of fresh food: Contamination and spoilage of milk; Cheese Production; Methods of food preservation- Physical Temperature, dehydration) and preservatives..

Unit-II : Environmental microbiology

Ecological groups of microorganisms (Based on carbon and oxygen requirements), Extremophiles. A brief account on extremophiles. Microbiology of soil and water. Microbiology of biogeochemical cycles. Interactions among microorganisms. Sewage treatment, BOD and COD, Siderophores. Bioremediation

Unit- III: Agriculture microbiology

Nitrogen fixers; Symbiotic and asymbiotic - Phosphate solubilizers; Biofertilizers

Unit- IV: Industrial microbiology

Fermentors and their types. Fermentation of primary metabolites (Alcohol,- Beer, citric acid) and secondary metabolites (Penicillin). Dairy industry – Cheese.

Unit- V: Medical microbiology

Clinical features; Symptoms, diagnosis, prophylaxis & treatment ofTuberculosis, Hepatitis and Ringworm. Vaccines (Prinicples and types).

References

1. Casida, L.E. (1997). Industrial microbiology, New publishers, New Delhi.
2. Kumar, H.D and Swati kumar, (1999). Modern concepts of microbiology, Vikas publishing House, New Delhi.
3. Rao, A.S.(2001). Introduction to microbiology. Prentice Hall of India, New Delhi.
4. Sharma, P.D. (2005). Environmental biology, Narosa publishers, New Delhi.
5. Subha Rao,N.S. (2000) ,Soil microbiology ,Oxford & IBH publishers, New Delhi

Practicals

1. Antibiosis.
2. Isolation of Rhizobium from root nodules.
3. Milk dye reduction test-Methylene blue and Risazurin.
4. Potable water quality test –MPN method.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U6BMC8**
COURSE TITLE : Plant Physiology **QN.NO : 8822**
TIME : 3 Hours **MAX.MARKS :75**

Course Objectives:

To help students to.

- Understand the relationship between structure and function as it relates to plant macromolecules, cells and tissues,
- Understand the interaction between the environment and plant growth and development,
- Gain an appreciation of the metabolic and physiological processes unique to plants.

Learning Outcomes.

- The main goal is to help students to acquire a comprehension of plant physiology.
- The course explores various topics including primary and secondary metabolism, photosynthesis, respiration, water relations, mineral nutrition, response to environmental stress and role of plant hormones.

Unit I (20 hr)

Concept of diffusion, osmosis and water potential. Translocation of water – mechanisms – ascent of sap. Theories supporting ascent of sap. Transpiration – types and significance. Stomatal movement – chemical and modern theories. Translocation of minerals – theories. Minerals – macro and trace, deficiency symptoms of microelements. Phloem loading and unloading.

Unit II (20 hr)

Photosynthesis – photosynthetic pigments (structure and function); organization of PS I and PS II, photosynthetic electron transport – ATP synthesis. Carbon fixation pathways – C3, C4 and CAM. Photorespiration and significance.

Unit III (20 hr)

Respiration – oxidative electron transport and phosphorylation. Pathways – glycolysis, PPP, TCA and their significance. Alternative respiration – CN resistant respiration. Nitrogen fixation. Biochemistry of nitrogen fixation. Role of nitrogenase.

Unit IV (15 hr)

Growth regulators: concept of phytohormones. Structure and physiological role of auxin, gibberellins, cytokinins and ethylene – brief account on synthetic hormones.

Unit V (15 hr)

Photoperiodism: concept, periodicity, role of phytochromes in flowering. Vernalization and its significance. Dormancy – seed dormancy – basis and methods to overcome. Programmed cell death – (senescence) – Physiological and biochemical changes. Brief account on circadian rhythm.

P.T.O.

References:

1. Bidwell RGS (1979). Plant Physiology, Mac Millan Publishing Company. New Delhi.
2. Devlin, RM (1974). Plant Physiology, Affiliated East West Press Pvt. Ltd.
3. Jain ,VK. (2007). Fundamentals of plant physiology, S. Chand & Compamy ltd, New Delhi.
4. Levitt (1972). Responses of plants to environmental stress, Academic press, New York.
5. Noggle, GR and Fritz, GJ (1976). Introductory Plant Physiology, Prentice-Hall, India.
6. Pandey, SN and Sinha, BK (2001). Plant Physiology. Third revised edition, Vikas publishing House Pvt. Ltd, New Delhi.
7. Salisbury, FB and Ross, CW (1986). Plant Physiology. Third edition, CBS Publishers and Distributors, New Delhi.
8. Taiz, L and Zeiger, E (2010). Plant Physiology. The Benjamin/Cummings Publishing company, Inc., California, New York.
9. Verma,V (2008). Text book of plant Physiology, Anne's student edition, New Delhi
10. Bajracharya, D (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
11. www.plantphysiol.org
12. www.plantphys.net.
13. www.khanacademy.org

Practicals:

1. Determination of osmotic potential by osmolytic method.
2. Determination of stomatal index and frequency of mesophytes, hydrophytes and xerophytes.
3. Effect of light qualities on oxygen evolution – Willmots bubbler.
4. Estimation of chlorophyll by spectrophotometry.
5. Estimation of NR activity by spectrophotometry.
6. Demonstration of plant growth using auxanometer and clinostat.
7. Bell jar experiment.
8. Demonstration of seed germination.
9. Demonstration of seed germination – effect of gibberellins on seed germination.
10. Ganong's photometer.

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PROGRAMME : B.Sc., Botany **COURSE CODE : 17U6BME2**
COURSE TITLE : Molecular Biology and Biotechnology **QN.NO : 8823**
TIME : 3 Hours **MAX.MARKS :75**

Objective

- To understand structure and functions of bio molecules.
- To acquire computer knowledge related to biological data bases.

Learning Outcome

- The students will acquire the knowledge about role of bio molecules and will be practiced in analzing the biological data bases using computer system.

Unit I (20 hr)

Concept of genome, genome organization in prokaryotes. Gene architecture. Transcription and translation events. Regulation of gene expression – operon concept with reference to lac operon.

Unit II (10 hr)

Genetic recombination – transformation, transduction, conjugation and sexduction. Transposable elements in maize and its significance.

Unit III (20 hr)

rDNA technology – origin and concept – importance. Restriction enzymes, polymerases, ligases and alkaline phosphatases. Vectors – salient features, types. Plasmid – natural – Ti plasmid and constructed – pBR 322.

Unit IV (15 hr)

Cloning strategies: PCR, blotting techniques – southern. cDNA and genomic library. Genetic markers – RAPD and RFLP.

Unit V (25 hr)

Gene transfer technology – gene transfer methods – Physical – Biolistics, Electroporation, Liposome mediated. Vector mediated – Agrobacterium. Plant tissue culture – totipotency, regeneration, hardening and plant recovery. Transgenic crops – Bt cotton, golden rice and Flavr Savr tomato. Biosafety.

References

1. David Friefieder., (2010) Essentials of Molecular biology, 4th Edition, Jones and Barlett Publishers, Massachusetts
2. Karp, G. (1999). Cell and molecular biology. Concept and experiments. John Wiley and Sons, Inc, USA
3. Chawla H.S., (2000). Introduction to Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
4. Gupta P.K., (1999). Elements of Biotechnology. Rastogi Publishers, India.
5. Gamborg O.L & Phillips G.C., (2005). Plant Cell Tissue & Organ Culture. Narosa Publishing House, New Delhi.
6. Kalyan Kumar. D (2008). An Introduction to Plant Tissue Culture. New Central Book Agency, Kolkata.
7. Old, R.W & Primrose, S.B., (1985). Principles of Gene Manipulation-An Introduction to Genetic Engineering. Blackwell Scientific Publication. London.
8. Slater, A., Scott N.W., Fowler, M.R., (2003). Plant Biotechnology, The Genetic Manipulation of Plants. Oxford University Press, New York.
9. https:// WWW.bio.org
10. https:// WWW.ncbi.nlm.nih.gov.
11. https://agrobac.biol.,

Practicals

1. Basics and procedure in molecular biology and tissue culture.
2. Isolation of plasmid DNA
3. Restriction of plasmid using ECoR I
4. Isolation of plant DNA from leaf sample using cTAB method.
5. DNA restriction maps
6. Preparation of MS medium.
7. Explants preparation and sterilization
8. Micropropagation
9. Gene transfer method – charts.
10. Agarose gel electrophoresis

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Qn.NO:8824

Course code	Course Title	C	H	I	E	T
17U6BME3	Bioinformatics	4	4	25	75	100

Unit I (15 hr)

Scope and objectives of Bioinformatics. Computer – basic components of computers – working – intra and internet – website.

Unit II (15 hr)

Genomics – structural, functional and comparative. Gene sequencing – Maxam-Gilbert method. Sanger method.

Unit III (10 hr)

Proteomics – overview; tools – 2D PAGE; MALDI-TOF

Unit IV (10 hr)

Data bases – types – classification – nucleic acid sequence – data bases – Gene bank: DDBI, EMBL net, Protein data bases – PIR, SWISS PROT.

Unit V (10 hr)

Sequence alignment – pair and multiple – alignment tool – BLAST.

References

1. Attwood,T.K., Parry-Smith, D.J. and Phukan,S.(2008). Introduction to bioinformatics.. Pearson Education Pvt.Ltd., New Delhi. India.
2. Mani,K and Vijayaraj,N. (2002). Bioinformatics for beginners. Kalaikathir Achchagam. Coimbatore. Tamil Nadu. India.
3. Rajadurai,M. (2010).Bioinformatics- a practical manual. PBS Book Enterprises.

THE MADURA COLLEGE (Autonomous), MADURAI – 625 011

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

PROGRAMME : B.Sc., Botany | **COURSE CODE : 17U6BSM4**

COURSE TITLE : Forestry | **QN.NO : 8827**

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

Objective

- To sensitise the students about the various aspects of forests.
- To understand the various ways and means to increase the forest cover on the earth.

Learning Outcome

- Students will experience that forests are the most important resource.
- Students will be equipped with the concepts and skills required to develop forests.

Unit- I (6Hr) Silviculture

Definition of forest and forestry. Classification of forests. Afforestation, Reforestation and Deforestation. Natural and artificial regeneration of forests.

Unit- II (6Hr) Plantation forestry

Definition, site preparation, planting pattern, choice of species.

Unit- III (6Hr) Agroforestry and Social forestry

Definition, aims, need, role in the life of people and domestic animals. Traditional agroforestry systems - Shifting Cultivation and its limitations.

Unit- IV (6Hr) Ethnobotany

Definition, scope and role in Indian medicine - Chipko movement- Joint Forest Management.

Unit-V (6Hr) Forest produce

Major-Timber (Teak, Rose wood), Fire wood (Diospyrus).
Minor- Gums (Arabic), resins (Abies) and Oil grasses (Lemon grass).

References:

1. Jain. S.K, Manual of Ethno botany, Scientific publishers, India.
2. Negi, S.S, Hand book of forestry. (1986). Publishers, International book distributors, New Delhi.
3. Negi, S.S. (1988). Elements of general silviculture, International book distributors, New Delhi.
4. Sagreiya, K.P - Forest and Forestry (1967), National book trust, India.
5. Sageriya, K.P. (1982). Forests and Forestry, National book trust, New Delhi.
6. WWW.forestry.ubc.ca.
7. https://WWW.botany.org

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

PROGRAMME : B.Sc., Botany **COURSE CODE : 20U1BMC1**
COURSE TITLE : Algae, Fungi and Lichens **QN.NO : 11001**
TIME : 3 Hours **MAX.MARKS :75**

DEPARTMENT OF BOTANY				*CLASS: I B.Sc. Botany*				
Sem	**Course type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
I	Major core- 1	20U1BMC1	**Algae, Fungi and Lichens**	3	3	25	75	100

Course Objectives:

1. To acquaint the structure and reproductive characteristics of lower forms of plants.
2. To understand the classification of lower life forms of plants.
3. To analyze the economic potential of lower plant groups.

UNIT-I: Algae

General characters of algae: Occurence, thallus organizations (Unicellular, Colonial, Filamentous, Siphonaceous and Parenchymatous); Pigmentation, reserve food materials, Flagellation, Classification of algae by Fritsch up to class level. Economic importance of algae.

UNIT-II

Reproduction – Asexual – Vegetative and sporulation, Sexual reproduction (Isogamy, anisogamy and oogamy). Pattern of Lifecycles - haplontic (*Chara*), diplontic (*Sargassum*), haplodiplontic (*Ulva*), haplobiontic (*Polysiphonia*) and diplobiontic (*Gracilaria*).

UNIT-III: Fungi

General characters of fungi. Types of fungi. Nutritions in fungi. Reproduction – Asexual (vegetative and sporulation), sexual (Planogametic: Isogamy, Anisogamy and Oogamy; Aplanogametic: Gametangial contact, gametangial copulation, somatogamy). Classification of fungi by Alexopoulos (1969).

UNIT-IV

Life cycle of *Mucor* (Zygomycotina), *Peziza* (Ascomycotina) *Agaricus* (Basidiomycotina) and *Cercospora* (Deuteromycotina). Beneficial aspects of fungi- medicine, food and agriculture.

UNIT-V: Lichens

Occurrence, salient features of lichens, types: crustose, foliose and fruticose. Special vegetative structures - Soredia and Isidia. Structure and reproduction of *Usnea.* Economic importance of lichens.

P.T.O.

Books for Study

1. Sharma, O. P. (2007). Text Book of Algae, Tata McGraw Hill Publishing Pvt. Ltd., New Delhi.
2. Vashista, Sinha B.R.& Singh, V.P.(2002). Botany for Degree students, Algae 9th revised edition, S.Chand & Company Ltd., New Delhi.
3. Hale, M. E. (1983). The Biology of Lichens, Edwad Arnold, London.
4. Pandey B. P (1989). Text Book of Botany, S. Chand Publishing Company, New Delhi,

Books for References

1. South G.R. & A. Whittick (1987). Introduction to Phycology. Blackwell Scientific Publications, Oxford.
2. Alexopolous, C.J. & C.W. Misra (1972). Introductory mycology. John Wiley and Sons, New York.
3. Chopra G.L (1972). A Text book of Fungi, S.Nagin & Co. Meerut, India
4. Dube, H. (1978). A Textbook of Fungi, Bacteria and Virus. Vikas Publishers.

Web Resources

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

Course Learning Outcomes:

	CLO Statement	Knowledge Level
CLO -1	Understand the morphological characteristics and identification of lower plants.	**K3**
CLO -2	Discuss the classification and its application on plant identification.	**K3**
CLO -3	Explain the patterns of lifecycle and the critical stages involved in it.	**K2**
CLO -4	Critically think about the origin and evolution of lower plants.	**K4**
CLO -5	Utilize the plant resources for the betterment of living organisms.	**K3**

Mapping Programme Specific Outcomes with Course Learning Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	3	2	3	2	3	3	3	3	2
CLO-2	2	2	3	3	3	2	3	3	3
CLO-3	2	3	3	2	3	3	3	3	3
CLO-4	3	3	3	3	3	3	3	2	3
CLO-5	3	3	3	2	3	2	2	3	3

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

P.T.O.

Mapping Programme Outcomes with Course Learning Outcome:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	1	3	2	3
CLO-2	2	1	2	1	3
CLO-3	2	2	2	1	1
CLO-4	-	3	1	-	2
CLO-5	1	3	-	3	1

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

Blue Print – Model for External Examination

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

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

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

P.T.O.

Distribution of Section- wise marks with K Levels

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Blue Print - Model for Internal Examination

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

Sl. No	**CLOs**	**K – Level**	**Section – A**		**Section – B**		**Section C (Either/ Choice)**	**Section D (Open Choice)**	**Total**
			MCQs		**Short Answer**				
			No. of Questions	**K – Level**	**No. of Questions**	**K - Level**			
1	CLO 1	Up to K2	2	K1&K2	1	K1	2(K2&K2)	2 (K2/K3)	
2	CLO 2	Up to K3	2	K1&K2	2	K2	2(K3&K3)	1 (K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise Marks with K Levels *

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	2		-	**4**	6.67	**50**
K2	2	4	10	10	**26**	43.33	
K3	-	-	10	10	**20**	33.33	**33**
K4	-	-		10	**10**	16.67	**17**
Total Marks	4	6	20	30	**60**	100.00	**100%**

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

PROGRAMME : B.Sc., Botany **COURSE CODE : 20U1BMC2**
COURSE TITLE : Bryophytes and Pteridophytes **QN.NO : 11002**
TIME : 3 Hours **MAX.MARKS :75**

DEPARTMENT OF BOTANY				*CLASS: I B.Sc. Botany*				
Sem	**Course type**	**Course Code**	**Course Title**	**Credits**	**Contact Hours/week**	**CIA**	**Ext**	**Total**
I	Major core- 2	20U1BMC2	**Bryophytes and Pteridophytes**	3	3	25	75	100

Course Objectives:

1. To familiarize and compare the land plants with primitive forms of plants.
2. To understand the structure and reproduction of Bryophytes and Pteridophytes.
3. To evaluate economic importance of Bryophytes and Pteridophytes .

UNIT-I

Bryophytes:

Occurrence, general characters, ecology and classification by Rothmaler (1951).

UNIT-II

Structure, reproduction and life cycle of *Riccia*, *Anthoceros* and *Funaria*. economic importance of Bryophytes.

UNIT-III

Pteridophytes:

Occurrence, general characters and classification by Smith. Stelar organization. Alternation of generations. economic importance.

UNIT-IV

Structure, reproduction and life cycle of *Psilotum* and *Selaginella*.

UNIT-V

Structure, reproduction and life cycle of *Equisetum* and *Marsilea*.

Books for Study

1. Rashid, A. (2000). An Introduction to Bryophyta, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Parihar, N. S. (2013). An Introduction to Embryophyta Bryophyta, 2013, Surjeet Publications, New Delhi.
3. Vashista, P.C (1971) Botany for degree students: Pteridophyta. S. Chand & Co., New Delhi
4. Pandey BP (1989). Text Book of Botany, S. Chand Publishing Company, New Delhi.

Books for References

1. Parihar, N.S (1967). An introduction to Embryophyta vol. II. Pteridophyta. Central Book Depot, Allahabad.
2. Watson, E.V (1974). The structure and life of Bryophytes. B.I. Publications, New Delhi.
3. Sporne, K.R (1976). Morphology of Pteridophytes. B.I. Publishers, New Delhi.
4. Smith, G.M. (1955). Cryptogamic Botany. Vol. III. McGraw Hill, New Delhi.

Web Resources

1. https://www.britannica.com/search?query=Bryophytes
2. https://byjus.com/biology/pteridophyta/?

Course Learning Outcomes:

	CLO Statement	Knowledge Level
CLO-1	Comprehend the vegetative and reproductive structure of primitive land plants.	**K3**
CLO-2	Understand the concepts of classification and their necessity.	**K3**
CLO-3	Explain the critical stage of plant lifecycle	**K4**
CLO-4	Compare the morphology across plant divisions.	**K3**
CLO-5	Use the knowledge for utilization and conservation aspects.	**K3**

Mapping Programme Specific Outcomes with Course Learning Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	3	3	3	3	3	3	2	3	2
CLO-2	3	2	2	2	3	3	2	3	2

CLO-3	3	3	2	3	3	3	3	3	3
CLO-4	2	2	2	2	2	3	3	2	3
CLO-5	2	3	2	3	2	3	3	2	3

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

Mapping Programme Outcomes with Course Learning Outcome:

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**
CLO-1	3	2	2	1	3
CLO-2	3	1	3	2	1
CLO-3	2	-	2	-	2
CLO-4	2	3	3	3	-
CLO-5	1	2	-	2	3

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

P.T.O.

Blue Print – Model for External Examination

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

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

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise marks with K Levels

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Blue Print – Model for Internal Examination
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Sl. No	**CLOs**	**K – Level**	**Section – A**		**Section – B**		**Section C (Either/ Choice)**	**Section D (Open Choice)**	**Total**
			MCQs		**Short Answer**				
			No. of Questions	**K – Level**	**No. of Questions**	**K – Level**			
1	CLO 1	Up to K 2	2	K1&K2	1	K1	2(K2&K2)	2 (K2/K3)	
2	CLO 2	Up to K 3	2	K1&K2	2	K2	2(K3&K3)	1 (K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise Marks with K Levels *

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	2		-	**4**	6.67	**50**
K2	2	4	10	10	**26**	43.33	
K3	-	-	10	10	**20**	33.33	**33**
K4	-	-		10	**10**	16.67	**17**
Total Marks	4	6	20	30	**60**	100.00	**100%**

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PROGRAMME : B.Sc., Botany **COURSE CODE : 20U1BMC3**
COURSE TITLE : Gymnosperms and Palaeobotany **QN.NO : 11005**
TIME : 3 Hours **MAX.MARKS :75**

DEPARTMENT OF BOTANY				*CLASS: I B.Sc. Botany*		
Sem	**Course type**	**Course Code**	**Course Title**	**Time**	**Maximum**	**Question Number**
II	**Major core – 3**	**20U2BMC3**	**Gymnosperms and Palaeobotany**	**3 hrs**	**75 marks**	**11005**

Course Objectives:

1. To understand the characteristic features and classification of Gymnosperms.
2. To study the concept of fossils, geological time scale and fossilization.
3. To analyze the economic importance of Gymnosperms and fossils.

UNIT-I

Gymnosperms: General characters – Origin and Classification by Sporne (1965) – Salient features of Progymnosperms - Phylogeny and Economic importance.

UNIT-II

Salient features of Cycadales, Coniferales and Gnetales. *Cycas* – Morphology, Anatomy, Reproduction and life Cycle (Need not study developmental aspect).

UNIT-III

Auracaria – Morphology, Anatomy, Reproduction and Life cycle. *Gnetum* – Morphology, Anatomy, Reproduction and Life cycle (Need not study developmental aspect).

UNIT-IV

Palaeobotany: Concepts of palaeobotany - Geological Time scale – Determination of age of fossils, Carbon dating – Fossil types - impressions, compressions, incrustation, casts, molds, petrifications and coal balls– Role of fossil in oil exploration – Contributions of Birbal Sahni to Palaeobotany.

UNIT-V

Morphological, anatomical and geological era of following fossils: *Rhynea*, *Lepidodendron*, *Pentoxylon*, *Cordaites*.

Books for Study

1. Pandey, B.P. (1998). A Text Book of Botany Vol. II. S Chand, NewDelhi.
2. Vashista, P.C. (1978). Botany for degree students: Gymnosperms. S. Chand & Co., New Delhi.
3. Arnold, C.A. (1947). An introduction to Palaeobotany. McGraw Hill Publisher, New Delhi.

P.T.O.

Books for References

1. Stuart WN (1998). Paleobotany and Evolution of Plants, New York Publications.
2. Johri , RM, Lata S, & Tyagi K (2005) A text book of Gymnosperms, Dominate pub and Distributer, NewDelhi.
3. Vastishta PC Sinha AK & Anikumar (2006). Gymnosperms (Revised edition), S. Chand and Company, Pvt. Ltd., New Delhi.
4. Sukla and S.P. Mishra (1982). Essentials of Palaeobotany. Vikas Publishing House.
5. Chamberlain, C.A. (1986). Gymnosperms-Structure and Evolution, Publishers & Distributors.

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

Course Learning Outcomes:

	CLO Statement	Knowledge Level
CLO-1	Understand the concept of identification, classification and economic importance of Gymnosperms and fossils	K3
CLO-2	Analyze the phylogeny of Gymnosperms	K4
CLO-3	Recall the structure and life cycle of cycadales	K2
CLO-4	Critically analyze the structure and reproduction in conifers and Gnetales	K4
CLO-5	Evaluate the concepts of geological time scale and fossilization processes	K3

Mapping Programme Specific Outcomes with Course Learning Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	2	3	3	3	3	3	2	2	3
CLO-2	3	3	3	2	3	3	3	3	3
CLO-3	3	3	3	3	3	3	3	2	2
CLO-4	3	3	2	3	3	3	3	3	3
CLO-5	3	3	3	3	3	2	3	2	2

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

P..T.O.

Mapping Programme Outcomes with Course Learning Outcome:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	2	3	2
CLO-2	3	3	2	3	3
CLO-3	2	2	1	-	2
CLO-4	1	-	2	2	1
CLO-5	-	1	-	2	-

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

Blue Print – Model for External Examination

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

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

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

P.T.O.

Distribution of Section- wise marks with K Levels

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Blue Print – Model for Internal Examination

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

Sl. No	**CLOs**	**K – Level**	**Section – A**		**Section – B**		**Section C (Either/ Choice)**	**Section D (Open Choice)**	**Total**
			MCQs		**Short Answer**				
			No. of Questions	**K – Level**	**No. of Questions**	**K - Level**			
1	CLO 1	Up to K 2	2	K1&K2	1	K1	2(K2&K2)	2 (K2/K3)	
2	CLO 2	Up to K 3	2	K1&K2	2	K2	2(K3&K3)	1 (K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

P.T.O.

Distribution of Section- wise Marks with K Levels *

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	2		-	**4**	6.67	**50**
K2	2	4	10	10	**26**	43.33	
K3	-	-	10	10	**20**	33.33	**33**
K4	-	-		10	**10**	16.67	**17**
Total Marks	4	6	20	30	**60**	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 : B.Sc., Botany **COURSE CODE : 20U2BMC4**
COURSE TITLE : Plant Anatomy and Embryology **QN.NO : 11006**
TIME : 3 Hours **MAX.MARKS :75**

DEPARTMENT OF BOTANY				*CLASS: I B.Sc. Botany*		
Sem	**Course type**	**Course Code**	**Course Title**	**Time**	**Maximum**	**Question Number**
II	Major core- 4	**20U2BMC4**	**Plant Anatomy and Embryology**	**3 hrs**	**75 marks**	**11006**

Course Objectives:

1. To study the structure and functions of cells and tissues.
2. To know the normal and anomalous secondary growth in Dicots and Monocots.
3. To understand the developmental processes of tissues form Spermatogenesis, Oogenesis to Embryo formation.

UNIT-I

Plant Anatomy: Meristems –classification and theories – Apical cell theory, shoot apical meristem (SAM), root organization – root apical meristem - Vascular Cambium – Types. Structure and functions of simple and complex tissues.

UNIT-II

Primary structure of Monocot stem (*Grass*) and Dicot stem (*Tridax*), Moncot root (*Zea mays*) and Dicot root (*Cicer*). Anomalous secondary growth in Dicot stem (*Achyranthes*) and Monocot stem (*Draceana*). Anatomy of Monocot leaf (Grass) and Dicot leaf (*Nerium*)

UNIT-III

Embryology of Angiosperms: Structure and development of Microsporangium, Microspores, Microgametophyte. Anther wall – tapetum – structure and functions. Structure and types of ovules. Monosporic, biosporic and tetrasporic types of embryosac and their cellular organization.

UNIT-IV

Pollination – types and agencies. Fertilization – types of pollen tube entry in to ovule. Double fertilization and Triple fusion- Endosperm –types and structure. – embryo development – Dicot (*Brassica*) and Monocot (*Drusa*).

UNIT-V

Polyembryony –Apomixis, Apospory, their role in crop improvement and seed development. Parthenocarpy. Prospects and significance of embryo and endosperm culture.

Books for Study

1. Cutler, D.F (1978). Applied plant Anatomy, Orient Longman Publishers, New Delhi
2. Agarwal, S. B (1990). Embryology of Angiosperms- a fundamental approach. Sahitya Bhawan, Agra.
3. Clowers, F. A. L (1961). Apical Meristems. Blackwell Scientific Publication, Oxford.
4. Bhojwani S. S. and Bhatnagar, S.P (2000). The Embryology of Angiosperms, Vikas Publishing House Pvt. Ltd., New Delhi.

Book for References

1. Easu, (1987). The Anatomy of seed plants. Wiley Eastern Ltd., New Delhi
2. Fahn, A. (1989). Plant Anatomy,Pergamon press, Oxford, New York.
3. Johri, B.M. (1984). Embryology and Angiosperms. Springer Verlag. Berlin
4. Maheshwari,P (2015).An Introduction to the Embryology of Angiosperms, Scholar Select Publishers.
5. Dwivedi, J. N. (1998). Embryology of Angiosperms. Rastogi and Co., Meerut.

Web Resources

1. https://www.easybiologyclass.com/plant-anatomy-online-tutorials-lecture-notes-study-materials/
2. https://www.britannica.com/science/embryo-plant

Course Learning Outcomes:

	CLO Statement	Knowledge Level
CLO-1	Develop and understanding of concepts and fundamentals of plant anatomy.	**K3**
CLO-2	Examine the internal anatomy of plant systems and organs.	**K3**
CLO-3	Develop critical understanding on the evolution on concepts of organizations of shoot and root apex.	**K2**
CLO-4	Analyze the composition of different parts of plants and their relationships.	**K4**
CLO-5	Critically analyze the development of male and female reproductive system and their functions.	**K3**

Mapping Programme Specific Outcomes with Course Learning Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	2	3	3	2	3	3	3	2	3
CLO-2	3	3	3	3	3	3	3	3	2
CLO-3	2	3	3	3	2	3	3	2	2
CLO-4	3	3	3	3	3	3	2	2	2
CLO-5	3	3	3	3	3	3	3	3	3

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

P.T.O.

Mapping Programme Outcomes with Course Learning Outcome:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	-	3	2	3
CLO-2	2	3	2	3	2
CLO-3	2	3	2	3	1
CLO-4	1	3	2	-	1
CLO-5	-	1	1	-	1

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

Blue Print – Model for External Examination

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

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

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise marks with K Levels

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Blue Print – Model for Internal Examination
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Sl. No	**CLOs**	**K – Level**	**Section – A**		**Section – B**		**Section C (Either/ Choice)**	**Section D (Open Choice)**	**Total**
			MCQs		**Short Answer**				
			No. of Questions	**K – Level**	**No. of Questions**	**K – Level**			
1	CLO 1	Up to K 2	2	K1&K2	1	K1	2(K2&K2)	2 (K2/K3)	
2	CLO 2	Up to K 3	2	K1&K2	2	K2	2(K3&K3)	1 (K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise Marks with K Levels *

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	2		-	**4**	6.67	**50**
K2	2	4	10	10	**26**	43.33	
K3	-	-	10	10	**20**	33.33	**33**
K4	-	-		10	**10**	16.67	**17**
Total Marks	4	6	20	30	**60**	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 : 20U3BMC5**

COURSE TITLE : Morphology and Taxonomy of Angiosperms **QN.NO : 11008**

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

Course Objectives: This course will enable the students

1. To understand the morphology of plants and various systems of classification.
2. To recognize the members of angiosperm families by identifying their diagnostic features and learn their economic importance.
3. To study the phylogenetic aspects of plant taxonomy for understanding the inter-relationship among plants.

UNIT	CONTENT	CLO	K LEVEL	HOURS
I	**Plant Morphology:** Types of root and its modifications - Stem: Types and their modifications - Leaves: Phyllotaxy, Types and its modifications - Inflorescence: Racemose, Cymose and Special types - Flower: Technical Description of Floral Parts, Floral Diagram and Floral Formula - Fruits: Simple (Fleshy and Dry), Aggregate and Composite.	1	Up to K4	15
II	**Plant Taxonomy:** Objectives and Goals - Various Hierarchical Categories - Contribution to Indian Botany by J.D. Hooker and J.S. Gamble - Systems of Classification with their Merits and Demerits: Artificial - Linnaeus; Natural - Bentham and Hooker; Modern - Cronquist; Outline of APG IV (2016).	2	Up to K4	15
III	**Nomenclature:** Key Preparation - Nomenclature: Binomial system, ICN - Principles and Rules, Typification and Various nyms - Herbarium: Preparation, Maintenance and Significance, Important Indian and World herbaria - Botanical Survey of India - Brief Outline on Modern Methods of Plant Identification: Chemotaxonomy, Numerical Taxonomy, Serotaxonomy and Molecular Techniques.	3	Up to K4	15
IV	**Selected Families:** Detailed studies on the vegetative, reproductive characters and economic importance of the following families: Nymphaeaceae, Brassicaceae, Malvaceae, Rutaceae, Meliaceae, Myrtaceae, Cucurbitaceae, Rubiaceae and Asteraceae.	4	Up to K4	15
V	**Selected Families:** Detailed studies on the vegetative, reproductive characters and economic importance of the following families: Sapotaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Aristolochiaceae, Euphorbiaceae, Orchidaceae, Commelinaceae and Poaceae.	5	Up to K4	15

Books for Study

1. Sharma, O.P., Plant Taxonomy, 2009, Tata McGraw Hill Education Private Limited, New Delhi.
2. Pullaiah, T. and Karuppusamy, S., Taxonomy of Angiosperms, 4th Ed, 2018, Regency Publication, New Delhi.
3. Lawrence, G.H.M., Taxonomy of Vascular Plants, 2012, Scientific Publishers. India.

Books for References

1. Naik, V.K., Principles of Plant Taxonomy, IBH Oxford.
2. Verma, B.K., Introduction to Taxonomy of Angiosperms, 2011, PHI Learning Pvt. Ltd., New Delhi.
3. Rendle, R.B., The Classification of Flowering Plants, Vols. I, II & III, Oxford-Clarendon.
4. Gamble, J.S., Flora of Presidency of Madras, Vols. I, II & III, 1986, Bishen Singh Mahendra Pal Singh, Dehra Dun.
5. Subrahmanyam, N.S., Modern Plant Taxonomy, 2011, Vikash Publishing House, New Delhi.
6. Singh, G, Plant Systematics - Theory and Practice, 2005, Oxford & IBH, New Delhi.
7. Pandey, B.P., Taxonomy of Angiosperms, 2017, S. Chand Publication, New Delhi.
8. Naik, V.N., Taxonomy of Angiosperms, 2000, Tata McGraw Hill Publishing Company Limited, New Delhi.
9. Singh, V. and Jain, D.K., Taxonomy of Angiosperms, 1981, Rastogi Publications.
10. Gurcharan Singh, Plant Systematics, 2nd Ed., 2005, Scientific Publications, Jodhpur.

Web Resources

1. http://www.theplantlist.org/
2. https://www.biologydiscussion.com/
3. https://www.britannica.com/search?query=taxonomy+of+angiosperms
4. https://www.easybiologyclass.com/topic-botany/

Rationale for Nature of the Course

The course will enable the students to acquire knowledge on morphology of plants, various systems of classification, plant identification, economically useful plant parts and their uses.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

The knowledge acquired by the students will be used to identify plants based on morphological observations. It will help them to attain a position after higher studies in reputed institutions like Botanical survey of India and its related organizations.

Pedagogy

Chalk and Talk, Power Point, Group Discussion, Seminar, Interaction, Problem Solving, Quiz, Virtual Images, You Tube Videos, Google classroom & LMS (CANVAS).

Course Learning Outcomes:

On successful completion of the course, the students will be able to know, understand, apply and analyse

CLOs	CLO Statement	Knowledge Level
CLO 1	The vegetative and reproductive morphology of angiosperms	**Up to K4**
CLO 2	The artificial, natural and modern systems of classifications	**Up to K4**
CLO 3	The ICN principles and modern methods of plant identification	**Up to K4**
CLO 4	The morphological description and illustration of selected dicotyledonous families	**Up to K4**
CLO 5	The morphological description and illustration of selected dicotyledonous and monocotyledonous families	**Up to K4**

Mapping Programme Specific Outcomes with Course Learning Outcomes:

#	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9
CLO1	2	3	2	3	-	2	-	3	2
CLO2	3	1	2	1	2	-	1	1	2
CLO3	3	2	3	2	3	-	2	2	1
CLO4	3	3	1	-	1	2	-	2	3
CLO5	3	3	1	-	2	2	1	2	3

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Mapping Programme Outcomes with Course Learning Outcomes:

#	PO1	PO2	PO3	PO4	PO5
CLO1	3	3	2	1	1
CLO2	3	1	3	2	2
CLO3	2	2	2	3	3
CLO4	3	3	3	2	2
CLO5	1	2	1	2	2

3 - Advance Application; 2 - Intermediate Level; 1 - Basic Level

Lecture Schedule

Unit	Description	Hours	Mode
I	Plant Morphology – Introduction	1	Chalk and Talk, Power Point, Group Discussion, Seminar, Quiz, Virtual Images, You Tube Videos, Google classroom & LMS (CANVAS).
	Types of root and its modifications	2	
	Stem: Types and their modifications	2	
	Leaves: Phyllotaxy, Types and its modifications	2	
	Inflorescence: Racemose, Cymose and Special types	2	
	Flower: Technical Description of Floral Parts	2	
	Floral Diagram and Floral Formula	2	
	Fruits: Simple (Fleshy and Dry), Aggregate and Composite	2	
II	Plant Taxonomy - Objectives and Goals	1	Chalk and Talk, Power Point, Group Discussion, Seminar, Quiz, Virtual Images, You Tube Videos, Google classroom & LMS (CANVAS).
	Various Hierarchical Categories in Taxonomy	1	
	Contribution to Indian Botany by J.D. Hooker	1	
	Contribution to Indian Botany by J.S. Gamble	1	
	Artificial Classification – Linnaeus	2	
	Natural Classification - Bentham and Hooker	4	
	Modern Classification – Cronquist	2	
	Outline of APG IV Classification (2016)	3	
III	TaxonomicKey Preparation	2	Chalk and Talk, Power Point, Group Discussion, Seminar, Quiz, Virtual Images, You Tube Videos, Google classroom & LMS (CANVAS).
	Nomenclature: Binomial system	1	
	ICN - Principles and Rules, Typification and Various nyms	3	
	Herbarium: Preparation, Maintenance and Significance	2	
	Important Indian and World herbaria	1	
	Botanical Survey of India	1	
	Brief Outline on Modern Methods of Plant Identification	1	
	Chemotaxonomy and Numerical Taxonomy	2	
	Serotaxonomy and Molecular Techniques	2	

IV	Nymphaeaceae, Brassicaceae and Malvaceae	5	Chalk and Talk, Power Point, Virtual images.
	Rutaceae, Meliaceae and Myrtaceae	5	
	Cucurbitaceae, Rubiaceae and Asteraceae	5	
V	Sapotaceae, Acanthaceae and Lamiaceae	5	Chalk and Talk, Power Point, Virtual images.
	Amaranthaceae, Aristolochiaceae and Euphorbiaceae	5	
	Orchidaceae, Commelinaceae and Poaceae	5	

Blue Print – Model for External Examination

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

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

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers
K3- Application oriented – Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise marks with K Levels

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Blue Print – Model for Internal Examination
Articulation Mapping – K Levels with Courses Leaning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section – A		Section – B		Section C (Either/ Choice)	Section D (Open Choice)	Total
			MCQs		Short Answer				
			No. of Questions	K – Level	No. of Questions	K - Level			
1	CLO x	Up to K 4	2	K1&K2	2	K1&	2(K2&K2)	1	

						K2		(K2/K3)	
2	CLO y	Up to K 4	2	K1&K2	1	K2	2(K3&K3)	2 (K3& K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers
K3- Application oriented – Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise Marks with K Levels

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	2		-	**4**	6.67	**50**
K2	2	4	10	10	**26**	43.33	
K3	-	-	10	10	**20**	33.33	**33**
K4	-	-		10	**10**	16.67	**17**
Total Marks	4	6	20	30	**60**	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 : 20U1BAC1/ 20U3BAC1**

COURSE TITLE : Allied Botany – I **QN.NO : 11010**

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

Course Objectives

1. Understand the diversity of plants and their economic importance.
2. Compare the life cycle patterns from lower to higher plants.
3. Discuss the structure and reproductive characters of different groups of plants.

Unit-I (10 Hours)

Plant Kingdom - Cryptogams and Phanerogams - salient features of Algae - Structure, reproduction and life cycle of *Caulerpa* - economic importance of Algae.

Unit-II: Fungi & Lichens(10 Hours)

General characters of Fungi - structure, reproduction and life cycle of *Puccinia* - economic importance of Fungi - Salient features of Lichens - structure and reproduction of *Usnea*.

Unit-III: Bryophytes & Pteridophytes (10 Hours)

General characters of Bryophytes - Structure, reproduction and life cycle of *Marchantia*. Salient features of Pteridophytes - Structure, reproduction and life cycle of *Lycopodium*.

Unit-IV: Gymnosperms (10 Hours)

General characters of Gymnosperms - structure, reproduction and life cycle of *Cycas* - economic importance of Gymnosperms.

Unit-V (20 Hours)

Taxonomy - Plant Nomenclature - Herbarium methods - Natural system of classification - vegetative characters, floral characters and economic importance of Rutaceae, Apocynaceae, Amaranthaceae and Poaceae.

Books for Study

1. Sharma OP(1992). Text Book of Algae, Tata McGraw Hill Publication Company Ltd., New Delhi, 1992.
2. Vashishta BR, Sinha AK & Singh VP (2011). Botany for Degree students Fungi, S. Chand Publishing Company, New Delhi.

Book for References

1. Rashid A (1999). An introduction to Pteridophyta, Vikas Publishing House Pvt. Ltd., 1999.
2. Vashishta BR, Sinha AK & Kumar A (2011). Botany for Degree students: Gymnosperms, S. Chand Publishing Company, New Delh.
3. Lawrence GHM (1969). Taxonomy of Vascular Plants, Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
4. Sambamurty AVSS (2009). Taxonomy of Angiosperms,I.K. International Publishing House Pvt. Ltd., New Delhi, 2009.

Web Resources

1. https://www.easybiologyclass.com/?s=algae
2. https://www.britannica.com/search?query=fungi
3. https://www.britannica.com/science/lichen
4. https://indiabiodiversity.org
5. https://www.easybiologyclass.com/classification-of-gymnosperms-by-sporne-short-notes/

Course Learning Outcomes:

	CLO Statement	Knowledge Level
CLO-1	Analyze the plant kingdom with specific groups and their features and economic importance	**K4**
CLO-2	Apply the characters for identification of fungi and lichens	**K3**
CLO-3	Understand the general characters and life cycle of Bryophytes and Pteridiophytes	**K2**
CLO-4	Examine the characters for grouping of plant kingdom	**K2**
CLO-5	Analyze the structure and reproduction in Gymnosperms	**K4**

Mapping Programme Specific Outcomes with Course Learning Outcome:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	-	-	1	1	-	-	-	-	-
CLO-2	-	-	-	1	-	-	-	-	-
CLO-3	-	-	2	1	-	-	-	-	-
CLO-4	-	-	1	1	-	-	-	-	-
CLO-5	-	-	1	2	-	-	-	-	-

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

Mapping Programme Outcomes with Course Learning Outcome:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	3	2	3
CLO-2	3	-	2	3	2
CLO-3	2	2	3	-	3
CLO-4	-	1	-	1	2
CLO-5	-	1	-	-	-

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

Lesson Plan:

Unit	Description	Staff Name	Hours	Mode
I	a) Plant Kingdom - Cryptogams and Phanerogams b) Salient features of Algae c) Structure & reproduction of Algae d) Life cycle of *Caulerpa* e) Economic importance of Algae	- - - - -	2 1 2 3 2	Black Board Discussion Seminar Power Point LMS

II	a) General characters of Fungi b) Structure, reproduction of *Puccinia* c) Life cycle of *Puccinia* d) Economic importance of Fungi e) Salient features of Lichens f) Structure and reproduction of *Usnea*.	- - - - - -	2 2 2 1 1 2	Power Point Black Board Power Point Discussion Black Board Virtual Lab
III	a) General characters of Bryophytes b) Structure, reproduction of *Marchantia* c) Life cycle of *Marchantia* d) Salient features of Pteridophytes e) Structure, reproduction of *Lycopodium* f) Life cycle of *Lycopodium*	- - - - - -	2 2 2 1 1 2	Interaction Black Board Power Point Seminar Power Point LMS
IV	a) General characters of Gymnosperms b) Structure, reproduction of *Cycas* c) Life cycle of *Cycas* d) Economic importance of Gymnosperms.	- - - -	3 5 3 4	Discussion Black Board LMS Black Board
V	a) Plant Nomenclature b) Herbarium methods c) Natural system of classification d) Vegetative & Floral characters e) Economic importance of Rutaceae, Apocynaceae, Amaranthaceae and Poaceae.	- - - - -	2 3 3 3 4	Interaction Virtual Lab Black Board Power Point Discussion
Total			**60**	

Blue Print – Model for External Examination
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

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

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

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers
K3- Application oriented – Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise marks with K Levels

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Blue Print - Model for Internal Examination
Articulation Mapping – K Levels with Courses Learning Outcomes (CLOs)

Sl. No	**CLOs**	**K – Level**	**Section – A**		**Section – B**		**Section C (Either/ Choice)**	**Section D (Open Choice)**	**Total**
			MCQs		**Short Answer**				
			No. of Questions	**K – Level**	**No. of Questions**	**K - Level**			
1	CLO 1	Up to K 2	2	K1&K 2	1	K1	2(K2&K2)	2 (K2/K3)	
2	CLO 2	Up to K 3	2	K1&K 2	2	K2	2(K3&K3)	1 (K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers
K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise Marks with K Levels *

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	2		-	**4**	6.67	**50**
K2	2	4	10	10	**26**	43.33	
K3	-	-	10	10	**20**	33.33	**33**
K4	-	-		10	**10**	16.67	**17**
Total Marks	4	6	20	30	**60**	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 : 20U3BSM1(A)**

COURSE TITLE : Horticulture | **QN.NO : 11012**

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

Course Objectives: This course will enable the students

1. To extensively use the space for gardening and improve green cover.
2. To develop skills on usage of horticultural tools.
3. To gain knowledge on horticultural practices and value added products.

UNIT	CONTENT	CLO	K LEVEL	HOURS
I	**Divisions and types:** Importance and scope of horticulture. A brief account on divisions of horticulture – pomology, olericulture, floriculture and ornamental horticulture. Types of gardens – formal, informal, landscape and terrace.	1	Up to K4	6
II	**Plant propagation methods:** Cutting (Drumstick), Budding (Mango), Grafting (Sapota), Layering: Air (Pomegranate) and ground (*Nerium*)	2	Up to K4	6
III	**After care of plants:** Weeding, top dressing - methods of pruning and topiary. Lawn making: types of lawn grasses and maintenance. Plants suitable for hedges.	3	Up to K4	6
IV	**Floriculture and value additions:** Floriculture- cultivation of commercial flowers – rose and jasmine. Flower arrangement – Ikebana. Value addition: Tomato – Jam and ketchup preparations.	4	Up to K4	6
V	**Ornamental gardens:** Green house, Landscape, terrarium, water garden, rockery plants, Bonsai techniques, hydroponics, arboratum, bambosetum and archidorium.	5	Up to K4	6

Books for Study

1. Manibhushan Rao, K, Text book of Horticulture, 1991, Mac Millan India Ltd., New Delhi.
2. Kumar, N., Introduction to Horticulture, 2010, Oxford & IBH Publishing Company Pvt. Ltd., New Delhi.
3. Randhava, G.S, 1973 – Ornamental horticultural in India Today and Tomorrow Printers and Publishers, New Delhi.

Books for References

1. Yawalkar, K.S. 1961 – Vegetables crops of India – Agri, Horticultural Publishing House, Nagpur.
2. Hand Book of Horticulture, Dr. Chadha – ICAR Publications. 2001.
3. Fundamentals of Horticulture – Edmunt Senn Andrews 1994 Tata McGraw Hill Publishing Co., Ltd., Delhi.

Web Resources

1. https//www.horticulture practices.com
2. https//www.horti.maintenance.com
3. https//www.horti.tools.com
4.

Rationale for Nature of the Course

This course focuses on handling different tools used in horticulture and develops various propagation methods for producing new varieties.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

The skills taught in the course will help them in choosing their own career focusing on self employment and they will become an entrepreneur.

Pedagogy

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

Course Learning Outcome: On successful completion of the course the students will be able to

CLOs	CLO Statement	Knowledge Level
CLO -1	Identify and classify the major divisions of horticulture and demonstrate the various types of gardens	**Up to K4**
CLO -2	Demonstrate and apply the plant propagation methods to multiply stocks of vegetable, fruit and ornamental crops	**Up to K4**
CLO -3	Identify the appropriate garden maintenance procedure (after care of plants) and apply the same suitably in different seasons	**Up to K4**
CLO -4	Recall and demonstrate the techniques in floriculture and value addition to the yield	**Up to K4**
CLO -5	Discuss, illustrate and design ornamental gardens for modern society	**Up to K4**

Mapping Programme Specific Outcomes with Course Learning Outcome

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	3	-	1	2	-	3	3	3	3
CLO-2	3	-	1	2	-	3	3	3	3
CLO-3	3	-	1	2	-	3	3	3	3
CLO-4	3	-	1	2	-	3	3	3	3
CLO-5	3	-	1	2	-	3	3	3	3

Mapping Programme Outcomes with Course Learning Outcome

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	2	2	2	3
CLO-2	3	2	2	2	3
CLO-3	3	2	2	2	3
CLO-4	3	2	2	2	3
CLO-5	3	2	2	3	3

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

Lesson Plan

Unit	Description	Hours	Mode
I	a) Importance and scope of horticulture b) Major divisions of horticulture – brief account c) Types of gardens – formal and informal d) Types of gardens – landscape and terrace e) Divisions and types	1 1 2 1 1	Black Board PPT Quiz PPT LMS
II	*a)* Cutting (Drumstick) b) Budding (Mango) c) Grafting (Sapota) d) Layering: Air (Pomegranate) e) ground (Nerium)	1 1 1 1 2	PPT Black Board Black Board PPT Power Point

III	a) Weeding b) top dressing - methods of pruning and topiary c) Lawn making: types of lawn grasses and maintenance d) Plants suitable for hedges	1 2 2 1	Black Board PPT PPT Black Board & Group discussion
IV	*a)* Floriculture: cultivation of commercial flowers – rose *b)* jasmine *c)* Flower arrangement – Ikebana d) Value addition: Tomato – Jam and ketchup preparations.	1 1 1 3	PPT PPT Assignment Black Board
V	a) Green house b) Landscape and terrarium water garden and rockery plants c) Bonsai techniques d) Hydroponics e) Arboratum, bambosetum & archidorium	1 1 1 1 2	PPT Virtual lab Virtual lab Group discussion and LMS
Total		**30**	

Blue Print – Model for External Examination

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

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

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers
K3- Application oriented – Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise marks with K Levels

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Blue Print – Model for Internal Examination

Articulation Mapping – K Levels with Courses Leaning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section – A MCQs		Section – B Short Answer		Section C (Either/ Choice)	Section D (Open Choice)	Total
			No. of Questions	K – Level	No. of Questions	K - Level			
1	CLO x	Up to K4	2	K1&K2	2	K1& K2	2(K2&K2)	1 (K2/K3)	
2	CLO y	Up to K4	2	K1&K2	1	K2	2(K3&K3)	2 (K3& K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers
K3- Application oriented – Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise Marks with K Levels

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	2		-	**4**	6.67	**50**
K2	2	4	10	10	**26**	43.33	
K3	-	-	10	10	**20**	33.33	**33**
K4	-	-		10	**10**	16.67	**17**
Total Marks	4	6	20	30	**60**	100.00	**100%**

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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 : 20U3BSM1(B)**

COURSE TITLE : Biofertilizers | **QN.NO : 11013**

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

Course Objectives: This course will enable the students

1. To understand the basis of biofertilizers and their cultivation.
2. To acquire knowledge of role of microbes in agriculture.
3. To study about mycorrhiza and their isolation and production.
4. To gain knowledge on the vermicompost techniques.

UNIT	CONTENT	CLO	K LEVEL	HOURS
I	**Biofertilizers**: Definition, Scope and importance - General account of biofertilizers. Classification of biofertilizers- Cyanobacteria (BGA), Symbiotic, Nitrogen fixing, Phosphate solubilizers. Liquid fertilizers- sea weeds.	1	Up to K4	6
II	**Nitrogen fixers:** Symbiotic nitrogen fixers**:** *Rhizobium*-characteristics, type, isolation, mass production and field application. Non-Symbiotic nitrogen fixers: free-living *Aztobacte*r- characteristics, type, isolation, mass production and field application.	2	Up to K4	6
III	**Nitrogen fixation:** *Nostoc*- morphology, mass production, Utilization and field application. *Azolla* and *Anabaena;* association nitrogen fixation- factors affecting BGA algae growth - *Azolla* in rice cultivation.	3	Up to K4	6
IV	***Mycorrhizal* Biofertilizers**: Importance of *mycorrhizal* inoculums, type *of mycorrhizae* and associated plants, mass inoculums production of *VAM,* field application of ectomycorrhizae and VAM.	4	Up to K4	6
V	**Vermicomposting**: Biological characteristics and types, Preparation of vermibed, Procedure for indoor vermicomposting and Economic importance of vermicompost- Preparation and importance of panchagavyaas- Biofertilizers- storage, Self-quality controlled and marketing..	5	Up to K4	6

Books for Study

1. Dubey R.C.,2005. A Text book of Biotechnology S.Chand and Co. New Delhi.
2. Subha Rao N.S 2000. Soil microbiology, Oxford and IBH Publishers, New Delhi.
3. Kumaresan V.2005 Biotechnology,Saras publication. New Delhi.
4. Sathe T.V 2004 Vermicultural and organic farming, Dayapublication.New Delhi.
5. John Jothi Prakash E 2004. Outlines of plant Biotechnology, Emkay publication. NewDelhi.

Books for References

1. Kanniyan, S. (2003). Biotechnology of Biofertilizers CHIPS,Texas.
2. Mahendra, K.Rai. (2005). Hand book of Microbial biofertilizers, The Haworth press. Inc. New Delhi.
3. Gupta P.K (1999). Soil plant water and fertilizer analysis. Agro Botanica. Bikaner.
4. Rai M.K (2006). Hand book of Microbial Biofertilizers. Food products Press, New York.

Web References

1. https://en.wikipedia.org/wiki/Biofertilizer#References
2. http://www.amm-mcrc.org/publications/biofertilizers.pdf
3. https://en.wikipedia.org/wiki/Vermicompost

Rationale for Nature of the Course

This course focuses on eco-friendly approach by understanding the concepts of bio-fertilizers and their role in field application.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

The skills learned by the students will help them to prepare organic manure on their own by utilizing the degradable household wastes and there by equip themselves for self-employability.

Pedagogy

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

Course Learning Outcomes: On the successful completion of the course the students will be able to

CLOs	CO Statement	Knowledge level
CLO- I	Understand the various concepts of biofertilizers.	**Up to K4**
CLO-2	Explain the method of crop field application.	**Up to K4**
CLO- 3	Knowledge of the principles and practices of organic agriculture and its role sustainable crop production.	**Up to K4**
CLO- 4	Inculcate biofertilizer preparation and get a train in formulating biofertilizer.	**Up to K4**
CLO-5	Explore knowledge of the eco-friendly approach in farming.	**Up to K4**

Mapping Programme Specific Outcomes with Course Learning Outcome:

	PSO-1	PSO-2	PSO--3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	2	2	2	3	3	3	2	3	3
CLO-2	2	2	2	2	2	3	2	3	3
CLO-3	2	2	3	3	2	2	2	3	3
CLO-4	2	2	2	2	2	3	2	3	3
CLO-5	3	2	2	2	3	3	2	3	3

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

Mapping Programme Outcomes with Course Learning Outcome:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	2	3	1	2	3
CLO-2	1	2	1	2	3
CLO-3	1	2	-	1	3
CLO-4	2	3	1	2	3
CLO-5	2	3	1	2	3

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

Lesson Plan

Unit	Description	Staff name	Hours	Mode
I	a) Definition, Scope and importance of biofertilizers. b) Classification of biofertilizers. c) Method of commercial cultivation of sea weeds.	- - -	2 2 2	Discussion Seminar Black Board
II	a) Characteristics of *Rhizobium* b) Mass production and Field application *Rhizobium* c) Characteristics of *Azatobacte*r. d) Mass production and Field application of *Azatobacte*r.	- - - -	2 2 1 1	Black Board Discussion Black Board Discussion
III	a) Mass production of *Nostoc* b) Utilization and field application of *Azolla* and *Anabaen*a. c) Factors affecting BGA algae growth	- - -	2 2 2	Power point Discussion Black Board
IV	a) Importance of *mycorrhizal* inoculums. b) Type *of mycorrhizae*. c) Mass inoculums production of VAM, d) Field application of Ectomycorrhizae and VAM.	- - - -	1 1 2 2	Black board Seminar Power point Discussion
V	a) Biological characteristics of vermicompost. b) Preparation of vermibed. c) Procedure for indoor vermicomposting. d) Economic importance of vermicompost. e) Preparation of panchagavyaas. f) Biofertilizers- Self- quality controlled and marketing.	- - - - - -	1 1 1 1 1 1	Black board Demonstration Demonstration Discussion Demonstration Seminar
Total			**30**	

Blue Print – Model for External Examination

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

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

K1 - Remembering and recalling facts with specific answers

K2- Basic understanding of fact and stating main ideas with general answers

K3- Application oriented – Solving Problems

K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise marks with K Levels

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	5	4	10	-	**19**	15.83	**42%**
K2	5	6	10	10	**31**	25.83	
K3	-	-	20	30	**50**	41.67	**42%**
K4	-	-	10	10	**20**	16.67	**16%**
Total Marks	10	10	50	50	**120**	100.00	**100%**

Blue Print – Model for Internal Examination
Articulation Mapping – K Levels with Courses Leaning Outcomes (CLOs)

Sl. No	**CLOs**	**K- Level**	**Section – A**		**Section – B**		**Section C (Either/ Choice)**	**Section D (Open Choice)**	**Total**
			MCQs		**Short Answer**				
			No. of Questions	**K – Level**	**No. of Questions**	**K - Level**			
1	CLO x	Up to K 4	2	K1&K2	2	K1& K2	2(K2&K2)	1 (K2/K3)	
2	CLO y	Up to K 4	2	K1&K2	1	K2	2(K3&K3)	2 (K3& K4)	
No. of Question to be asked			4		3		4	3	14
No. of Question to be answered			4		2		2	2	10
Mark for each question			1		2		5	10	
Total Marks for each section			4		6		10	20	40

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers
K3- Application oriented – Solving Problems
K4- Examining, analyzing, presentation and make inferences with evidences

Distribution of Section- wise Marks with K Levels

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	2		-	**4**	6.67	**50**
K2	2	4	10	10	**26**	43.33	
K3	-	-	10	10	**20**	33.33	**33**
K4	-	-		10	**10**	16.67	**17**
Total Marks	4	6	20	30	**60**	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 : 20U3BNM1**

COURSE TITLE : Herbal Botany **QN.NO : 11014**

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

Course Objectives: This course will enable the students

1. To provide the knowledge on diversity and importance of indigenous medicinal plants and their role in traditional medicinal systems.
2. To enrich the knowledge on identification, medicinal properties and their mechanism of action of locally available medicinal plants.
3. To analyze the chemical principles and their drug values, conservation and utilization of endangered medicinal plants.

UNIT	CONTENT	CLO	K LEVEL	HOURS
I	**Herbal medicines**: History and scope – Diversity of Indian Medicinal Plants - role of medicinal plants in traditional systems of medicines; Demands of Indian Medicinal herbs for drug industries and exports.	1	Up to K2	6
II	**Pharmacognosy**: Systematic position, morphology, chemical principles, medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Gooseberry and Black pepper.	2	Up to K2	6
III	**Phytochemistry**: Active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (antiproliferative), *Withaniasomnifera* (nervine tonic), *Andrographis paniculata* (Hepatoprotective) and *Centella asiatica* (memory booster).	3	Up to K2	6
IV	**Analytical pharmacognosy**: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).	4	Up to K2	6
V	**Herbal Drugs**: Conservation needs of endangered and endemic medicinal plants – *Andrographis paniculata*, *Gloriosa superba*, and *Withaniasomnifera.* Modern methods of extraction of phytodrugs – *in vitro* production of andrographolides, colchicine and withanolides.	5	Up to K2	6

Books for the study

1. Chopra, RN., Nayar, S.L and Chopra, I.C. (1956) Glossary of Indian medicinal plants, C.S.I.R, New Delhi.
2. Kanny, Lall, Dey and Raj Bahadur, (1984) The indigenous drugs of India, International Book - Distributors.
3. Agnes A, (1999) Herbal plants and Drugs Mangal Deep Publications. New Delhi.

4. Sivarajan, V.V. and Balachandran, I. (1994) Ayurvedic drugs and their plant source. Oxford IBH publishing Co. New Delhi.
5. Miller, Light and Miller, Bryan, (1998) Ayurveda and Aromatherapy. Banarsidass, New Delhi.

Books for References

1. Anne, G. (2000) Principles of Ayurveda, Thomsons, London.
2. Kokate, C.K.et al. (1999) Pharmacognosy, NiraliPrakashan, New Delhi.
3. Trivedi, P. C. (2006) Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
4. Sharma, R. (2004) Agro techniques of medicinal plants, Daya publishing House, New Delhi,
5 Farooqi, A.A. and Sreeramu. B.S. (2001) Cultivation of medicinal and aromatic crops, University press India.
6. Purohit, S.S., and Vyas. S.P. (2008) Medicinal plant cultivation", scientific Approach, Agrobios, India, 2006.

Web Resources

1. https://www.nhp.gov.in/introduction-and-importance-of-medicinal-plants-and-herbs_mtl
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5847565/
3. https://cb.imsc.res.in/imppat/home
4. http://www.ccras.nic.in/content/medicinal-plants
5. http://envis.frlht.org/implad

Rationale for Nature of the Course

This course will help the students to develop their knowledge on diversity and importance of indigenous medicinal plants and their role in traditional medicinal systems.

Activities having direct bearing on Skill development / Employability / Entrepreneurship

The concepts learned by the students related to medicinal properties and their mechanism of action help them to gain a position in pharmaceutical and its related industries.

Pedagogy

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

Course Learning Outcomes: On the successful completion of the course the students will be able to

CLOs	CLO Statement	Knowledge level
CLO-1	Understand the importance Indian medicinal plants for traditional medicines and commercial values.	**Up to K2**
CLO-2	Familiarize the knowledge on identification, properties and uses of local medicinal plants	**Up to K2**
CLO-3	Analyze the utilization and their medicinal values of common medicinal plants	**Up to K2**
CLO-4	Evaluate the scientific screening of medicinal plants for its purity of drugs and chemical principles	**Up to K2**
CLO-5	Synthesize the conservation methods of endangered medicinal plants and also modern extraction methods of Phyto drugs	**Up to K2**

Mapping Programme Specific Outcomes with Course Learning Outcomes:

	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	PSO-9
CLO-1	2	3	3	3	3	3	2	2	2
CLO-2	3	3	2	3	3	2	1	1	2
CLO-3	3	3	3	3	2	2	2	1	1
CLO-4	2	2	3	3	2	3	3	2	1
CLO-5	3	3	2	2	3	2	2	1	1

3 – Advance application; 2 – Intermediate level; 1 – Basic level

Mapping Programme Outcomes with Course Learning Outcomes:

	PO-1	PO-2	PO-3	PO-4	PO-5
CLO-1	3	3	3	3	2
CLO-2	3	3	2	3	2
CLO-3	3	3	1	-	2
CLO-4	2	1	2	1	-
CLO-5	3	3	3	2	1

3 – Advance application; 2 – Intermediate level; 1 – Basic level

Lesson Plan

Unit	Description	Hours	Mode
I	History and scope of herbal medicines	1	Discussion
	Diversity of Indian Medicinal Plants	2	Power Point
	Role of medicinal plants in traditional medicine	2	Black Board
	Values of medicinal herbs in industries and exports	1	Power Point
II	Systematic position of selected medicinal plants	1	Discussion
	Chemical principles and medicinal uses of Tulsi and Ginger	2	Power point
	Medicinal properties of Fenu Greek	1	Black Board
	Medicinal values of Indian Goose berry and Black Pepper	2	Discussion
III	Methods of testing active principles in medicinal plants	2	Black board
	Identification of medicinal plants for utilization	1	Discussion
	Discussion on *Catharanthus* and *Withania*	1	Discussion
	Discussion on *Andrographis* and *Centella*	2	Discussion
IV	Drug adulteration	1	Quiz
	Drug evaluation – Biological methods	2	Black board
	Phytochemical screening of secondary metabolites	2	Power Point
	Types of secondary metabolites in medicinal herbs	1	Discussion
V	Conservation needs of endangered medicinal plants	1	Discussion
	Modern extraction of medicinal drugs	1	Black Board
	In vitro production of Andrographolides and colchicines	2	Power Point
	In vitro extraction of Withanolides.	2	Assignment
Total		**30**	

Blue Print – Model for Internal Examination
Articulation Mapping – K Levels with Courses Leaning Outcomes (CLOs)

Sl. No	CLOs	K- Level	Section – A Short Answer		Section B (Either/ Choice)	Section C (Open Choice)	Total
			No. of Questions	K - Level			
1	CLO x	Up to K 2	2	K1& K1	2(K2&K2)	1 (K1)	
2	CLO y	Up to K 2	1	K1	2(K2&K2)	2 (K1& K1)	
No. of Question to be asked			3		4	3	14
No. of Question to be answered			2		2	2	10
Mark for each question			2		7	10	
Total Marks for each section			6		14	20	40

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers

Distribution of Section- wise Marks with K Levels

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	**Total Marks**	% of Marks without choice	**Consolidated**
K1	10	-	30	**40**	66.67	**100**
K2	-	20	-	**20**	33.33	
Total Marks	10	20	30	**60**	100.00	**100%**

Blue Print – Model for External Examination

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

Sl. No	CLOs	K- Level	Section – A Short Answer		Section B (Either/ Choice)	Section C (Open Choice)
			No. of Questions	K – Level		
1	CLO 1	Up to K 2	1	K1	2(K2&K2)	1 (K1)
2	CLO 2	Up to K 2	1	K1	2(K2&K2)	1 (K1)
3	CLO 3	Up to K 2	1	K1	2(K2&K2)	1 (K1)
4	CLO 4	Up to K 2	1	K1	2(K2&K2)	1 (K1)
5	CLO 5	Up to K 2	1	K1	2(K2&K2)	1 (K1)
No. of Question to be asked			5		10	5
No. of Question to be answered			5		5	3
Mark for each question			2		7	10
Total Marks for each section			10		35	30

K1 - Remembering and recalling facts with specific answers
K2- Basic understanding of fact and stating main ideas with general answers

Distribution of Section- wise marks with K Levels

K Levels	Section A (No Choice)	Section B (Either/or)	Section C (Open Choice)	**Total Marks**	% of Marks without choice	**Consolidated**
K1	20	-	50	**70**	58.33	**100**
K2	-	50	-	**50**	41.67	
Total Marks	20	50	50	**120**	100.00	**100%**

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