Proposed Syllabus

for

B.Sc. Botany

Submitted by

Department of Botany

Osmania University

Under Choice Based Credit System

2017

B.Sc. BOTANY I&II Year, CBCS Syllabus
Telangana State Council of Higher Education, Govt. of Telangana B.Sc., CBCS Common Core Syllabi for all Universities in Telangana
PROPOSED SCHEME FOR
CHOICE BASED CREDIT SYSTEM IN B.Sc., BOTANY

FIRST YEAR **SEMSTER-I**

CODE	COURSE TITTLE	COURSE TYPE	HPW	CREDITS
BS 101	Environmental studies	AECC-1	2	2
BS 102	English	CC-1A	5	5
BS 103	Second Language	CC-2A	5	5
BS 104	**Optional-I Botany-I** **Microbial Diversity of Lower Plants**	**DSC-1A**	**4T+2P=6**	**4+1=5**
BS 105	Optional-II	DSC-2A	4T+2P=6	4+1=5
BS 106	Optional-III	DSC-1A	4T+2P=6	4+1=5
	Total Credits			**27**

SEMSTER-II

CODE	COURSE TITTLE	COURSE TYPE	HPW	CREDITS
BS 201	Gender Sensitization	AECC-2	2	2
BS 202	English	CC-1B	5	5
BS 203	Second Language	CC-2B	5	5
BS 204	**Optional-I Botany-II** **Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany**	**DSC-1B**	**4T+2P=6**	**4+1=5**
BS 205	Optional-II	DSC-2B	4T+2P=6	4+1=5
BS 206	Optional-III	DSC-3B	4T+2P=6	4+1=5
	Total Credits			**27**

SECOND YEAR **SEMSTER-III**

BS 301	**SEC-I: Biofertilizers**	**SEC-1**	**2**	**2**
BS 302	English	CC-1C	5	5
BS 303	Second language	CC-2C	5	5
BS 304	**Optional-I BOTANY-III** **Taxonomy of Angiosperms and Medicinal Botany**	**DSC-1C**	**4T+2P=6**	**4+1=5**
BS 305	Optional-II	DSC-2C	4T+2P=6	4+1=5
BS 306	Optional-III	DSC-3C	4T+2P=6	4+1=5
	Total Credits			**27**

SEMSTER-IV

BS 401	**SEC-II: Herbal Technology**	SEC-2	2	2
BS 402	English	CC-1D	5	5
BS 403	Second language	CC-2D	5	5
BS 404	**Optional- I BOTANY-IV** **Plant Anatomy, Embryology and Palynology**	**DSC-1D**	**4T+2P=6**	**4+1=5**
BS 405	Optional II	DSC-2D	4T+2P=6	4+1=5
BS 406	Optional III	DSC-3D	4T+2P=6	4+1=5
	Total Credits			**27**

AECC: Ability Enhancement Compulsory Course, **SEC**: Skill Enhancement Course, **DSC**: Discipline Specific Course, **DSE**: Discipline Specific Elective, **GE**: Generic Elective

B.Sc (CBCS) Botany- I year
Semester-I - Paper-I
Microbial Diversity of Lower Plants

DSC - 1A (4 hrs./week) Theory Syllabus

Credits- 4
(60 hours)

UNIT - I

1. Brief account of Archaebacteria, Actinomycetes. (4h)

2. Cyanobacteria: General characters, cell structure, thallus organisation and their significance as biofertilizers with special reference to *Oscillatoria, Nostoc* and *Anabaena.*(6h)

3. Lichens: Structure and reproduction; ecological and economic importance. (5h)

UNIT- II

4. Viruses: Structure, replication and transmission; plant diseases caused by viruses and their control with reference to Tobacco Mosaic and Rice Tungro. (7h)

5.. Bacteria**:** Structure, nutrition, reproduction and economic importance. An outline of plant diseases of important crop plants caused by bacteria and their control with reference to Angular leaf spot of cotton and Bacterial blight of Rice. (8h)

6. General account of Mycoplasma with reference to Little leaf of brinjal and Papaya leaf curl

UNIT-III

7. General characters, structure, reproduction and classification of algae (Fritsch) and thallus organization in algae. (3h)

8. Structure and reproduction of the following:
   Chlorophyceae- *Volvox, Oedogonium* and *Chara.* (5h)
   Phaeophyceae- *Ectocarpus* (2h)
   Rhodophyceae- *Polysiphonia.* (3h)

9. Economic importance of algae in Agriculture and Industry. (2h)

UNIT-IV

10. General characters and classification of fungi (Ainsworth). (3h)

11. Structure and reproduction of the following:
   (a)Mastigimycotina- *Albugo*
   (b) Zygomycotina- *Mucor*
   (c) Ascomycotina- *Saccharomyces* and *Penicillium.*
   (d) Basidiomycotina- *Puccinia*
   (e) Deuteromycotina- *Cercospora.* (10h)

12. Economic importance of fungi in relation to mycorrhizae and mushrooms. General account of mushroom cultivation

(2h)

References:

1. Alexopolous, J. and W. M. Charles. 1988. Introduction to Mycology. Wiley Eastern, New Delhi.

2. Mckane, L. and K. Judy. 1996. Microbiology – Essentials and Applications. McGraw Hill, New York.

3. Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.

4. Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.

5. Sambamurthy, A. V. S. S. 2006. A Textbook of Plant Pathology. I. K. International Pvt. Ltd., New Delhi.

6. Sambamurthy, A. V. S. S. 2006. A Textbook of Algae. I. K. International Pvt. Ltd., New Delhi.

7. Sharma, O. P. 1992. Textbook of Thallophyta. McGraw Hill Publishing Co., New Delhi.

8. Thakur, A. K. and S. K. Bassi**.** 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.

9. Vashishta, B. R., A. K. Sinha and V. P. Singh. 2008. Botany for Degree Students: Algae. S. Chand& Company Ltd, New Delhi.

10. Vashishta, B. R. 1990. Botany for Degree Students: Fungi, S. Chand & Company Ltd, New Delhi.

11. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.

B.Sc (CBCS) Botany-I year
Semester-I - Paper-I
Microbial Diversity of Lower Plants

Theory Model Question Paper

Time : 2 hrs **Max. Marks: 40**

Draw well-labeled diagrams wherever necessary.

1. Write short notes on any FOUR of the following: - **4 X 2 = 8M**

a. Heterocyst.

b. Citrus Canker.

c. Nucule

d. Cleistothecium.

e. Mycoplasma

f. *Mucor*

II. Essay Questions: **4 X 8 = 32M**

1. a. Briefly describe the structure and reproduction of *Oscillatoria*.
(OR)
b. Describe the cyanophycean cell structure.

2. a. Describe the structure and modes of transmission of plant viruses.
(OR)
b. Write an essay on economic importance of Bacteria.

3. a. Describe the life cycle of *Oedogonium* with the help of well- labelled diagram .
(OR)
b. Give an account on thallus organization in algae.

4. a. Describe the life cycle of *Albugo* with the help of well-labelled diagram .
(OR)
b. Give a brief account on Mushroom cultivation.

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B.Sc (CBCS) Botany-I year
Semester-I - Paper-I
Microbial Diversity of Lower Plants

Practical Syllabus

(45 hours)

1. Study of viruses and bacteria using electron micrographs (photographs). (3h)
2. Gram staining of Bacteria. (3h)
3. Study of symptoms of plant diseases caused by viruses, bacteria, Mycoplasma and fungi:
   Viruses: Tobacco mosaic
   Bacteria: Angular leaf spot of cotton and Rice tumgro.
   Mycoplasma**:** Little leaf of Brinjal and Leaf curl of papaya (3h)
   Fungi: White rust on Crucifers, Rust on wheat & Tikka disease of Groundnut. (6h)
4. Vegetative and reproductive structures of the following taxa:
   Algae: *Oscillatoria*, *Nostoc, Volvox*, *Oedogonium*,*Chara* ,*Ectocarpus* and *Polysiphonia.* (6 h)
   Fungi: *Albugo, Mucor*,*Saccharomyces, Penicillium*, *Puccinia* and *Cercospora* (6h)
5. Section cutting of diseased material infected by Fungi and identification of pathogens as per theory syllabus. White rust of Crucifers, Rust on wheat & Tikka disease of Groundnut. (9h)
6. Lichens: Different types of thalli and their external morphology (3 h).
7. Examination of important microbial, fungal and algal products:
   Biofertilizers, protein capsules, antibiotics, mushrooms, Agar-agar etc. (3h)
8. Field visits to places of algal / microbial / fungal interest (e.g. Mushroom cultivation, water bodies). (3h)

B.Sc (CBCS) Botany- I year
Semester-I - Paper-I
Microbial Diversity of Lower Plants

Practical Model Paper

Time : 2 $^{1}/_{2}$ hrs **Max. Marks: 25**

1. Identify the given components 'A' , 'B' & 'C' in the algal mixture .

   Describe with neat labeled diagrams & give reasons for the classifications. **3 X 3 = 9M**

2. Classify the given bacterial culture 'D' using Gram – staining technique. **4M**

3. Take a thin transverse section of given diseased material 'E'.

   Identify & describe the symptoms caused by the pathogen. 5**M**

4. Identify the given specimens 'F', 'G' & 'H' by giving reasons .

   (Fungal-1, Bacteria-1 & Viral-1) **3 X 1 = 3M**

5. Comment on the given slides 'I' & 'J' .

   (Algae-1 , Fungi-1) **2 X 1 = 2M**

6. Record **2M**

B.Sc (CBCS) Botany- I year
Semester-II - Paper-II
Bryophytes, Pteridophytes, Gymnosperms and Paleobotany

DSC-1B (4 hrs./week) Theory Syllabus

Credits- 4
(60 hours)

UNIT-I

1. Bryophytes**:** General characters and classification. (3h)
2. Structure, reproduction, life cycle and systematic position of *Marchantia, Anthoceros* and *Polytrichum.* (Development stages are not required). (10h)
3. Evolution of Sporophyte in Bryophytes. (2h)

UNIT-II

4. Pteridophytes: General characters and classification (Sporne's) (3h)
5. Structure, reproduction, life cycle and systematic position of *Rhynia, Lycopodium, Equisetum* and *Marsilea.* (10h)
6. Stelar evolution, heterospory and seed habit in Pteridophytes. (2h)

UNIT-III

7. Gymnosperms: General characters, structure, reproduction and classification (Sporne's). (4h)
8. Distribution and economic importance of Gymnosperms. (3h)
9. Morphology of vegetative and reproductive parts, systematic position and life cycle of *Pinus* and *Gnetum* . (8 h)

UNIT-IV.

10. Palaeobotany: Introduction, Fossils and fossilization ; Importance of fossils. (8 h)
11. Geological time scale; (4 h)
12. Bennettitales: General account. (3 h)

References:

1. Watson, E. V. 1974. The structure and life of Bryophytes, B. I. Publications, New Delhi.

2. Pandey, B. P. 2006. College Botany, Vol. II: Pteridophyta, Gymnosperms and Paleobotany.

S. Chand & Company Ltd, New Delhi.

3. Sporne, K. R. 1965. Morphology of Gymnosperms. Hutchinson Co., Ltd., London.

4. Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany - Pteridophyta (Vascular Cryptogams). . Chand & Company Ltd, New Delhi.

5. Pandey, B. P. 2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi.

6. Pandey, B. P. 2007. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics. S. Chand & Company Ltd, New Delhi.

7. Thakur, A. K. and S. K. Bassi**.** 2008. A Textbook of Botany: Diversity of Microbes and Cryptogams. S. Chand & Company Ltd, New Delhi.

8. Vashishta, B. R., A. K. Sinha and Adarsha Kumar. 2008. Botany for Degree Students: Bryophyta. S. Chand & Company Ltd, New Delhi.

9. Vashishta, P. C., A. K. Sinha and Anil Kumar. 2006. Botany for Degree Students: Gymnosperms. Chand & Company Ltd, New Delhi.

10. Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.

B.Sc (CBCS) Botany- I year
Semester-II - Paper-II
Bryophytes, Pteridophytes, Gymnosperms and Paleobotany

Theory Model Question Paper

Time : 2 hrs **Max. Marks: 40**

Draw well-labeled diagrams wherever necessary.

1 . Write short notes on any FOUR of the following: - **4 X 2 = 8M**

a. Gemma cup.

b. Protostele .

c. Pinus pollen grain.

d. *Ptilophyllum.*

e. *Anthoceros* thallus

f. Fossilization

II . Essay Questions: **4 X 8 = 32M**

1. a.Write about the structure & evolution of sporophyte in *Anthoceros* .
(OR)
b. Describe the gametophores of *Marchantia* .

2. a. Describe the anatomy of *Equisetum* stem & add a note on its ecological adaptations .
(OR)
b. Discuss in detail the internal structure of the sporocarp of *Marsilea* .

3.a. Describe the anatomy of *Pinus* needle with a well labeled diagram.
(OR)
b. Give an account of general characters of Gymnosperms.

4. a. Describe the general characters of Bennettitales .
(OR)
b. Write about economic importance of Gymnosperms.

B.Sc (CBCS) Botany- I year
Semester-II - Paper-II
Bryophytes, Pteridophytes, Gymnosperms and Paleobotany

(45 hours)

Practical Syllabus – 2016

1.Study of Morphology (vegetative and reproductive structures) and anatomy of the following Bryophytes: *Marchantia*, *Anthoceros* and *Polytrichum*. (9 h)

2. Study of Morphology (vegetative and reproductive structures) and anatomy of the following Pteridophytes: *Lycopodium*, *Equisetum* and *Marsilea*. (9 h)

3. Study of Anatomical features of *Lycopodium* stem, *Equisetum* stem and *Marsilea* petiole & rhizome by preparing double stained permanent mounts. (12h)

4. Study of Morphology (vegetative and reproductive structures) of the following taxa: Gymnosperms: *Pinus* and *Gnetum*. (6 h)

5. Study of Anatomical features of *Pinus* needle and *Gnetum* stem by preparing double stained permanent mounts. (6h)

6. Fossil forms using permanent slides / photographs: *Rhynia* and *Cycadeoidea.* (3h)

B.Sc (CBCS) Botany- I year
Semester-II - Paper-II
Bryophytes, Pteridophytes, Gymnosperms and Paleobotany

Practical Model Paper

Time : 2 $^{1}/_{2}$ hrs **Max. Marks: 25**

1 . Prepare a double stained permanent mount of the given material ‘ A ‘ (Pteridophyte)

Draw diagram & give reasons for identification. **7M**

2 . Prepare a double stained permanent mount of the given material ‘ B ‘ (Gymnosperms)

Draw diagram & give reasons for identification. **8M**

3 . Identify the given specimens C , D , E & F (Bryophyte – 2 , Pteridophyte – 1 & Gymnosperm – 1) **4 X 1 =4M**

4 . Identify the given slides G , H , I & J (Bryophyte – 2 , Pteridophyte – 1 & Gymnosperm – 1) **4 X 1 =4M**

5 . Record **2M**

B.Sc (CBCS) BOTANY- II YEAR
Semester-III - Paper-III
Taxonomy of Angiosperms and Medicinal Botany

DSC-1C (4 hrs./week) Theory syllabus

Credits-4
(60 hours)

UNIT - I

1. Introduction: Principles of plant systematics, Types of classification: Artificial, Natural and Phylogenetic; Systems of classification: Salient features and comparative account of Bentham & Hooker and Engler & Prantle. An introduction to Angiosperm Phylogeny Group (APG). (7h)
2.. Current concepts in Angiosperm Taxonomy: Embryology in relation to taxonomy, Cytotaxonomy, Chemotaxonomy and Numerical Taxonomy. (4 h)
3.. Nomenclature and Taxonomic resources: An introduction to ICBN, Vienna code - a brief account. Herbarium: Concept, techniques and applications. (4 h)

UNIT-II

4.. Systematic study and economic importance of plants belonging to the following families: Polypetalae : Annonaceae, Capparidaceae, Rutaceae, Fabaceae (Faboideae/papilionoideae, Caesalpinioideae, Mimosoideae), Cucurbitaceae
5. Gamopetalae: Apiaceae, Asteraceae, Asclepiadaceae, Lamiaceae
6. Monochalmydeae: Amaranthaceae, Euphorbiaceae, Monocotyledons: Orchidaceae and Poaceae. (15h)

UNIT - III

7.. Ethnomedicine: Scope, interdisciplinary nature, distinction of Ethnomedicine from Folklore medicine. (3h)
8. Outlines of Ayurveda, Sidda, Unani and Homeopathic systems of traditional medicine. Role of AYUSH, NMPB, CIMAP and CDRI. (5 h)
9.. Plants in primary health care: Common medicinal plants – Tippateega (*Tinospora cordifolia*), tulasi (*Ocimum sanctum*), pippallu (*Piper longum*), Karakaya (*Terminalia chebula*), Kalabanda (*Aloe vera*), Turmeric (*Curcuma longa*). Evaluation of crude drugs. (7h)

UNIT-IV

10. Traditional medicine vs Modern medicine: Study of selected plant examples used in traditional medicine as resource (active principles, structure, usage and pharmacological action of modern medicine: Aswagandha (*Withania somnifera*), Sarpagandha (*Rauwolfia serpentina***)**, Nela usiri *(Phyllanthus amarus),* Amla (*Phyllanthus emblica*) and Brahmi (*Bacopa monnieri*). (8h)
11.Pharmacognosy: Introduction and scope. Adulteration of plant crude drugs and methods of identification - some examples. Indian Pharmacopoeia. (4h)
12. Plant crude drugs: Types, methods of collection, processing and storage practices. (3h)

References:

Pandey, B. P. 2007. Botany for Degree Students: Diversity of Seed Plants and their Systematics, Structure, Development and Reproduction in Flowering Plants. S. Chand & Company Ltd, New Delhi.

Rastogi, R. R. and B. N. Mehrotra. 1993. Compendium of Indian Medicinal Plants. Vol. I & Vol. II. CSIR, Publication and Information Directorate, New Delhi.

Sivarajan, V. V. and I. Balasubramaniyan. 1994. Ayurvedic Drugs and their Plant Sources. Oxford and IBH, New Delhi.

Stace, C. A. 1989. Plant Taxonomy and Biostatistics (2nd Ed.). Edward Arnold, London.

Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.

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Davis, P. H. and V. H. Heywood. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.

Heywood, V. H. 1965 . Plant Taxonomy. ELBS , London.

Heywood, V. H. and D. M. Moore (Eds). 1984. Current Concepts in Plant Taxonomy. Academic Press, London.

Jain, S. K. and V. Mudgal. 1999. A Handbook of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun.

Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.

Joshi, S. G. 2000. Medicinal Plants. Oxford and IBH, New Delhi.

Kokate, C. and Gokeale- Pharmocognacy- Nirali Prakashan, NewDelhi.

Lad, V. 1984. Ayurveda – The Science of Self-healing. Motilal Banarasidass, New Delhi.

Lewis, W. H. and M. P. F. Elwin Lewis. 1976. Medical Botany. Plants Affecting Man's Health. A Wiley Inter science Publication. John Wiley and Sons, New York.

B.Sc (CBCS) BOTANY- II YEAR
Semester-III - Paper-III
Taxonomy of Angiosperms and Medicinal Botany

Theory Model Question Paper

Time: 2 hrs **Max. Marks: 40**

Draw well-labeled diagrams wherever necessary.

1. Write short notes on any FOUR of the following: - **4 X 2 = 8M**

a. Artificial system of classification.

b. Floral structure of Cucurbitaceae .

c. Role of AYUSH and CIMAP.

d. Active principles of *Phyllanthus niruri*.

e. Herbarium

f. *Aloe vira*

II. Essay Questions:

4 X 8 = 32M

1 a. Discuss in detail the Bentham and Hooker's system of classification and add a note on its merits and de-merits .

(OR)

b. Write an account on Chemotaxonomy.

2 a. Write salient features of the sub-family Fabaceae with a note on its economic importance .

(OR)

b. Discuss in detail the important characters of Asteraceae family with a note on its advanced characters.

3 a. Discuss the outline of Ayurvedic system of medicine.

(OR)

b. Write in detail organicleptic evaluation of *Ocimum sanctum* and its medicinal importance .

4 a. Discuss the morphological aspects of *Rauwolfia serpentina* and Discuss its medicinal importance .

(OR)

b. Write an account on methods of collection, processing and storage practices associated with Crude drugs.

B.Sc (CBCS) BOTANY- II YEAR
Semester-III - Paper-III
Taxonomy of Angiosperms and Medicinal Botany

Practical syllabus

(45 hours)

1. Systematic study of locally available plants belonging to the families prescribed in theory syllabus
   (Minimum of one plant representative for each family) (24h)
2. Demonstration of herbarium techniques. (3 h)
3. Identification,medicinal value & active principle present in the following plants : Tulasi (*Ocimum sanctum*), Karakaya (*Terminalia chebula*), Kalabanda (*Aloe vera*). (6 h)
4. Ethnomedicinal value/practice of the following plants :
   Aswagandha (*Withania somnifera*), Sarpagandha (*Rauwolfia serpentina***)**, Amla (*Phyllanthus emblica*) and
   Brahmi (*Bacopa monnieri*). (6h)
5. Pharmacognosy:
   Powder analysis : Pippalu (*Piper longam)*, Nela usiri (*Phyllanthus niruri*),
   Study of Organoleptic (sectional study) of the following:
   Tippateega (*Tinospora cordifolia*)and Turmeric (*Curcuma longa*). (6h)
6. Candidate have to submit at least 30 herbarium sheets

B.Sc (CBCS) BOTANY- II YEAR
Semester-III - Paper-III
Taxonomy of Angiosperms and Medicinal Botany

Practical Model Paper

Time: 2 $^{1}/_{2}$ hrs **Max. Marks: 25**

1. Technical description of the given plant twig ‘ A ‘ 9M

2. Identify the given material ‘ B ‘ & write its medicinal properties **3M**

3. Identify the specimen ‘ C ‘ & write organoleptic evaluation 3M

4. Identify the given material D ‘ & discuss the ethno medicinal value of it. **3M**

5. Identify the given material ‘ E ‘ . Write the active principle and uses **3M**

6. Herbarium **2M**

7. Record **2M**

B.SC (CBCS) BOTANY- II YEAR
Semester-IV- Paper IV
Plant Anatomy, Embryology and Palynology

DSC-1D (4 hrs./week) Theory syllabus

Credits-4
(60 hours)

UNIT - I:

1. Meristems*:* Types, histological organization of shoot and root apices and theories. (3h)
2. Tissues and Tissue Systems*:* Simple, complex and special tissues. (6 h)
3. Leaf: Ontogeny, diversity of internal structure; stomata and epidermal outgrowths. (6 h)

UNIT-II

4. Stem and root anatomy*:* Vascular cambium - Formation and function. (3h)
5. Anomalous secondary growth of Stem - *Achyranthes, Boerhaavia, Bignonia, Dracaena;* Root– *Beta vulgaris* (5h)
6. Wood structure*:* General account. Study of local timbers – Teak (*Tectona grandis*), Rosewood, (*Dalbergia latefolia*), Red sanders, (*Pterocarpus santalinus*) Nallamaddi (*Terminalia tomentosa*) and Neem (*Azadirachta indica*). (7h)

UNIT - III

7. Introduction: History and importance of Embryology. (2h)
8. Anther structure, Microsporogenesis and development of male gametophyte. (6h)
9. Ovule structure and types; Megasporogenesis; types and development of female gametophyte. (7h)

UNIT-IV

10. Pollination - Types; Pollen - pistil interaction. Fertilization. (4h)
11. Endosperm - Development and types. Embryo - development and types; Polyembryony and Apomixis - an outline. (5h)
12.. Palynology- Pollen morphology, NPC system and application of Palynology. (6h)

References:

Bhattacharya et. al. 2007. A textbook of Palynology, Central, New Delhi.

Bhojwani, S. S. and S. P. Bhatnagar. 2000. The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.

M.R.Saxena- A textbook of Palynology.

Vashista- A textbook of Anatomy.

P.K.K.Nair- A textbook of Palynology.

Esau, K. 1971. Anatomy of Seed Plants. John Wiley and Son, USA.

Johri, B. M. 1984. Embryology of Angiosperms. Springer-Verleg, Berlin.

Kapil, R. P. 1986. Pollination Biology. Inter India Publishers, New Delhi.

Maheswari, P. 1971. An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.

Dutta A.C. 2016. Botany for Degree Students. Oxford University Press.

B.SC (CBCS) BOTANY- II YEAR
Semester-IV- Paper IV
Plant Anatomy, Embryology and Palynology

Theory Model Question Paper

Time: 2 hrs **Max. Marks: 40**

Draw well labeled diagrams wherever necessary.

I. Write short notes on any FOUR of the following: - **4 X 2 = 8M**

a.Types of Stomata.

b. parenchyma.

c. Different types of Ovules.

d. Exine stratification.

e. Rose Wood

f. Polyembryony

II . Essay Questions: **4 X 8 = 32M**

1 a .Classify Meristems ? Discuss in detail the various types of meristems.

(OR)

b. Theories associated with root apices.

2 a. Primary and secondary structure of *Boerhaavia diffusa* stem.

(OR)

b . Describe in detail the wood structure of *Pterocarpus santalinus*.

3 a . Discuss different Embryo sacs studied by you.

(OR)

b. Describe the development of Male Gametophyte.

4 a. Describe in detail various steps in Fertilization.

(OR)

b. Discuss in detail the various applications of Palynology.

B.SC (CBCS) BOTANY- II YEAR
Semester-IV- Paper IV
Plant Anatomy, Embryology and Palynology

Practical syllabus

(45 hours)

Suggested Laboratory Exercises:

1. Demonstration of double staining technique. (3 h)
2. Tissue organization in root and shoot apices using permanent slides (3 h)
3. Preparation of double stained Permanent slides

Primary structure: Root - *Cicer, Canna*; Stem – *Tridax, Sorghum* (6 h)

Secondary structure: Root – *Tridax* sp.; Stem –*Pongamia*

Anomalous secondary structure: Examples as given in theory syllabus. (6 h)

4. Stomatal types using epidermal peels. (3 h)
5. Microscopic study of wood in T.S., T.L.S. and R.L.S. (6 h)
6. Structure of anther and microsporogenesis using permanent slides. (3 h)
7. Structure of pollen grains using whole mounts - *Hibiscus, Acacia* and Grass). (3 h)
8. Pollen viability test using Evans Blue – *Hibiscus* (3 h)
9. Study of ovule types and developmental stages of embryosac. (3 h)
10. Structure of endosperm (nuclear and cellular); Developmental stages of dicot and monocot embryos using permanent slides. (3 h)
11. Isolation and mounting of embryo (using *Cymopsis / Senna* / *Crotalaria*) (3 h)

B.SC (CBCS) BOTANY- II YEAR
Semester-IV- Paper IV
Plant Anatomy, Embryology and Palynology

Practical Model Paper

Time: 2 $^{1}/_{2}$ hrs **Max. marks : 25**

1. Prepare a double stained permanent mount of transverse section of

given material " A " . **9M**

2. Prepare a temporary mount of epidermal peel of the given leaf

material " B " and identify the stomatal type . **4M**

3. Conduct the pollen viability test " C " (OR) Isolate the embryo from

the given material . **4M**

4. Identify and describe the specimens / slides with well labelled diagrams

(a) Embryology – D (b) Palynology – E (c) Anatomy – F **3 X 2 = 6M**

5. Record **2M**

B.Sc. II Year
Semester-III
Skill Enhancement Course

SEC-1 (2 hrs/week) (Credits 2) Lectures: 30

Biofertilizers

Unit-I

1. Microbes as biofertilizers – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis. (4h)
2. *Azospirillum:* isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication. (8h)
3. Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, the role of blue green algae and *Azolla* in rice cultivation. (4h)

Unit-II

4. Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants. (8h)
5. Organic farming – Green manuring and organic fertilizers, Recycling of bio-degradable municipal, agricultural and Industrial wastes – preparation of biocompost, types and method of vermicomposting – field Application. (6h)

Suggested Readings

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.

B.Sc. II Year
Semester-IV
Skill Enhancement Course

SEC-2 (2 hrs/week) **(Credits 2) Lectures: 30**

Herbal Technology

Unit-I

1. Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants. **(6h)**
2. Pharmacognosy - systematic position, medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka. **(6h)**
3. Medicinal plant banks, Micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy) **(4h)**

UNIT-II

4. Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster). **(6h)**
5. 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) **(8h)**

Suggested Readings

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.