ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

I SEMESTER Course-1 BOTANY TIME: 3Hrs/week

BOTANY 1101 (3) DIVERSITY OF MICROBES Max.Marks:100

w.e.f. "25AM"

I. Objectives: By the end of this course the learner has to:

1. Gain awareness on hypotheses about the origin of life on Earth, and structure and multiplication of viruses.
2. Identify and describe the unique characteristics and significance of special types of bacteria.
3. Describe the structure, classification, and reproductive methods of eubacteria.
4. Tell the types of soil microorganisms and explain their interactions with each other, plants, and soil components.
5. Identify and differentiate between beneficial and harmful activities microbes in different fields.

II. Course Outcomes: On completion of this course students will be able to:

1. Illustrate the origin of life on Earth and diversity, multiplication and economic value of viruses.
2. Deliberate the general characteristics, and economic importance of special groups of bacteria.
3. Explain the structure, nutrition, reproduction and significance of eubacteria.
4. Evaluate the interactions of soil microbes among themselves and with plants.
5. Compile the value and applications of microbes in various fields.

Course Syllabus:

Unit-1: Origin of life and Viruses 10 Hrs.

1. Origin of life, concept of primary Abiogenesis; Miller and Urey experiment.; discovery of microorganisms, Pasteur experiments, germ theory of diseases; three domain – six kingdom classification of Carl Woese.
2. Shape and symmetry of viruses; structure of TMV and Gemini virus.
3. Lytic and lysogenic cycles of T-even phages; a brief account of prions, viroids and virusoids.
4. Transmission of plant viruses and their control; significance of viruses in production of vaccines and bio-pesticides.

Unit-2: Special groups of Bacteria 7 Hrs.

1. General characteristics, and economic importance of following special groups of bacteria:
   a) Archaebacteria b) Actinomycetes c) Phytoplasma d) Cyanobacteria
2. Culture and cultivation of *Spirulina*

Unit-3: Eubacteria 8 Hrs.

1. Occurrence, distribution and cell structure of eubacteria; classification of Eubacteria based on nutrition
2. Reproduction- asexual (binary fission and endospores) and bacterial recombination (conjugation, transformation, and transduction).
3. Economic importance of Eu-bacteria with reference to their role in Agriculture and industry (fermentation and medicine).

Unit-4: Soil microbes – interactions 10 Hrs.

1. Distribution of microorganisms in soil; factors influencing the soil microflora; role of microorganisms in soil fertility.
2. Microbial interactions: symbiosis, neutralism, commensalism, competition, antagonism, synergism, parasitism and predation.
3. Microorganisms of rhizosphere, phyllosphere and spermosphere; microbial interactions and their effect on plant growth.

Unit-5: Beneficial and harmful microbes 10 Hrs.

1. A brief account of symptoms of viral diseases in plants; Tungro disease in paddy.
2. A summary of symptoms of bacterial diseases in plants; Citrus canker.
3. Microorganisms as food; probiotics and prebiotics; products from microorganisms, Metabolites, enzymes, and antibiotics.
4. Bacterial and Cyanobacterial biofertilizers – their applications; Bacterial biopesticides and their applications.

IV. Text Books:

1. Bhattacharjee, R.N., (2017) Introduction to Microbiology and Microbial Diversity, Kalyani publishers, New Delhi.
2. Dubey, R.C. & D. K. Maheswari (2013) A Text Book of Microbiology, S. Chand & Company Ltd., New Delhi
3. Toshiwal, R.L. (2007) Agricultural Microbiology, Agrobios (India), Jodhpur

V. Reference Books:

1. Pelczar Jr., M.J., E.C.N. Chan & N. R. Krieg (2001) Microbiology, Tata McGraw-Hill Co, New Delhi
2. Presscott, L. Harley, J. and Klein, D. (2005) Microbiology, Tata McGraw-Hill Co. New Delhi.
3. Gyaneshwar, A.D., G.J. Parekh, and V.S. Reddy (2004) Agricultural Microbiology: Plant-Soil Interactions, Research Signpost, Kerala, India
4. Zaki A. Shuler and Zainul Abid (2014) Agricultural Microbiology: Principles and Applications, CRC Press, Boca Raton, Florida, USA

VI. Suggested activities and evaluation methods: Unit-1: Activity: Collecting scientific literature on historical developments in microbiology. **Evaluation method:** Evaluating the report based on a rubric. **Unit-2: Activity:** Group discussion on various groups of special bacteria. **Evaluation method:** Assessment of active participation, soft skills, communication skills, collaborative skills, time management etc., of a group or a student based on a rubric.

Unit-3: Activity: Presentation or poster summarizing the classification of Eu-bacteria based on nutrition. **Evaluation method:** Assessment based on accuracy and understanding.

Unit-4: Activity: Microscopic observation of bacterial samples from soil/ phylloplane in their native place/ college campus. **Evaluation method:** Evaluating the report on characteristics and classification of eubacteria.

Unit-5: Activity: Visit to Agriculture/Horticulture universities to learn about biofertilizers and biopesticides. **Evaluation method:** Evaluating the report submitted by the student based a rubric.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

I SEMESTER	**BOTANY**	**TIME: 2Hrs/week**
BOTANY B-Ma 1-1151 (2)	**DIVERSITY OF MICROBES**	**Max.Marks:50**
w.e.f. "25AM"	**Practical Syllabus**	

Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Take all necessary precautions in the microbiology laboratory.
2. Handle the instruments and prepare media for laboratory work.
3. Identify various microbes through microscopic observations.

II. Laboratory/Field exercises:

1. Study the principle and applications of important instruments (autoclave, hot air oven, incubator, Inoculation loop, Inoculation needle, membrane filter, laminar air flow system, colony counter. biological safety cabinets, BOD incubator, pH meter) used in the microbiology laboratory.
2. Study of Viruses (TMV and Gemini) using electron micrographs/ models.
3. Microscopic study of Cyanobacteria using temporary/permanent slides.
4. Study of Archaebacteria, Actinomycetes and Phytoplasma using permanent slides/ electron micrographs/diagrams.
5. Microscopic study of Eubacteria using temporary/permanent slides.
6. Gram staining technique of Bacteria.
7. Demonstration of culture and cultivation of *Spirulina*.
8. Tungro in Paddy and Citrus canker.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

I SEMESTER BOTANY TIME: 3Hrs/week

BOTANY B-Ma2 1101 (3) DIVERSITY OF THALLOPHYTES Max.Marks:100

w.e.f. "25AM"

I. Objectives: By the end of this course the learner has to:

1. Brief the general characters, classification and value of algae.
2. Discuss the morphology, reproduction and life cycles of some algae.
3. Tell the general characters, classification and value of fungi.
4. Discuss the morphology, reproduction and life cycles of some fungi.
5. Summarize the morphology, anatomy, reproduction and economic value of lichens.

II. Course Outcomes: On completion of this course students will be able to:

1. Compile the general characteristics of algae and their significance in nature.
2. Compare and contrast the characteristics of different groups of algae.
3. Summarize the important features of fungi and their economic value.
4. Distinguish different groups of fungi based on their characteristics.
5. Elaborate the features and significance of lichens.

III. Syllabus of Theory:

Unit-1: Introduction to Algae 8Hrs.

1. General characteristics of algae: occurrence and distribution, cell structure, pigments, flagella and reserve food material.
2. F.E.Fritsch (1935) classification of algae; thallus organization in algae.
3. Life cycles in algae; ecological and economic importance of algae.

Unit-2: Biology of selected Algae 10Hrs.

1. Occurrence, structure, reproduction and life cycle of: (a) Chlorophyceae: *Spirogyra* (b) Phaeophyceae: *Ectocarpus* and (c) Rhodophyceae: *Polysiphonia*
2. Culture and cultivation of *Chlorella*

Unit-3: Introduction to Fungi 8Hrs.

1. General characteristics of fungi; Ainsworth (1973) classification.
2. Thallus organization and nutrition in fungi.
3. Reproduction in fungi (asexual and sexual); heterothallism and para-sexuality.
4. Ecological and economic importance of fungi.

Unit-4: Biology of selected Fungi 10Hrs.

1. Occurrence, structure, reproduction and life cycle of. (a) Zygomycotina: *Rhizopus* (b) Ascomycotina: *Penicillium* (c) Basidiomycotina: *Puccinia*
2. General account of Dueteromycetes; Tikka disease of Groundnut, Red rot of Sugarcane.

Unit-5: Lichens 7 Hrs.

1. Lichen: definition, phycobionts and mycobionts in lichens; morphology and internal structure of lichens; classification based on growth form, habitat and fungal partner.
2. Reproduction – vegetative, asexual and sexual methods.
3. Ecological and economic importance of lichens.

IV. Text Books:

1. Pandey, B.P. (2013) College Botany; Volume-I, S. Chand Publishing, New Delhi
2. Hait,G., K.Bhattacharya & A.K.Ghosh (2011) A Text Book of Botany; Volume-I, New Central Book Agency Pvt. Ltd., Kolkata

V. Reference Books:

1. Fritsch, F.E. (1945) The Structure & Reproduction of Algae (Vol. I & Vol. II) Cambridge University Press Cambridge, U.K.
2. Bold, H.C.& M. J. Wynne (1984) Introduction to the Algae, Prentice-Hall Inc., New Jersey
3. Robert Edward Lee (2008) Phycology, Cambridge University Press, New York
4. Van Den Hoek, C., D.G.Mann & H.M.Jahns (1996) Algae: An Introduction to Phycology. Cambridge University Press, New York.
5. Alexopoulos, C.J., C.W.Mims & M.Blackwell (2007) Introductory Mycology, Wiley& Sons, Inc., New York
6. Mehrotra, R.S.& K. R. Aneja (1990) An Introduction to Mycology. New Age International Publishers, New Delhi.

7. Kevin Kavanagh (2005) Fungi; Biology and Applications John Wiley& Sons, Ltd., West Sussex, England.
8. John Webster & R. W. S. Weber (2007) Introduction to Fungi, Cambridge University Press, New York.

VI. Suggested activities and Evaluation methods: Unit-1: Activity: Algae specimen collection from any water bodies in their locality, recording the characteristics, identification and classifying them according to Fritsch system. **Evaluation method:** Evaluating the presentation or report summarizing findings.

Unit-2: Activity: Microscopic observations and recording distinguishing characters of any six algal forms excluding the genera in the syllabus. **Evaluation method:** Conducting a Quiz or an exam/ evaluating the chart or drawings or summarized data on similarities and differences.

Unit-3: Activity: Collection of economically valuable fungal products. **Evaluation method:** Evaluating the collections made and awarding grade.

Unit-4: Activity: Group discussion/quiz/JAM on characteristics of various groups of algae. **Evaluation method:** Assessment of the performance of individual/group of students based on a rubric.

Unit-5: Activity: Microscopic observations and summarizing the salient features of the fungal genera and lichen forms in the syllabus. **Evaluation method:** Conducting a Quiz or an exam/ evaluating the chart or drawings or concise data on similarities and differences.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

I SEMESTER Course-1 BOTANY TIME: 2Hrs/week

BOTANY B- Ma2 1105 DIVERSITY OF THALLOPHYTES Max.Marks:50

W.e.f. "25AM" Practical Syllabus

Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Identify some algal and fungal species based on the structure of thalli and reproductive organs.
2. Decipher the lichens based on morphological, anatomical and reproductive features.
3. Realize the value of algal, fugal and lichen products available in markets.

II. Laboratory/field exercises: Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts:

1. **Algae:** *Spirogyra, Ectocarpus, Vaucheria* and *Polysiphonia;* a centric and a pennate diatom.
2. Demonstration of culture and cultivation of *Chlorella*
3. Identification of some algal products available in local market.
4. **Fungi:** *Rhizopus, Penicillium* and *Puccinia*
5. Tikka disease of Groundnut and Red rot of Sugarcane
6. Identification of some fungal products available in the local market.
7. **Lichens:** Crustose, foliose and fruticose
8. Identification of some lichen products available in the local market.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

II SEMESTER Course-3 BOTANY TIME: 3Hrs/week

BOTANY B-Ma1 2102 DIVERSITY OF ARCHEGONIATES Max.Marks:100

W.e.f. "25AM"

I. Objectives: By the end of this course the learner has to:

1. Explain the general characters, classification and significance of Bryophytes.
2. Discuss the morphological, anatomical and reproductive characters of Pteridophytes.
3. Acquire knowledge of evolutionary trends in Pteridophytes and their value.
4. Brief the morphological, anatomical and reproductive characters of Gymnosperms.
5. Summarize the evolutionary trends in Gymnosperms.

II. Course Outcomes: On completion of this course students will be able to:

1. Compare and contrast the morphological, anatomical and reproductive features of some Bryophytes.
2. Illustrate the morphological, anatomical and reproductive characteristics of some Pteridophytes.
3. Infer the evolution of vasculature, heterospory, and seed habit in Pteridophytes.
4. Compare and contrast the morphological, anatomical and reproductive features of some Gymnosperms.
5. evaluate the evolutionary trends in Gymnosperms.

III. Syllabus of Theory:

Unit-1: Biology of Bryophytes 9 Hrs.

1. General characteristics of Bryophytes; Rothmaler (1951) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of (a) Hepaticopsida: **Marchantia** (b) Anthocerotopsida: **Anthoceros** (c) Bryopsida: **Funaria**
3. General account on the evolution of sporophytes in Bryophyta.

Unit-2: Biology of Pteridophytes 10 Hrs.

1. General characteristics of Pteridophyta: Smith (1955) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Lycopsida: **Lycopodium** (b) Sphenopsida: **Equisetum** and (c) Filicopsida: **Marsilea**

Unit-3: Evolutionary trends in Pteridophytes 8 Hrs.

1. Geological time scale: a brief account of **Rhynia**
2. Stelar evolution in Pteridophytes; heterospory and seed habit.
3. Ecological and economic importance of Pteridophytes.

Unit-4: Biology of Gymnosperms 10 Hrs.

1. General characteristics of Gymnosperms: Sporne (1965) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of:(a) Cycadopsida: **Cycas** (b) Ginkgoopsida: **Ginkgo** and (b) Gnetopsida: **Gnetum**

Unit-5: Evolutionary trends in Gymnosperms 8 Hrs.

1. A brief account on fossilization processes and types of fossils.
2. A over view of **Cycadeoidea** and **Pentoxylon**
3. A summary of evolutionary trends in Gymnosperms.
4. Ecological and economic importance of Gymnosperms.

IV. Text Books:

1. Acharya, B.C., (2019) Archegoniates, Kalyani Publishers, New Delhi
2. Bhattacharya, K., G. Hait&Ghosh, A. K., (2011) A Text Book of Botany, VolumeII, New Central Book Agency Pvt. Ltd., Kolkata
3. Hait,G., K.Bhattacharya & A.K.Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata
4. Pandey, B.P. (2013) College Botany, Volumes-I&II, S. Chand Publishing, New Delhi

V. Reference Books:

1. Shaw, A.J.& B.Goffinet (2000) Bryophyte Biology. Cambridge University Press, New York
2. Smith, G.M. (1971) Cryptogamic BotanyVol. II., Tata McGraw Hill, New Delhi
3. Sharma,O.P.(2012) Pteridophyta. Tata McGraw-Hill, New Delhi
4. Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London
5. Coulter, J.M. & C.J.Chamberlain(1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois
6. Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New Delhi

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Collection and identification of Bryophytes from their locality. **Evaluation method:** Assessing the collections made by the student and assigning a grade.
Unit-2: Activity: Making temporary slides/models/drawings of Pteridophytes in the syllabus. **Evaluation method:** Assessment of the temporary slides/model/drawing.
Unit-3: Activity: Group discussion/Quiz/JAM on evolutionary trends in Pteridophytes. **Evaluation method:** Assessing the abilities of a group/ an individual based on the performance.
Unit-4: Activity: Study of wood elements in locally available Gymnosperms and making temporary slides. **Evaluation method:** Validation of prepared slides submitted by the learner.
Unit-5: Activity: Assignment/seminar on evolutionary trends in Gymnosperms-making comparative account. **Evaluation method:** Evaluating the quality of assignment written with apt examples/quality of presentation using a rubric.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

I SEMESTER Course-3 BOTANY TIME: 2Hrs/week

BOTANY B-Ma1 2152 DIVERSITY OF ARCHEGONIATES Max.Marks:50

w.e.f. "25AM" Practical Syllabus

Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, the student shall be able to:

1. distinguish the Pteridophytes and Gymnosperms based on their morphological, anatomical and reproductive structures.
2. make systematic classification of plant species using vegetative and floral characters.
3. identify angiosperm plant species and make herbarium specimens.

II Laboratory/field exercises:

1. Study/ microscopic observation of vegetative, sectional/anatomical, and reproductive structures of the following using temporary or permanent slides/specimen/ mounts: A. Bryophyta: **Marchantia**, **Anthoceros** and **Funaria** B. Pteridophyta: **Rhynia**, **Lycopodium**, **Equisetum**, and **Marselia** C. Gymnosperms: **Cycadeoidea**, **Pentoxylon**, **Cycas**, **Ginkgo** and **Gnetum**
2. Field trip to a Botanic garden or local floristic area/forest.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

II SEMESTER Course-4 BOTANY TIME: 3Hrs/week

BOTANY B-Ma1 2102 ANATOMY AND EMBRYOLOGY Max.Marks:100

w.e.f. "25AM"

I. Objectives: By the end of this course the learner has to:

1. Deliberate about various types of tissues in plants and their organization.
2. Explain anomalous secondary growth in plants and economic value of woods.
3. Debate on structure of anther and development of male gametophyte in plants.
4. Discuss the structure of ovules and process of fertilization.
5. Explain the embryo development and seed structure in monocots and dicots.

II. Course Outcomes: On completion of this course students will be able to:

1. Categorize various tissues and evaluate their role in plants.
2. Explain anomalous secondary growth in some plants and justify the value of timber plants.
3. Summarize the events in micro-sporogenesis and development of male gametophyte.
4. Illustrate the events in mega-sporogenesis and development of female gametophyte.
5. Propose the incidents in embryogenesis and structure of seeds in angiosperms.

III. Syllabus of Theory:

Unit-1: Tissues in plants 8 Hrs.

1. Meristematic tissues: Definition, classification, structure and functions.
2. Apical meristems: Generalized structure of shoot apex, theories on organization of Shoot Apical Meristem (SAM) - Apical cell theory, Tunica-Corpus theory and Histogen theory.
3. Permanent tissues (simple and complex); a brief account of plant secretory tissues/cells.

Unit-2: Anomalous growth in plants 10Hrs.

1. Tissue systems - Epidermal, ground and vascular.
2. Anomalous secondary growth in root of **Beta vulgaris**; anomalous secondary growth in stems of **Boerhaavia** and **Dracaena**
3. Study of timbers of economic importance - Teak, Red-sanders and Rosewood; applications of anatomy forensics and pharmacognosy.

Unit-3: Anther and pollen 10Hrs.

1. Anther: Structure and functions of anther wall, micro-sporogenesis.
2. Pollen wall structure, NPC system; development of male gametophyte, MGU (male germ unit).
3. Pollen wall proteins; pollen viability, storage and germination; abnormal features: Pseudomonads and polyads; Nemec phenomenon.
4. A brief account of palynology and its scope.

Unit-4: Ovules, fertilization and endosperm 10Hrs.

1. Structure and types of ovules, megasporogenesis; monosporic (**Polygonum**), bisporic (**Allium**) and tetrasporic (**Peperomia**) types of embryo sacs.
2. Pollination: types of self and cross pollination – contrivances; agents of pollination.
3. Double fertilization in angiosperms – process and consequences.
4. Perisperm; endosperm – types (free nuclear, cellular, helobial and ruminate) and biological importance.

Unit-5: Embryogeny and seeds

7Hrs.

1. Embryo development in dicot (**Capsella bursa-pastoris**) and monocot (**Sagittaria sagittifolia**) plants.
2. Seed structure in monocot and dicot; importance of seed and seed dispersal mechanisms.
3. Polyembryony and apomixes: Introduction, classification, causes and applications.

IV. Text Books:

1. Pandey, B.P. (2013) College Botany, Volumes-II& III, S. Chand Publishing, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume-II, New Central Book Agency Pvt. Ltd., Kolkata

V. Reference Books:

1. Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA.
2. Fahn, A. (1990) Plant Anatomy, Pergamon Press, Oxford.
3. Cutler, D.F., T. Botha & D. Wm. Stevenson (2008) Plant Anatomy: An Applied Approach, Wiley, USA
4. Paula Rudall (1987) Anatomy of Flowering Plants: An Introduction to Structure and Development. Cambridge University Press, London
5. Bhojwani, S. S. and S. P. Bhatnagar (2000) The Embryology of Angiosperms (4th Ed.). Vikas Publishing House, Delhi.
6. Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
7. Maheswari, P. (1971) An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
8. Johri, B.M. (2011) Embryology of Angiosperms. Springer-Verlag, Berlin

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Microscopic observations on different tissues in plants and recording characteristics. **Evaluation method:** Judgement of the report/seminar on comparative and contrasting features of various tissues in plants.

Unit-2: Activity: Visits to timber depots and furniture shops and making a report on various woods. **Evaluation method:** Assessment of report submitted with data, photographs and summary.

Unit-3: Activity: Study of pollen structure, germination and viability in some local plant species. **Evaluation method:** Evaluating the report/seminar presentation with collected data.

Unit-4: Activity: Group discussion/quiz on endosperm types and functions. **Evaluation method:** Assessment of the best performing group.

Unit-5: Activity: Drawings of embryogeny in some angiosperms and making comparative report. **Evaluation method:** Evaluating the best drawings and comparative report.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

I SEMESTER Course-4 BOTANY TIME: 2Hrs/week

BOTANY B-Ma1-2152 ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS Max.Marks:50

w.e.f. "25AM" Practical Syllabus

Practical Credits: 1 2 hrs/week

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Conduct dissections of various plant organs and study the internal structures by staining.
2. Explain the embryological characteristics from sex organs to seeds in angiosperms.
3. Demonstrate skills in studying anatomical and embryological features of angiosperms.

II. Laboratory/field exercises:

1. Observation of meristems in dicot and monocot plants.
2. Tissue organization in shoot apices using permanent slides.
3. Tissues; Simple Complex and Secretory ; stomata - Dicot and Monocot Tissues, lenticel.
4. Anomalous secondary growth in root of **Beta vulgaris**
5. Anomalous secondary growth in stems of **Boerhaavia** and **Dracaena**.
6. Study of anther and ovules using permanent slides/photographs.
7. Study of pollen germination and pollen viability.
8. Dissection and observation of embryo sac haustoria in **Santalum** or **Argemone**.
9. Structure of endosperm (nuclear and cellular) using permanent slides/photographs.
10. Dissection and observation of endosperm haustoria in **Crotalaria** or **Coccinia**.
11. Developmental stages of dicot and monocot embryos using permanent slides/photographs.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER BOTANY TIME: 3Hrs/week

B-Mi1 3101 (3) Vascular Plants Max.Marks:100

W.e.f. "24AL" (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

I. Learning Objectives: By the end of this course the learner has:

1. To recognize the morphology, anatomy and reproduction in two groups of archegoniates.
2. To acquire knowledge of the taxonomic aids and classification systems.
3. To read the vegetative and floral characteristics of some forms of angiospermic families along with their economic value.
4. To study the significance of other branches of botany in relation to plant taxonomy.

II. Learning Outcomes: On completion of this course students will be able to:

1. Infer the evolution of vasculature, heterospory and seed habit in Pteridophytes.
2. Illustrate the general characteristics of Gymnosperms along with their uses.
3. Discuss about some Taxonomic aids and their applications in plant systematics.
4. Compare and contrast the vegetative and floral characteristics of some angiospermic families.
5. Evaluate the economic value of plant species from the families under the study.
6. Defend the utility of evidences from different branches of botany in solving the taxonomic lineages of some species.

III. Syllabus of Theory:

Unit-1: Pteridophytes (10 Hrs.)

1. General characteristics of Pteridophyta; Smith (1955) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Lycopsida: *Lycopodium* and (b) Filicopsida: *Marsilea*
3. Stelar evolution in Pteridophytes; Heterospory and seed habit.
4. Ecological and economic importance of Pteridophytes.

Unit-2: Gymnosperms (10 Hrs.)

1. General characteristics of Gymnosperms; Sporne (1965) classification.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of: (a) Cycadopsida: *Cycas* and (b) Gnetopsida: *Gnetum*
3. Ecological and economic importance of Gymnosperms.

Unit-3: Principles of Plant Taxonomy (10 Hrs.)

1. Aim and scope of taxonomy, species concept, taxonomic hierarchy-major and minor categories.
2. Plant nomenclature: Binomial system, ICBN- rules for nomenclature.
3. Herbarium and its techniques, BSI herbarium and Kew herbarium; concept of digital herbaria.
4. Bentham and Hooker system of classification.
5. Phylogenetic systematics: primitive and advanced, homology and analogy, parallelism and convergence, monophyly, paraphyly, polyphyly, clades, synapomorphy, symplesiomorphy, apomorphy. APG-IV classification.

Unit-4: Descriptive Plant Taxonomy (8 Hrs.) Systematic description and economic importance of the following families:

1. Polypetalae: (a) Annonaceae (b) Cucurbitaceae
2. Gamopetalae: (a) Asteraceae (b) Asclepiadaceae
3. Monochlamydae: (a) Amaranthaceae (b) Euphorbiaceae
4. Monocotyledonae: (a) Arecaceae (b) Poaceae

Unit-5: Evidences for Plant systematics (7 Hrs.)

1. Anatomy and embryology in relation to plant systematics.
2. Cytology and cytogenetics in relation to plant systematics.
3. Phytochemistry in relation to plant systematics.
4. Numerical taxonomy
5. Origin and evolution of angiosperms.

IV. Text Books:

1. Acharya, B.C., (2019) Archchegoniates, Kalyani Publishers, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume II, New Central Book Agency Pvt. Ltd., Kolkata
3. Hait, G., K. Bhattacharya & A.K. Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata
4. Pandey, B.P. (2013) College Botany, Volumes-I & II, S. Chand Publishing, New Delhi

V. Reference Books:

1. Smith, G.M. (1971) Cryptogamic Botany Vol. II., Tata McGraw Hill, New Delhi
2. Sharma, O.P. (2012) Pteridophyta. Tata McGraw-Hill, New Delhi
3. Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London
4. Coulter, J.M. & C.J. Chamberlain (1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois
5. Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New Delhi
6. Sambamurty, A.V.S.S. (2005) Taxonomy of Angiosperms I. K. International Pvt. Ltd., New Delhi
7. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi.
8. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.

VI. Suggested activities and evaluation methods:

Unit-1: Activity: Making temporary slides/models/drawings of Pteridophytes in the syllabus.
Evaluation method: Assessment of the temporary slides/model/drawing.
Unit-2: Activity: Study of wood elements in locally available Gymnosperms and making temporary slides.
Evaluation method: Validation of prepared slides submitted by the learner.
Unit-3: Activity: Botanical field trip and collecting plant specimens for herbarium.
Evaluation method: Attendance in field trip and submission of field note book and herbarium sheets with filled in labels.
Unit-4: Activity: Making good models or drawings or collection of photographs of some important plant species from the families included in the syllabus.
Evaluation method: Authorize the quality of the work and conferring reward.
Unit-5: Activity: Collection of scientific literature on solving taxonomic problems by taking evidences from other branches of Botany.
Evaluation method: Validation of the collection submitted along with summary.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

III SEMESTER Course-2 BOTANY TIME: 2Hrs/week

BOTANY B-Mi1 3151 (2) Vascular Plants Max.Marks:50

W.e.f. "24AL" (Pteridophytes, Gymnosperms and Taxonomy of Angiosperms)

Practical Syllabus

I. Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Distinguish the Pteridophytes and Gymnosperms based on their morphological, anatomical and reproductive structures.
2. Make systematic classification of plant species using vegetative and floral characters.
3. Identify angiosperm plant species and make herbarium specimens.

II Laboratory/field exercises: I. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/specimens/ mounts:

1. Pteridophyta: *Lycopodium* and *Marselia*
2. Gymnosperms: *Cycas* and *Gnetum*

II. Technical description of locally available plant species from the following angiosperm families:

1. Annonacae
2. Cucurbitaceae
3. Asteraceae
4. Asclepiadaceae
5. Amaranthaceae
6. Euphorbiaceae
7. Arecaceae
8. Poaceae

III. Demonstration of herbarium techniques. IV. Field trip to a local floristic area/forest (Submission of 30 number of Herbarium sheets of wild plants with the standard system are mandatory).

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER BOTANY TIME: 3Hrs/week

BOTANY B-Mi1 4101 (3) Anatomy and Embryology of angiosperms Max.Marks:100

W.e.f. "24AL"

I. Learning Objectives: By the end of this course the learner has:

1. To know about various types of tissues in plants and their organization.
2. To obtain awareness on anomalous secondary growth in plants and economic value of woods.
3. To acquire knowledge on development of male and female gametophytes in plants.
4. To probe into embryogenesis in angiosperms.

II. Learning Outcomes: On completion of this course students will be able to:

1. Categorize various tissues and evaluate their role in plants.
2. Explain anomalous secondary growth in some plants and justify the value of timber plants.
3. Summarize the events in micro-sporogenesis and development of male gametophyte.
4. Discuss the events in mega-sporogenesis and development of female gametophyte.
5. Propose the incidents in embryogenesis of an angiospermic plant species.
6. Compile the aspects of developmental and reproductive biology in plants.

III. Syllabus of Theory:

Unit – 1: Tissues in plants (8 Hrs.)

1. Meristematic tissues: Definition, classification, structure and functions.
2. Apical meristems: Generalised structure of shoot apex, theories on organization of Shoot Apical Meristem (SAM) - Apical cell theory, Tunica-Corpus theory and Histogen theory.
3. Permanent tissues (simple and complex).
4. A brief account of plant secretory tissues/cells.

Unit-2: Anomalous growth in plants (10 Hrs.)

1. Tissue systems—Epidermal, ground and vascular.
2. Anomalous secondary growth in root of *Beta vulgaris*
3. Anomalous secondary growth in stems of *Boerhaavia* and *Dracaena*
4. Study of timbers of economic importance - Teak, Red-sanders and Rosewood.
5. Applications of anatomy in plant systematics, forensics and pharmacognosy.

Unit-3: Anther and pollen (10 Hrs.)

1. Anther: Structure and functions of anther wall, micro-sporogenesis, callose deposition and its significance.
2. Pollen wall structure, MGU (male germ unit) structure, NPC system; a brief account of Palynology and its scope; development of male gametophyte.
3. Pollen wall proteins; Pollen viability, storage and germination; Abnormal features: pseudomonads, polyads, massulae, pollinia.

Unit-4: Ovules, fertilization and endosperm (10 Hrs.)

1. Structure and types of ovules, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types of embryo sacs.
2. Outlines of pollination; self-incompatibility- basic concepts; methods to overcome self-incompatibility (mixed pollination, bud pollination, stub pollination).
3. Double fertilization in angiosperms – process and consequences.
4. Perisperm; endosperm – types (free nuclear, cellular, helobial and ruminate) and biological importance.

Unit-5: Embryogeny and seeds (7 Hrs.)

1. Embryogeny in dicot (*Capsella bursa-pastoris*)
2. Embryogeny in monocot (*Sagittaria sagittifolia*).
3. Seed structure in monocot and dicot.
4. Importance of seed and seed dispersal mechanisms.
5. Polyembryony and apomixes: Introduction, classification, causes and applications.

IV. Text Books:

1. Pandey, B.P. (2013) College Botany, Volumes-II & III, S. Chand Publishing, New Delhi
2. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume-II, New Central Book Agency Pvt. Ltd., Kolkata

V. Reference Books:

1. Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA.
2. Fahn, A. (1990) Plant Anatomy, Pergamon Press, Oxford.
3. Cutler, D.F., T. Botha & D. Wm. Stevenson (2008) Plant Anatomy: An Applied Approach, Wiley, USA
4. Paula Rudall (1987) Anatomy of Flowering Plants: An Introduction to Structure and Development. Cambridge University Press, London
5. Bhojwani, S. S. and S. P. Bhatnagar (2000) The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
6. Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
7. Maheswari, P. (1971) An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
8. Johri, B.M. (2011) Embryology of Angiosperms. Springer-Verlag, Berlin

VI. Suggested activities and evaluation methods:

- **Unit-1: Activity:** Microscopic observations on different tissues in plants and recording characteristics.
    - **Evaluation method:** Judgement of the report/seminar on comparative and contrasting features of various tissues in plants.
- **Unit-2: Activity:** Visits to timber depots and furniture shops and making a report on various woods.
    - **Evaluation method:** Assessment of report submitted with data, photographs and summary.
- **Unit-3: Activity:** Study of pollen structure, germination and viability in some local plant species.
    - **Evaluation method:** Evaluating the report/seminar presentation with collected data.
- **Unit-4: Activity:** Group discussion/quiz on endosperm types and functions.
    - **Evaluation method:** Assessment of the best performing group.
- **Unit-5: Activity:** Drawings of embryogeny in some angiosperms and making comparative report.
    - **Evaluation method:** Evaluating the best drawings and comparative report.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER **BOTANY** **TIME: 2Hrs/week**

BOTANY B-Mi1 4151 **Anatomy and Embryology of angiosperms** **Max.Marks:50**

W.e.f. "24AL" **Practical Syllabus**

Course Outcomes: On successful completion of this practical course, student shall be able to:

1. Conduct dissections of various plant organs and study the internal structures by staining.
2. Look into the embryological characteristics from sex organs to seeds in angiosperms.

Laboratory/field exercises:

1. Observation of meristems in dicot and monocot plants.
2. Tissue organization in shoot apices using permanent slides.
3. Anomalous secondary growth in root of *Beta vulgaris*
4. Anomalous secondary growth in stems of *Boerhaavia* and *Dracaena*.
5. Study of anther and ovule s using permanent slides/photographs.
6. Study of pollen germination and pollen viability.
7. Dissection and observation of embryo sac haustoria in *Santalum* or *Argemone*.
8. Structure of endosperm (nuclear and cellular) using permanent slides/photographs.
9. Dissection and observation of Endosperm haustoria in *Crotalaria* or *Coccinia*.
10. Developmental stages of dicot and monocot embryos using permanent slides /photographs.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER BOTANY TIME: 3Hrs/week

BOTANY B-Mi1 4101 (3) Plant Ecology, Biodiversity and Phytogeography Max.Marks:100

W.e.f. "24AL"

I. LEARNING OBJECTIVES

By the end of this course, the learner will be able to:

1. Understand the components of an ecosystem and energy flow among different trophic levels.
2. Explain the characteristics of autecology and synecology.
3. Understand climate change and its impacts on biotic components.
4. Recognize the value of biodiversity, its threats, and conservation strategies.
5. Know the distribution of various plant groups in different geographical areas.

II. LEARNING OUTCOMES

On completion of this course, students will be able to:

1. Explain interactions among biotic and abiotic components in an ecosystem.
2. Summarize the characteristics of populations and communities.
3. Anticipate environmental problems arising due to climate change.
4. Assess biodiversity value and select appropriate conservation strategies.
5. Conduct surveys on the distribution of plant groups in specific geographical areas.

III. SYLLABUS OF THEORY

UNIT 1: Basic Concepts in Ecology *(10 Hrs.)*

1. Ecology: Definition, branches, significance, and relationship with other sciences.
2. Structure and function of ecosystems – Abiotic and biotic components; energy flow.
3. Cycling of materials – Water, carbon, nitrogen, and phosphorus; trophic pyramids, food chains, and food webs.
4. Plants and environment – Climatic factors (light and temperature) and edaphic factors.
5. Interactions among plants; interactions between plants and animals.

UNIT 2: Population and Community Ecology *(10 Hrs.)*

1. Population ecology: Definition, characteristics – natality, mortality, growth curves, ecotypes, ecads.
2. Community ecology: Characteristics – frequency, density, cover, life forms, competition, biological spectrum.
3. Ecological succession – Hydrosere and xerosere.
4. Concepts of productivity – Gross Primary Productivity (GPP), Net Primary Productivity (NPP), and community respiration.
5. Secondary production, P/R ratio, and ecosystems.

UNIT 3: Climate Change – Impacts *(8 Hrs.)*

1. Soil degradation – Causes, consequences, and management strategies.
2. Deforestation and forest fires – Causes, consequences, and management strategies.
3. Global warming, ozone layer depletion, acid rain, and ocean acidification – Causes and effects.
4. Carbon footprints and carbon credits; Montreal Protocol and Kyoto Protocol.
5. Plant indicators and their role in environmental monitoring.

UNIT 4: Concepts of Biodiversity *(10 Hrs.)*

1. Biodiversity: Basic concepts; Convention on Biodiversity – Earth Summit.
2. Value of biodiversity; types and levels of biodiversity; threats to biodiversity.
3. Biodiversity hotspots in India – North Eastern Himalayas and Western Ghats.
4. Principles of conservation – IUCN threat categories and Red Data Book.
5. Role of NBPGR and NBA in biodiversity conservation.

UNIT 5: Phytogeography *(7 Hrs.)*

1. Principles of phytogeography; distribution – wide, endemic, and discontinuous species.
2. Endemism – Types and causes.
3. Phytogeographic regions of the world.
4. Phytogeographic regions of India.
5. Vegetation types in Andhra Pradesh.

IV. TEXT BOOKS

1. Pandey B.P. (2013). *College Botany*, Volumes II & III. S. Chand Publishing, New Delhi.
2. Bhattacharya K., Hait G., Ghosh A.K. (2011). *Textbook of Botany*, Volume II. New Central Book Agency Pvt. Ltd., Kolkata.
3. Subrahmanyam N.S., Sambamurty A.V.S.S. (2008). *Ecology*. Narosa Publishing House, New Delhi.
4. Sharma P.D. (2012). *Ecology and Environment*. Rastogi Publications, Meerut, India.
5. Kumar U. (2007). *Biodiversity: Principles and Conservation*. Agrobios (India), Jodhpur.
6. Mani M.S. (1974). *Ecology and Biogeography of India*. Dr. W. Junk Publishers, The Hague.

V. REFERENCE BOOKS

1. Kormondy E.J. (1996). *Concepts of Ecology*. Prentice-Hall of India Pvt. Ltd., New Delhi.
2. Begon M., Harper J.L., Townsend C.R. (2003). *Ecology*. Blackwell Science Ltd., USA.
3. Odum E.P. (1996). *Fundamentals of Ecology*. Natraj Publishers, Dehradun.
4. Kumar H.D. (1992). *Modern Concepts of Ecology* (7th Ed.). Vikas Publishing Co., New Delhi.
5. Newman E.I. (2000). *Applied Ecology*. Blackwell Scientific Publisher, UK.
6. Chapman J.L., Reiss M.J. (1992). *Ecology: Principles and Applications*. Cambridge University Press, UK.
7. Kumar H.D. (2000). *Biodiversity and Sustainable Conservation*. Oxford & IBH Publishing Co. Ltd., New Delhi.
8. Cain S.A. (1944). *Foundations of Plant Geography*. Harper & Brothers, New York.
9. Good R. (1997). *The Geography of Flowering Plants* (2nd Ed.). Longmans, Green & Co., London & Allied Science Publishers, New Delhi.

VI. SUGGESTED ACTIVITIES AND EVALUATION METHODS

Unit 1:
Activity: Field visit to local ecosystems and preparation of a report on biotic and abiotic components and their interactions.
Evaluation Method: Assessment based on attendance, report submission, and conclusions.

Unit 2:
Activity: Case studies on population and community ecology; preparation of a comprehensive report.
Evaluation Method: Evaluation of report and grading.

Unit 3:
Activity: Case studies on global and local climate change and their impacts; preparation of a report.
Evaluation Method: Assessment and grading of report.

Unit 4:
Activity: Survey in the local area to identify endangered and threatened species.
Evaluation Method: Evaluation of survey report using a rubric.

Unit 5:
Activity: Collection of local flora data and preparation of a project report.
Evaluation Method: Assessment and grading of project report.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

IV SEMESTER BOTANY TIME: 2Hrs/week

BOTANY B-Mi1 4151 Plant Ecology, Biodiversity and Phytogeography Max.Marks:50

W.e.f. "24AL" Practical Syllabus

I. COURSE OUTCOMES

On successful completion of this practical course, the student shall be able to:

1. Handle instruments used in ecological studies.
2. Perform experiments and collect data on autecology and synecology.
3. Identify various plant groups based on their morphological and anatomical adaptations.
4. Collect and analyze data related to biodiversity and phytogeography.

II. LABORATORY / FIELD EXERCISES

1. Study of instruments used to measure microclimatic variables:
   a) Soil thermometer
   b) Maximum and minimum thermometer
   c) Anemometer
   d) Rain gauge
   e) Lux meter
2. Visit to the nearest/local meteorological station where data is regularly collected and prepare a field visit report for practical submission.
3. Study of morphological and anatomical adaptations of any two hydrophytes.
4. Study of morphological and anatomical adaptations of any two xerophytes.
5. Quantitative analysis of herbaceous vegetation in the college campus for frequency, density, and abundance.
6. Identification of vegetation/various plant species in the college campus and comparison with Raunkiaer's frequency distribution law.
7. Determination of alpha-diversity of plants in a given area.
8. Mapping of biodiversity hotspots of the world and India.
9. Mapping of phytogeographical regions of the world and India.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

V SEMESTER **BOTANY** **TIME: 3Hrs/week**

BOTANY B-Ma1 5101 (3) **Cell Biology and Genetics** **Max.Marks:100**

W.e.f. "23AK"

I. Learning Objectives

By the end of this course the learner has:

1. To look into the ultra-structure of plant cell and its organelle
2. To know the morphology and functions of chromosomes
3. To understand the principles of genetics, structure and functions of gene

II. Learning Outcomes

On completion of this course students will be able to:

1. Sketch the ultra-structural aspects of plant cell and its components.
2. Hypothesise the role of chromosomes in inheritance.
3. Justify the role of genes in inheritance of characters by descent.
4. Correlate the functions of the nucleic acid with their structure.
5. Explain the discoveries led to understand the fine structure of a gene.

III. Syllabus of Theory

Unit-1: Cell and its organelle (8 Hrs.)

1. Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra-structure of a plant cell.
2. Ultra-structure of cell wall.
3. Ultra-structure of plasma membrane and various theories on its organization.
4. Polymorphic cell organelles (Plastids); ultra structure of chloroplast, plastid DNA.
5. Ultrastructure of mitochondria, mitochondrial DNA.

Unit-2: Chromosomes (8 Hrs.)

1. Prokaryotic vs eukaryotic chromosome; morphology of a eukaryotic chromosome.
2. Euchromatin and Heterochromatin; Karyotype and ideogram.
3. Brief account of chromosomal aberrations - structural and numerical changes.
4. Organization of DNA in a chromosome (nucleosome and solenoid models).

Unit-3: Mendelian and non-Mendelian Genetics (10 Hrs.)

1. Mendel's laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism.
2. Complementary, supplementary and duplicate gene interactions (plant-based examples are to be dealt).
3. A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point test cross.
4. Concept of maternal inheritance (Corren's experiment on *Mirabilis jalapa*).

Unit-4: Structure and function of DNA (10 Hrs.)

1. Watson and Crick model of DNA. Brief account on DNA Replication (Semiconservative method).
2. Brief account on transcription, types and functions of RNA.
3. Genetic code and a brief account of translation.
4. Regulation of gene expression in prokaryotes - Lac Operon.

Unit-5: Gene concept and Sex determination (9 Hrs.)

1. Evolution of gene concept: classical vs molecular concepts of gene.
2. Cis–Trans complementation test for functional allelism, gene as unit of function, mutation and recombination.
3. Pattern of sex determination in plants.
4. Allele and genotype frequencies, Hardy-Weinberg law.

IV. Text Books

1. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi

2. Ghosh, A.K., K. Bhattacharya & G. Hait (2011) A Text Book of Botany, Volume-III, New Central Book Agency Pvt. Ltd., Kolkata
3. A.V.S.S. Sambamurty (2007) Molecular Genetics, Narosa Publishing House, New Delhi
4. S. C. Rastogi (2008) Cell Biology, New Age International (P) Ltd. Publishers, New Delhi

V. Reference Books

1. P. K. Gupta (2002) Cell and Molecular biology, Rastogi Publications, New Delhi
2. B. D. Singh (2008) Genetics, Kalyani Publishers, Ludhiana
3. Cooper, G.M. & R.E. Hausman (2009) The Cell – A Molecular Approach, A.S.M. Press, Washington
4. Becker, W.M., L.J. Kleinsmith & J. Hardin (2007) The World of Cell, Pearson, Education, Inc., New York
5. De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002) Cell and Molecular Biology, Lippincott Williams & Wilkins Publ., Philadelphia
6. Robert H. Tamarin (2002) Principles of Genetics, Tata McGraw –Hill Publishing Company Limited, New Delhi.
7. Gardner, E.J., M. J. Simmons & D.P. Snustad (2004) Principles of Genetics, John Wiley & Sons Inc., New York
8. Micklos, D.A., G.A. Freyer & D.A. Cotty (2005) DNA Science: A First Course, I.K. International Pvt. Ltd., New Delhi

VI. Suggested activities and evaluation methods

- **Unit-1: Activity:** Group discussion on different types of cells and their components.
  - **Evaluation method:** Identifying the best group or performer and giving a reward.
- **Unit-2: Activity:** Observation of chromosomal aberrations in *Allium cepa* root cells exposed to industrial effluent/ heavy metals
  - **Evaluation method:** Validation of report and assigning a grade based on a rubric.
- **Unit-3: Activity:** Solving the problems on classical genetics.
  - **Evaluation method:** Assessing the accuracy in solving the problems and awarding a grade.
- **Unit-4: Activity:** Making models of nucleic acids.
  - **Evaluation method:** Selecting the best and assigning a grade.
- **Unit-5: Activity:** Making a comprehensive report on sex determination in plants by collecting scientific literature.
  - **Evaluation method:** Validation of report and assigning a grade based on a specified point scale.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

V SEMESTER	**BOTANY**	**TIME: 2Hrs/week**
BOTANY B-Mi1 4151	**Cell biology and Genetics**	**Max.Marks:50**
W.e.f. "24AL"	**Practical Syllabus**	

Practical Course Outcomes

On successful completion of this practical course, student shall be able to:

1. Identify the stages of mitotic and meiotic cell divisions.
2. Infer the structure and functions of nucleic acids.
3. Predict the consequences of a particular genetic condition.

II. Laboratory/field exercises

1. Study of ultra structure of plant cell and its organelles using electron microscopic photographs /models.
2. Demonstration of mitosis in *Allium cepa*/*Aloe vera* roots using squash technique.
3. Observation of various stages of mitosis in permanent slides.
4. Demonstration of meiosis in P.M.C.s of *Allium cepa* flower buds using squash technique.
5. Observation of various stages of meiosis in permanent slides.
6. Study of structure of DNA and RNA molecules using models.
7. Solving problems on monohybrid, dihybrid, back and test crosses.
8. Solving problems on gene interactions (at least one problem for each of the gene interactions in the syllabus).
9. Chromosomes mapping using problems of 3- point test cross data.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

V SEMESTER **BOTANY** **TIME: 3Hrs/week**

BOTANY B-Ma1 5101 (3) **Plant Physiology and Metabolism** **Max.Marks:100**

W.e.f. "23AK"

I. Learning Objectives:

By the end of this course the learner has:

1. To understand the concept of Soil-Plant-Atmosphere continuum based on plant-water relations.
2. To study the anabolic and catabolic processes in plants.
3. To understand the role of plant growth regulators on growth, development and flowering.

II. Learning Outcomes:

On successful completion of this course, the students will be able to:

1. Comprehend the importance of water in plant life and mechanisms for transport of water and solutes in plants.
2. Explain the role of minerals in plant nutrition and their deficiency symptoms.
3. Interpret the role of enzymes in plant metabolism.
4. Hypothesise the light reactions and carbon assimilation processes responsible for synthesis of food in plants.
5. Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
6. Evaluate the physiological factors that regulate growth, development and flowering in plants.

III. Syllabus of Theory:

Unit – 1: Plant-Water relations (8 Hrs.)

1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis, water potential, osmotic potential, pressure potential.
2. Absorption and lateral transport of water; Ascent of sap.
3. Transpiration: stomata structure and mechanism of stomatal movements (K^+ ion flux).
4. Mechanism of phloem transport; source-sink relationships.

Unit – 2: Mineral nutrition, Enzymes and Respiration (10 Hrs.)

1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency.
2. Absorption of mineral ions; passive and active processes.
3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.
4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

Unit – 3: Photosynthesis and Photorespiration (10 Hrs.)

1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect.
2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation.
3. Carbon assimilation pathways (C3, C4 and CAM).
4. Photorespiration - C2 pathway.

Unit – 4: Nitrogen and lipid metabolism (9 Hrs.)

1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system.
2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.
3. Anabolism of triglycerides, β-oxidation of fatty acids, Glyoxylate cycle.

Unit – 5: Plant growth - development (8 Hrs.)

1. Growth and Development: Definition, phases and kinetics of growth.
2. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
3. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.
4. Seed germination and senescence; physiological changes during seed germination.

IV. Text Books:

1. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi.
2. Ghosh, A. K., K. Bhattacharya & G. Hait (2011) A Text Book of Botany, Volume III, New Central Book Agency Pvt. Ltd., Kolkata.

V. Reference Books:

1. Aravind Kumar & S.S. Purohit (1998) Plant Physiology – Fundamentals and Applications, Agro Botanica, Bikaner.
2. Datta, S.C. (2007) Plant Physiology, New Age International (P) Ltd., Publishers, New Delhi.
3. Hans Mohr & P. Schopfer (2006) Plant Physiology, Springer (India) Pvt. Ltd., New Delhi.
4. Hans-Walter heldt (2005) Plant Biochemistry, Academic Press, U.S.A.
5. Hopkins, W.G. & N.P.A. Huner (2014) Introduction to Plant Physiology, Wiley India Pvt. Ltd., New Delhi.
6. Noggle Ray & J. Fritz (2013) Introductory Plant Physiology, Prentice Hall (India), New Delhi.
7. Pandey, S.M. & B.K. Sinha (2006) Plant Physiology, Vikas Publishing House, New Delhi.
8. Salisbury, Frank B. & Cleon W. Ross (2007) Plant Physiology, Thomsen & Wadsworth, Australia & U.S.A.
9. Sinha, R.K. (2014) Modern Plant Physiology, Narosa Publishing House, New Delhi.
10. Taiz, L. & E. Zeiger (2003) Plant Physiology, Panima Publishers, New Delhi.
11. Verma, V. (2007) Text Book of Plant Physiology, Ane Books India, New Delhi.

VI. Suggested activities and evaluation method:

- **Unit-1: Activity:** Observe and tabulate the water content of different plant parts and justify the importance of the water based on the morphological nature.
    - **Evaluation method:** Assess the report and assign the grade points based on a rubric.
- **Unit-2 Activity:** Survey report on various inorganic and organic fertilizers available in the local markets.
    - **Evaluation method:** Assess the record and award the grades on a specified point scale.
- **Unit-3 Activity:** Identify the C4 plants from their locality and make a report.
    - **Evaluation method:** Assessing the clarity, organization, and effectiveness of the report's presentation and communication based on a rubric.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

V SEMESTER **BOTANY** **TIME: 2Hrs/week**

BOTANY B-Ma1 5153 **Plant Physiology and Metabolism** **Max.Marks:50**

W.e.f. "23AK" **Practical Syllabus**

I. Course outcomes:

On successful completion of this practical course, students shall be able to:

1. Conduct lab and field experiments pertaining to plant physiology.
2. Estimate the quantities and qualitative expressions using experimental results and calculations.
3. Interpret the factors responsible for growth and development in plants.

II. Laboratory/field exercises:

1. Determination of osmotic potential of plant cell sap by plasmolytic method using *Rhoeo/Tradescantia* leaves.
2. Calculation of stomatal index and stomatal frequency of a mesophyte, a hydrophyte and a xerophyte.
3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (at least for a dicot and a monocot).
4. Effect of temperature on membrane permeability by colorimetric method.
5. Study of mineral deficiency symptoms using plant material/photographs.
6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzyme concentration.
7. Separation of chloroplast pigments using paper chromatography technique.
8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

V SEMESTER **BOTANY** **TIME: 3Hrs/week**

BOTANY B-Ma1 5101 (3) **Organic farming** **Max.Marks:100**

W.e.f. "23AK"

I. Learning Objectives:

By the end of this course the learner has:

1. To know the beneficial aspects of organic farming against chemical farming.
2. To gain knowledge about soil fertility, organic pest and disease management strategies.
3. To understand the organic certification process, including the standards and regulations that govern organic farming practices.

II. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Compare and contrast the advantages and disadvantages of conventional and organic farming.
2. Acquire skills on different composting methods.
3. Acquaint with cultural and crop protection practices related to organic farming.
4. Acquire knowledge on various management practices in organic farming.
5. Discuss about the certification and marketing of organic foods.
6. Explain the initiatives of government in promoting organic farming.

III. Syllabus of Theory:

UNIT-1: Basic concepts of organic farming (8 Hrs.)

1. Organic farming: Definition, ecological social and economic benefits.
2. Organic farming and its components; concepts and principles.
3. Biodynamic and natural farming approaches; permaculture and LEISA farming approaches.
4. Sustainable agriculture, key indicators of sustainable agriculture.
5. Living soil and healthy plant concepts.

UNIT-2: Organic inputs for soil (8 Hrs.)

1. Vermicompost production technology.
2. Organic manures: Farmyard Manure (FYM), enrichment of FYM.
3. Compost, methods of composting (Bangalore, Indore, Coimbatore, NADEP methods).
4. Green manuring, classification of green manures.
5. Classification of organic residues; recycling of organic residues.

UNIT-3: Organic crop management (10 Hrs.)

1. Introduction to organic crop management – land preparation, planting technic, nutrient management.
2. Factors considered for nutrient management; recommended nutrient quantity – blanket, major problems; balance sheet method.
3. Nutrient composition of some organic resources, right timing of nutrient application.
4. Right method of nutrient application, nutrient use efficiency.

UNIT-4: Cultural and crop protection practices (10 Hrs.)

1. Pre-sowing irrigation; crop rotation, intercropping and mixed cropping.
2. Use of tolerant and resistant varieties; manipulation in sowing dates, irrigation/flooding, destruction of volunteer plants.
3. Pest and disease management – preventive, physical and mechanical methods.
4. Organic crop management – rice, red gram, groundnut, and tomato.
5. Government interventions to promote organic farming: NPOF, NPMSHF, NHM, RKVY, KVK and APEDA.

UNIT-5: Certification and Marketing of Organics (9 Hrs.)

1. Organic certification process – definition, need, aim and scope, requirements to maintain certification.

2. Organic certification process – labelling of products, NPOP, organic quality control, standards, accreditation, inspection, and certification.
3. Operational structure of organic certification.
4. Marketing of organic products.

IV. Text Books:

1. Vandana Shiva, Poonam Pande and Jitendra Singh, (2004). Principles of Organic Farming - Renewing the Earth's Harvest, Navdanya, New Delhi.
2. Sujit Chakrabarty, Sumati Narayan, Farooq Ahmad Khan, (2019). Arts and Science of Organic Farming, Purna Organics.
3. Thapa, U., and P. Tripathi, (2016). Organic Farming in India, Agrotech Publications, Udaipur.
4. Peter, V. Fossel, (2007). Organic Farming (Everything You Need to Know), Voyageur Press, USA.

V. Reference Books:

1. Richard Wiswall (2009), The Organic Farmer's Business Handbook, Chelsea Green Publishing, White River Junction, VT, USA.
2. William Lockeretz (2007), Organic Farming: An International History, CABI Publishing, Wallingford, UK.
3. Ann Larkin Hansen (2010), The Organic Farmer's Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm, Storey Publishing, North Adams, MA, USA.
4. Masanobu Fukuoka (1978), The One-Straw Revolution: An Introduction to Natural Farming, Rodale Press, Emmaus, PA, USA.
5. Gary Zimmer (2000), The Biological Farmer: A Complete Guide to the Sustainable & Profitable Biological System of Farming, Acres U.S.A., Austin, TX, USA.
6. Albert Howard (1947), The Soil and Health: A Study of Organic Agriculture, University Press of Kentucky, Lexington, KY, USA.
7. Terri Paajanen (2014), The Complete Guide to Organic Livestock Farming, Atlantic Publishing Group, Inc., Ocala, FL, USA.

VI. Suggested activities and evaluation methods:

- **Unit-1 Activity:** Group discussion on advantages and disadvantages of organic and inorganic farming methods.
    - **Evaluation method:** Analyzing the quality and depth of the content discussed, identifying key ideas, arguments, and supporting evidences.
- **Unit-2 Activity:** Internship on preparation of composts and other organic inputs.
    - **Evaluation method:** Performance evaluations, team feedback and competition results.
- **Unit-3 Activity:** Case study report on management practices in organic farming.
    - **Evaluation method:** Evaluating the clarity, coherence, and logical structure of the case study report.
- **Unit-4 Activity:** Critical written assignment on support from government agencies to promote organic farming.
    - **Evaluation method:** Evaluating the application of critical thinking skills, such as analysis, evaluation, and interpretation of information or ideas presented in the assignment.
- **Unit-5 Activity:** A survey report on marketing of organic food products.
    - **Evaluation method:** Evaluating the appropriateness and effectiveness of the survey design, including the clarity of questions, survey structure, and response options.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

V SEMESTER **BOTANY** **TIME: 2Hrs/week**

BOTANY B-Ma1 5153 **Organic farming** **Max.Marks:50**

W.e.f. "23AK" **Practical Syllabus**

I. Course outcomes:

On successful completion of this practical course, students shall be able to:

1. Prepare different organic formulations for organic farming.
2. Design a vermicompost unit and prepare the compost.
3. Identify various manures for organic farming.

II. Laboratory/field exercises:

1. Preparation of Jeevamrutham (liquid and solid) and Beejamrutham.
2. Preparation of Neemastram and Brahmastram.
3. Preparation of Agniastram and Dashaparni Kashayam.
4. Study of intercropping method.
5. Study of water management in Organic Farming.
6. Study of livestock component in Organic Farming.
7. Hands on training on vermicompost preparation.
8. Study of different organic and green manures.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

V SEMESTER **BOTANY** **TIME: 3Hrs/week**

BOTANY B-Ma1 5101 (3) **Plant propagation techniques** **Max.Marks:100**

W.e.f. "23AK"

I. Learning Objectives: By the end of this course the learner has:

1. To gain knowledge on asexual propagation methods in plants.
2. To understand the principles pertaining to various vegetative propagation methods.
3. To know the specific propagation method that is applied to a particular species.

II. Learning Outcomes: Students at the successful completion of the course will be able to:

1. Explain various plant propagation structures and their utilization.
2. Understand advantages and disadvantages of vegetative, asexual and sexual plant propagation methods.
3. Assess the benefits of asexual propagation of certain economically valuable plants using apomictics and adventive polyembryony.
4. Demonstrate skills related to vegetative plant propagation techniques such as cuttings, layering, grafting and budding.
5. Apply a specific macro-propagation technique for a given plant species.

III. Syllabus of Theory:

Unit – 1: Basic concepts of propagation 8 Hrs.

1. Propagation: Definition, need and potentialities for plant multiplication; asexual and sexual methods of propagation – advantages and disadvantages.
2. Propagation facilities: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery – tools and implements.
3. Identification and propagation by division and separation: Bulbs, pseudobulbs, corms, tubers and rhizomes; runners, stolons, suckers and offsets.

Unit – 2: Apomictics in plant propagation 8 Hrs.

1. Apomixis: Definition, facultative and obligate; types – recurrent, non-recurrent, adventitious and vegetative; advantages and disadvantages.

2. Polyembryony: Definition, classification, horticultural significance; chimera and bud sport.

3. Propagation of mango, Citrus and Allium using apomictic embryos.

Unit – 3: Propagation by Cuttings (10 Hrs.)

1. Cuttings: Definition, different methods of cuttings; root and leaf cuttings.
2. Stem cuttings: Definition of stem tip and section cuttings; plant propagation by herbaceous, soft wood, semi hard wood, hard wood and coniferous stem cuttings.
3. Physiological and biochemical basis of rooting; factors influencing rooting of cuttings; use of plant growth regulators in rooting of cuttings.

Unit – 4: Propagation by Layering (10 Hrs.)

1. Layering: Definition, principle and factors influencing layering.
2. Plant propagation by layering: Ground layering – tip layering, simple layering, trench layering, mound (stool) layering and compound (serpentine layering).
3. Air layering technique – application in woody trees.

Unit – 5: Propagation by Grafting and Budding (9 Hrs.)

1. Grafting: Definition, principle, types, graft incompatibility, collection of scion wood stick, scion-stock relationship and their influences, bud wood certification; micrografting.
2. Propagation by veneer, whip, cleft, side and bark grafting techniques.
3. Budding: Definition; techniques of 'T', inverted 'T', patch and chip budding.

IV. Text Books

1. Sharma RR and Manish Srivastav (2004). *Plant Propagation and Nursery Management*. International Book Distributing Co., Lucknow.
2. Sadhu, M.K. (1996). *Plant Propagation*. New Age International Publishers, New Delhi.

V. Reference Books

1. Alan Toogood (2003). *Plant Propagation*. DK Publishing, London, UK.
2. Hudson T. Hartmann, Dale E. Kester, Fred T. Davies Jr., and Robert L. Geneve (2010). *Plant Propagation: Principles and Practices*. Prentice Hall, Upper Saddle River, NJ, USA.
3. John Mason (2006). *Plant Propagation*. Landlinks Press, Collingwood, VIC, Australia.
4. Peter Thompson (2006) *The Basics of Plant Propagation*, Timber Press, Portland, OR, USA.

VI. Suggested activities and evaluation methods:

5. **Unit-1: Activity:** Preparation of a report on vegetative propagation organs in different plant species of economic importance.
   Evaluation method: Assessing the correctness and quality of report prepared using a determined rubric.
6. **Unit-2: Activity:** Critical written assignment on polyembryony in various plant species.
   Evaluation method: Assessing the depth of analysis and the originality of ideas presented in the assignment.
7. **Unit-3: Activity:** Field trip to a horticulture research station to learn propagation of plants by cuttings.
   Evaluation method: Participation, observing the student's active involvement, curiosity, and interaction with the experts in the field.
8. **Unit-4: Activity:** A case study report on propagation of plants using layering technique.
   Evaluation method: Assessing the integration of relevant principles and concepts from the course into the case study analysis.
9. **Unit-5: Activity:** Group discussion on grafting techniques in plants.
   Evaluation method: Assessing individual participation and contributions during the discussion.

ST. JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS) VISAKHAPATNAM

V SEMESTER	**BOTANY**	**TIME: 2Hrs/week**
BOTANY B-Ma1 5153	**Plant Propagation techniques**	**Max.Marks:50**
W.e.f. "23AK"	**Practical Syllabus**	

I. Course Outcomes:

On successful completion of this practical course, student will be able to:

1. Make use of different plant propagation structures for plant multiplication.
2. Explore the specialized organs or asexual propagules in some plants for their proliferation.
3. Demonstrate skills on micropropagation of plants through vegetative propagation techniques.
4. Evaluate and use a suitable propagation technique for a given plant species.

II. Laboratory/field exercise:

1. Preparation of nursery beds – flat, raised and sunken beds.
2. Propagation through apomictic.
3. Propagation by separation and division technique.
4. Propagation by cuttings.
5. Propagation by layering
6. Propagation by grafting.
7. Propagation by budding.
8. Preparation of potting mixture, potting and repotting.