

VIJANAGARA SRIKRISHNADEVARAYA UNIVERSITY,

BALLARI



SYLLABUS

For

BACHELOR OF SCIENCE IN BOTANY

From

With effect from 2016-17

BACHELOR OF SCIENCE IN BOTANY

COURSE OF VSK UNIVERSITY

B. Sc. BOTANY Syllabus

Semister	Code No.	Title of the paper	Examination Hours	Max marks	I A marks	Teaching hours
I	BOT-101	Paper-I : Viruses, Bacteria, Cyanobacteria, Algae, Fungi and Lichens	3 Hrs	80	20	4 Hrs/week
	BOT-101	Practical: Viruses, Bacteria, Cyanobacteria, Algae Fungi and Lichens	3 Hrs	40	10	3x2=6 hrs
II	BOT-201	Paper-II: Bryophytes, Pteridophytes, Paleobotany and Gymnosperms.	3 Hrs	80	20	4 Hrs/week
	BOT-201	Practical: Bryophytes, Pteridophytes, Paleobotany & Gymnosperms	3 Hrs	40	10	3x2=6 hrs
III	BOT-301	Paper – III Histology, Anatomy, Embryology and Polynology	3 Hrs	80	20	4 Hrs/week
	BOT-301	Practical: History, Anatomy, Embryology, Polynology	3 hrs	40	10	3x2=6 hrs
IV	BOT-401	Paper-IV – Ecology and Environmental Biology	3 Hrs	80	20	4 Hrs/week

	BOT-401	Practical: Ecology and Environmental Biology	3 hrs	40	10	3x2=6 hrs
V	BOT-501	Paper- V – Morphology, Taxonomy and Economic Botany	3 Hrs	80	20	3 Hrs/week
	BOT-501	Practical: Morphology, Taxonomy, Economic	3 hrs	40	10	3x2=6 hrs
V	BOT-502	Paper- VI– Cell Biology and Cytogenetic	3 Hrs	80	20	3 Hrs/week
	BOT-502	Practical: Cell Biology & Cytogenetics	3 hrs	40	10	3x2=6 hrs
VI	BOT-601	Paper: VII – Plant Breeding, Biotechnology and Plant Tissue Culture	3 Hrs	80	20	3 Hrs/week
	BOT-601	Practical: Plant Breeding, Biotechnology and Plant Tissue Culture	3 hrs	40	10	3x2=6 hrs
VI	BOT-602	Paper-VIII: Plant Physiology	3 Hrs	80	20	3 Hrs/week
	BOT-602	Practical: Plant Physiology	3 hrs	40	10	3x2=6 hrs

B. Sc. Botany I Semester

Paper-I : Viruses, Bacteria, Cyanobacteria, Algae, Fungi and Lichens

Code: BOT-101

Contact Hours: 60 Hours

Credit Points:

Univ Code:

Workload: 4 hours per week

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination- 80 marks

Theory:

Unit 1: Aim and Scope of Microbiology

1 Hr

Unit 2: VIRUSES :- History and Discovery – Characteristics feature of viruses , Structure of Bacteriophage and T. M. V, Diseases caused by T. M. V and Papaya Leaf Curl Virus (P. L.C. V)

4 Hrs

Unit 3: BACTERIA: - Introduction, Classification, flagellation, Ultra structure, Nutrition, Chemistry of gram +ve and gram –ve Bacteria. Brief account of plasmids Reproduction in Bacteria – Cell division, Conjugation, transduction and transformation. Economic importance of Bacteria (Useful and harmful effects). Bacteria diseases – Citrus canker, Sugarcane red stripe.

5 Hrs

Unit 4: CYANOBACTERIA:- A general account of occurrence, ultra structure of cell. Photosynthesis and reproduction. Economic importance in N₂ fixation. Type study of Scytonema, Gloeotrichia and Oscillatoria

6 Hrs

Unit 5: ALGAE: - A general account (Characteristics). Thallus organization, Structure, Plastids (Structure of Chloroplast) Reproduction, Life cycle pattern and classification (Fritsch). Study of structure, reproduction and life cycle of *Volvox*, *Oedogonium*, *Vaucheria* and *Chara*. Diatoms only Pennate type (reproduction - cell-division and Auxospore formation). *Ectocarpus* and *Batrachospermum*. (Developmental aspects are not required).

22 Hrs

Unit 6: FUNGI: - General Characters, Classification based on Alexopolous. Structure, Reproduction and life cycle, disease symptoms and controlling methods of following Plants

Albugo, Rhizopus, Pencillium, Puccinia and Cercospora

Unit 7: LICHENS:- Occurrence and classification. External and internal structures of Crustose, Foliose and Fruticose Lichens – Economic importance as spices, medicine, cosmetics and pollution indicators.

Unit 8: PLANT PATHOLOGY:- Symptoms, etiology, casual organism and control of the following diseases.

2.) Red rot of Sugarcane – Powdery mildew of Crucifers (3). Smut disease of Jawar

Unit 9: BIO-PROSPECTING

1. *Nostoc*, *Anabaena* and *Rhizobium* as fertilizer.

2. Use of *Trichoderma* as pesticides

3. *Spirulina* as food

4. Diatomaceous earth and Agar- Agar.

22 Hrs

Reference Books:-

1. Agrios G.N, 1988. Plant Pathology, Academic Press. San Diego, London.

2. Alexopoulos and Mims C. N. 1983. Introductory Mycology. Willey Estern, New-York
3. Rangaswamy G. 1988. Diseases of crop plants in India. Prentice Hall of India.
4. Gangulee & Kar 1993. College Botany Vol.- II, New Central book agency, Kolkatta.
5. Hans G. Schlegel (1993) General Microbiology Volume-I, Cambridge Press, Cambridge.
6. F Whitcomb and J.G Turil (1978) the Mycoplasmas-III Plant and Mycoplasmas.
7. C.L. Mandahar (1978) Introduction to plant viruses.
8. Mathews (1981) Plant Viruses.
9. K.M.Smith (1977) Plant Viruses.
10. Smith, G.M. 1971. Cyptogamic botany, Vol. 1 Alage & Fungi, Tata McGraw Hill Publishing Co., New Delhi.
11. Sharma, O.P. 1992. Text book of Thallophytes. Tata McGraw Hill Publishing Co., New Delhi.
12. Sharma, P.D. The Fungi. Rastogi and Co., Meerut.
13. Dube, H.C. 1990. An Introduction to Fungi. Vikas Publishing House Pvt. Ltd. New Delhi.
14. Clifton, A. 1958. Introduction to the Bacteria. Tata McGraw Hill Publishing Co., New Delhi.
15. Aneja, K.R. 1993. Experiments in Microbiology, Pathology and Tissue Culture. Vishwa Prakashan, New Delhi.
16. Basu, A.N. 1993. Essentials of plant viruses, vectors and plant diseases. New Age International, New Delhi.
17. Chopra, G.L. A text book of algae. Rastogi and Co., Meerut.
18. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
19. Rangaswamy, G. 1988. Diseases of crop plants of India. Prentice Hall of India, New Delhi.
20. Sundarajan, S. 1977. College Botany, Vol. 1. S. Chand & Co., Ltd., New Delhi.
21. Alexopoulos, 1992. An introduction to Mycology. New Age International, New Delhi.
22. Vashista, B.R. 1978. Fungi. S. Chand & Co., Ltd., New Delhi.

B. Sc. Botany First Semester, Practical – I
MODEL QUESTION PAPER:

Paper-I : Viruses, Bacteria, Cyanobacteria, Algae Fungi and Lichens

Time: 03 Hrs

Max. Marks: 40

1. Stain the given material 'A' by the staining using (Safranin) / Crystal Violet (in curds). Write the procedure and identify with reasons 04
2. Identify the specimens B, C D. & E. Sketch and label giving reasons 12

B	-	Cyanobacteria
C	-	Algae
D	-	Fungi
E	-	Lichens
3. Identify the specimens F. and G draw labeled diagram with reasons. 06

F	-	Viral / Bacterial disease
G	-	Fungal disease
4. Identify the slides H , I , J & K giving reasons 08

H	-	Algae	
I	-	Algae	
J	-	Fungi	
K	-	Fungi	
5. Questions on Bio prospecting			05
L	-	Bio fertilizers	
M	-	Bio Pesticides	
6. Record and Submission			05
			Total 40

**Scheme of Evaluation for Botany Practical-I
B. Sc. I Semester**

Practical – I: Viruses, Bacteria, Cyanobacteria, Algae, Fungi & Lichens

1. Gram Staining of Material A			04
Staining procedure	-	02	
Identification	-	02	
2. Identify the Specimens B, C, D & E			12
Identification	-	01	
Sketch & Label	-	01	
Reasons	-	01	
3. Identify the Specimens F and G			06
Casual organism of disease	-	01	
Symptoms	-	01	
Control measures	-	01	
4. Identify the slides H, I, J and K			08
Identification	-	01	
Reasons	-	01	
5. Questions on Bio Prospecting L & M			05
L	-	2 ½ Marks	
M	-	2 ½ Marks	
6. Record and submission			05
			Total = 40

Note: Every student must submit at least 5 specimens from the forms studied.

**Syllabus for Second Semester
Botany – Paper-II**

Code: BOT-201

Univ Code:

Contact Hours: 60 Hours

Workload: 4 hours per week

Credit Points:

**Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination- 80 marks**

Paper-II: Bryophytes, Pteridophytes, Paleobotany and Gymnosperms.

Unit 1: BRYOPHYTE:- Introduction, Classification, Structure and reproduction and alternation of generation of the following example.

Marchantia, Anthoceros and Polytrichum

Brief account of evolution of sporophyte in Bryophytes. **12 Hrs**

Unit 2: PTERIDOPHYTA:- Introduction, Classification, occurrence, external & Internal organization, reproduction and life cycle of the following.

Lycopodium, Selaginella, Equisetum, Ophioglossum, Adiantum, Marselia

Brief account on Origin, Stellar Evolution, Heterospory and seed habit.

22Hrs

Unit 3: PALEOBOTANY:- Introduction, process of fossilization types and fossils. Geological time scale. A brief account of *Rhynia, Calamites, Lepidodendron*

10 Hrs

Unit 4: GYMNOSPERMS:- General characters and classification. Morphology and anatomy of root, stems & leaf. Reproduction and life cycle in *Cycas, Pinus* and *Gnetum*). (Development aspects not required) **12 Hrs**

Unit 5. Evolution: Brief account of theories of evolution – Lamark, Weismann, Darwin and De-vries. **04 Hrs**

Reference Books :-

1. Chopra R.N. 1988, Biology of Bryophytes. Willey Eastern Ltd., New- Delhi.
2. Singh, Pandey & Jain, Pteridophyta, Gymnosperm & Paleobotany, Rastogi Publication, Meerut.
3. S.Sundarajan, College Botany, Vol-II., Himalaya Publishing House, New Delhi.
4. Smith, G.M. 1971. Cryptogamic Botany, Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
5. Sharma, O.P. 1990. Text book of Pteridophyta. McMillan India, Ltd.
6. Puri, P. 1980. Bryophyta. Atma Ram & Sons, New Delhi.
7. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. 1. Bryophyta. Central Book Depot. Allahabad.
8. Sporne, K.R. 1966. Bryophytes.
9. Vashista, B.R. 1978. Bryophytes. S. Chand & Co., Ltd., New Delhi.
10. Bhatnagar, S.P. and Malhotra, A. 1966. Gymnosperms. New Age International Ltd., New Delhi.
11. Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of vascular plants. W.H. Freeman and Co., New York.
12. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd. London.
13. Stewart, W.M. 1983. Paleobotany and the Evolution of plants. Cambridge University press. Cambridge.
14. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and application in exploration of fossil fuels. Oxford & IBH., New Delhi.
15. Parihar, N.S. 1977. The morphology of Pteridophytes. Central Book Depot. Allahabad.

16. Rashid, A. 1998. An Introduction to Pteridophyta. II Ed., Vikas Publishing House, New Delhi.
17. Sporne, K.R. 1966. The morphology of Pteridophytes. The structure of ferns and Allied plants. Hutchinson & Co., Ltd. London.

Syllabus for Second Semester Practical question paper
Botany Practical – II

Paper - II: Bryophytes, Pteridophytes, Paleobotany & Gymnosperms

Time : 03 Hrs

Max. Marks: 40

1. Identify the specimens A, B, C and D. Sketch and label giving reasons	12
A - Bryophytes.	
B - Pteridophyta	
C - Pteridophyta	
D - Gymnosperms	
2. Describe the anatomy of specimen E and F	06
E - Pteridophyte	
F - Gymnosperm	
3. Mount the given specimen G	05
Identify giving reasons (Gemma cups)	
<i>Equisetum</i> spores, <i>Pinus</i> pollen grains)	
4. Identify the slides H, I, J and K giving reasons	12
H - Bryophyte	
I - Pteridophyte	
J - Gymnosperm	
K - Fossil - Slide / Impression	
5. Submission and Record	05
Total -40	

Note: Every student submits at least 5 specimens from the forms studied.

Scheme of evaluation for Botany Practical – II

	Marks
I. Identify the specimens A, B, C and D.	12
Identification -	01
Sketch & Label -	01
Reasons -	01
II. Describe the anatomy of specimen E and F	06
Identification -	01
Diagram & reasons -	02
III. Mounting of Specimen G	05
Identification -	01
Labeled diagram -	02
Reasons -	02
IV. Identify the slides H, I, J, K	12

Identification	-	01	
Reasons	-	02	
V. Record and submission			05
			Total 40

Vijayanagar Sri Krishnadevaraya University, Bellary
Botany Syllabus, B.Sc. III Semester

Code: BOT-301

Univ Code:

Contact Hours: 60 Hours

Workload: 4 hours per week

Credit Points:

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination- 80 marks

Paper – III Histology, Anatomy, Embryology and Polynology

Theory:

Unit 1: HISTOLOGY: -

- a. Study of meristematic and permanent tissue, classification of meristems based on origin, function and position theories of Histogen and Tunica Corpus. Structure and function of Parenchyma, Collenchyma, Sclerenchyma, Xylem and phloem. **06 Hrs**
- b. Tissue system: Dermal tissue, structure and functions of epidermis and epidermal hairs including glandular hairs. **02 Hrs**
- c. Ground tissue system: Cortex, endodermis, Pericycle, pith and their structure and function. **03 Hrs**
- d. Vascular tissue system: Types of vascular bundle, radial, conjoint, collateral, Bicollateral and Concentric. **03 Hrs**

Unit 2: ANATOMY: -

- a. Internal structure of Dicot stem – *Tridax* and *Cucurbita*. Monocot stem, Grass, Maize. Dicot leaf – *Tridax* – Monocot leaf – Grass. Normal secondary growth in typical Dicot stem, formation of cambial ring, activity of cambium, secondary xylem. Secondary phloem, Vascular rays sap wood, Heart wood, growth rings, tyloses and periderm. **12Hrs**
- b. Secondary growth - in typical Dicot root (Ex. *Cicer*). Anomalous secondary growth in the stem of *Bougainvillea* and *Boerhaavia*. **06 Hrs**

Unit 3: EMBRYOLOGY

- a. Historical accounts - Contribution of Indian embryologists P. Maheswari & B.G.L. Swamy **02 Hrs**
- b. Microsporogenesis – Development of anther, development of male gametophyte. **03 Hrs**
- c. Megasporogenesis - Types & Ovules, differentiation of archesporial initials, Formation of megaspores, Types of tetrads, Types of embryosacs Monosporic, Biosporic, (*Allium* type) and Tetrasporic (*Adox* type). Development of Monosporic

- type of embryosac (*Polygonum* type) Double fertilization, Triple fusion; its significance. **06 Hrs**
- d. Endosperm Types – Cellular, Helobial, free nuclear. Detailed study of cellular, type of endosperms, endosperm haustorium, vermiform appendage. **04 Hrs**
- e. Embryo Types – Dicot and Monocot , development of Dicot embryo – Crucifer type, suspensor, houstorium (definition with examples) **02 Hrs**
- f. Apomixis – a brief account **02 Hrs**
- g. Polyembryony types- causes, induction of polyembryology, significance **02 Hrs**
- h. Pollination types – Self and cross pollination, types of cross pollination and lever mechanism, sensor mechanism, contrivances for cross pollination **04 Hrs**

Unit 4: PALYNOLOGY –

1. Definition, Scope, Pollen morphology – Pollen, Structure, Size and shape of Pollen grains (Spherical, Prolate, subprolate and Periprostate), wall layers and their morphology. (Exine – ectoexine, endoexine) Nexine I, II, III and Intine), Pollen kit. **03 Hrs**

Suggested Reference

Bhojwani, S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas Publishing House, New Delhi.

Cutter, E.G. 1969. Part. I. Cells and tissues. Edward Arnold, London.

Cutter, E.G. 1971. Plant Anatomy: Experiment and interpretation. Part II. Organs Edward Arnold, London.

Easu, K. 1977. Anatomy of seed plants. 2nd edition. John Wiley & Sons, New York.

Fahn, A. 1974. Plant Anatomy. 2nd edition. Pergamon Press, Oxford.

Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Publishing Co., Inc., Mento Park, California, USA.

Raven, P.H., Evert, R.F. and Eichhorn, S.E. 1999. Biology of plants. 5th edition. W.H. Freeman and Co., Worth Publishers, New York.

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

Maheshwari, P. 1950. An Introduction to Embryology of Angiosperms. Tata McGraw Hill, New York.

Shukla, A.K. 1999. Biology of Pollen. Atlas Books & Periodicals.

Raghavan, V. 1986. Embryogenesis in Angiosperms: A Developmental and Experimental Study. Cambridge University Press. New York.

**B. Sc. III Semester Practical Model question Paper
(History, Anatomy, Embryology, Polynology)**

Time: 03 Hrs

Total Marks: 40

I. Identify the specimen ‘A’ from given material	-	05
II. Mount and sketch of endosperm/embryo ‘B’ from given material	-	06
III. Preparation of temporary stained material ‘C’.	-	06
IV. Identify the slides D,E, F, G, H & I	-	18
V. Record submission	-	05
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	Total	40

**B.Sc. III Semester, Practical Scheme of Evaluation
(Histology, Anatomy, Embryology, Polynology)**

I. Mount, identify, Sketch label the specimen ‘A’	05
Pollen Mounting	- 02

Identification	-	01	
Sketch / Label	-	02	
II. Mount and sketch the Endosperm / embryo – ‘B’			06
Mounting	-	03	
Identification	-	01	
Sketch / Label	-	02	
III. Preparation of temporary stained slide ‘C’ Sketch label and identify with reason			06
Preparation	-	03	
Sketch / Label	-	01	
Identification	-	01	
Reason	-	01	
IV. Identify the slide D,E , F G, H & I with sketch label with reasons			18
Identification	-	01	
Sketch – Label	-	01	
Reason	-	01	
(Two from Histology/two from anatomy/ two from embryology)			
V. Record submission			05

Total Marks	40
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Vijayanagara Sri Krishnadevaraya University, Bellary
B.Sc. Botany – IV Semester

Code: BOT-401

Univ Code:

Contact Hours: 60 Hours

Workload: 4 hours per week

Credit Points:

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination- 80 marks

Paper-IV – Ecology and Environmental Biology

Theory:

Unit 1: ECOLOGY

1. Aim and Scope, Factors affecting plant growth and their distribution edaphic, climate and biotic factors, study of water cycle. **08 Hrs**
2. Response of plants to stress conditions- Mesophytes, Hydrophytes, Xerophytes, epiphytes and halophytes. **04 Hrs**
3. Ecosystems – Concept and structure and functions of ecosystem. Pond and Forest ecosystem. Ecological Pyramids, Ecological niche, food chain, trophic level, food web & food chain, energy flow and Bio-geo-chemical cycles of Nitrogen, Carbon and Phosphorous. **08 Hrs**
4. Ecological succession: Process of plant succession, hydrosere, Xerosere, concepts of climax. **06 Hrs**
5. Community Ecology: Methods of studying natural vegetation by quadrates & transects **02 Hrs**

Unit 2: ENVIRONMENTAL BIOLOGY

1. Introduction, Renewable and Non renewable resources. **07 Hrs**
2. Environmental Pollution – A general account of Air, Water, Soil and Noise pollution effects and their control. **07 Hrs**
3. Forestry – Deforestation, Reforestation and Aforestation. Importance of Forestry **04 Hrs**
4. Conservation Ecology – Soil erosion, control of soil erosion, conservation and Management of wild life, National Parks and sanctuaries **08 Hrs**
5. Phytogeography – Phytogeographical regions of India, vegetation types of India with special reference to Karnataka. **06 Hrs**

**B. Sc. Botany – IV Semester Practical -IV – Scheme of Evaluation.
(Ecology and Environmental Biology)**

1. Identification of Hydrophytes, Xerophytes, Epiphytes (Any Two) – (5+5 Marks)	10
Preparation : 03 Marks	
Identification : 01	
Sketch & Label : 01	
2. Comment on the given materials C and D	08
Identification : 01 Mark	
Comments : 03 Marks	
(Hydrophytes, Xerophytes, Epiphytes, Halophytes)	
3. Comment on ecological Instrument ‘E’	04
Identification : 01 Mark	
Comments : 02 Marks	
Uses : 01	
4. Estimation of Chloride, Sulphate and Phosphate of given samples.	08
Procedure : 06 (3+3)	
Results : 02	
5. Mapping the vegetation / phytogeographical types of Karnataka/India Marking and labeling	05
6. Record and Submission	05
	Total 40

**B. Sc. IV Semester Practical – IV Model Question Paper
(Ecology and Environmental Biology)**

Time: 03 Hrs**Max Marks: 40**

1. Prepare temporary stained material A and B. Sketch, label, identify and leave the preparation for observation (Hydrophyte, Xerophyte, and Epiphyte) 10
2. Comment on the given materials C and D (Epiphyte, Halophyte, and Parasites) 08
3. Comment on ecological instrument E 04
4. Estimate chloride/ phosphate / sulphate of different soil samples. 08
5. Mark and label given Vegetation types of Karnataka/India in the supplied map 05
6. Record submission 05

Total 40

Reference Books :-

1. Singh, Pandey & Jai, A Text book of Botany (Angiosperm Anatomy, Economic Botany, Taxonomy & Embryology, Rastogi Publication, Meerut.
2. B. P. Pandey, Embryology of Angiosperm, Rastogi Publication, Meerut.
3. B. P. Pandey, Plant Anatomy, S. Chand & Co. Ltd., New Delhi.
4. Odum, E.P. 1983. Basic Ecology, Saunders, Philadelphia.
5. Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd. Delhi.
6. Mackenzie, A et al. 1999. Instant Notes in Ecology. Viva Books Pvt. New Delhi.
7. Sharma, P.D. 1993, Ecology and Environment. Rastogi Publications, New Delhi.

B. Sc. V Semester Botany

Code: BOT-501

Univ Code:

Contact Hours: 50 Hours

Workload: 3 hours per week

Credit Points:

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination- 80 marks

Paper- 5.1 – Morphology, Taxonomy and Economic Botany

Unit 1: MORPHOLOGY: Vegetative Morphology

1. **Root:** General introduction including classification, Modifications for storage (fusiform, conical, napiform & fasciulated), support (epiphytic / aerial) & respiration (pneumatophores) floating and haustoria.
2. **Stem:** General introduction, including branching types, Modifications: Rhizome, stem tuber, bulb, corm, stolon, sucker, offset, phylloclade, thorn & tendril.
3. **Leaf:** General introduction, types (Simple & Compound), Phyllotaxy (Alternate, opposite & whorled) and stipules. Modifications: Phyllode, spines, tendrils, hooks. Insectivorous plant, pitcher plant, sundew plant & bladder-wort.
4. **Inflorescence:** General account of racemes & cymose including special cymes.
5. **Floral Morphology of Flower:** Complete account of flower
6. **Fruit:** General account including classification & Types of fruits
7. **Seed:** Structure of monocot & Dicot seed, germination of seeds. 20Hrs

Unit 2: TAXONOMY OF ANGIOSPERMS

1. Principles of classifications, Binomial nomenclature, species concept, systems of classification by Bentham & Hooker, AGP III and their merits and demerits.
2. Major contributions of cytology (cyto-taxonomy), phyto-chemistry (chemotaxonomy) and taximetrics (numerical taxonomy) to taxonomy.
3. Herbarium techniques, botanical gardens and Botanical Survey of India and its functions & Important herbaria of India.

4. Study of the following families with plants of economic importance (Bentham & Hooker's system to be followed).
5. **Dicots:** Anonaceae, Brassicaceae, Capparaceae, Malvaceae, Rutaceae, Anacardiaceae, Fabaceae (Caesalpinioideae, Mimosoideae & Fabioideae), Myrtaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Amaranthaceae and Euphorbiaceae.
6. **Monocots:** Liliaceae, Arecaceae, Orchidaceae & Poaceae. 22Hrs

Unit 3: ECONOMIC BOTANY:

1. **Food:** - Cereals, Millets & Pulses: Jower, Ragi, Wheat, Rice, Black gram & Bengal gram.
2. **Oils & Fats:** Ground nut, Coconut & Safflower
3. **Beverages :** Tea, Coffee
4. **Textile Fibres :** Cotton & Coir.
5. **Spices:** Clove
6. **Timber:** Teak & Rosewood
7. **Narcotic plants:** Tobacco.
8. **Medicinal Plants:** *Rauwolfia serpentine*, *Catharanthus rosea*, *Tylophora asthamatica*, *Artemisia nilagirica*, *Withania somnifera*. 08 Hrs

Botanical Study tour of 3-7 days is compulsory.

Every student has to submit 10 herbarium sheets (plants from cultivated lands or college campus) and 15 plant based products at the time of examination.

Suggested Reference

1. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
2. Heywood, V.H. and Moore, D.M. (Eds.) 1984. Current concepts in Plant Taxonomy Academic Press, London.
3. Jeffrey, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge, London.
4. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2nd edition). McGraw Hill Book Co., New York.
5. Radford, A.E. 1986. Fundamentals of Plant Systematics. Harper and Row, New York.
6. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH, New Delhi.
7. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2nd edition). Edward Arnold, London.
8. Dutta, S.C. 1988. Systematic Botany. Wiley Eastern, New Delhi.
9. Jaques, H.E. 1999. Plant families – How to know them. IBS, New Delhi.
10. Lawrence, G.H.M. 1951. Taxonomy of vascular plants. MacMillan, New York.

**B. Sc. Botany fifth semester Practical Syllabus
Paper- V (5.1): Morphology, Taxonomy, Economic
PRACTICAL- V: QUESTION PAPER MODEL**

Time: 03 Hrs

Max Marks: 40

1. Identify the families A, B, C, and D with reasons.	12
2. Describe 'E' with technical terms & Draw floral diagram with floral formula	06
3. Write the morphological & Biological importance of F, G & H and I	08
4. Write the economic importance of J and K	04
Record	05
Herbarium	05
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Total Marks 40	

B.Sc. Botany FIFTH SEMESTER PRACTICAL - V
(5.1) Morphology, Taxonomy, Economic Botany
Scheme of Evaluation

Q-1. One each from Polypetalac (A), Gamopetalae (B), Monochlamydae (C), and Monocot (D) (Identification = 01 Marks, Salient characters = 02 Marks)	12		
Q-2. E = Technical description= 03 Marks F= Floral Diagram & Floral Formula=03 Marks	06		
Q-3. G= Root / Stem / Leaf Modifications =02 Marks H= Inflorescence = 02 Marks I Fruit = 02 Marks J Seed = 02 Marks	08		
Q-4. One each from Monocot (K) & Dicot (L) Family and Botanical Name - 1 Parts used and Uses - 1	04		
Record	05		
Herbarium Submission (Ten plants from cultivated lands or college campus)	05		
<table border="1"><tr><td>Total</td><td>40</td></tr></table>	Total	40	
Total	40		

B. Sc. V Semester Botany

Code: BOT-502

Univ Code:

Contact Hours: 50 Hours

Workload: 4 hours per week

Credit Points:

Evaluation: Continuous Internal Assessment - 20 marks

Semester and Examination- 80 marks

Paper- 5.2 – Cell Biology and Cytogenetic

Theory	:	50 Hrs
Maximum Marks	:	80
IA Marks	:	20
No of teaching hours per week	:	06
Duration of examination	:	03

Unit 1: The Cell: Ultra structure of plant cell, organization, function & its components – cell wall, membranes (fluid mosaic model) Endoplasmic reticulum, Golgi apparatus, Lysosomes, Peroxisomes, Ribosomes, Mitochondria, Plastids, Cytoplasm, Vacuole, Cell sap. Non living inclusion, Nucleus, Nucleoplasm, Nuclear membrane, pores & Nucleolus. 10Hrs

Unit 2: Chromosomes: Size, Number, Structure, chromatid, centromere, telomere, secondary constriction, Nuclear organizer, types of chromosomes (based on position of centromere), karyotype, heterochromatin (facultative and constitute heterochromatin). Euchromatin, chromosomal Model, nucleosome models, Mitosis & Meiosis in plants, Chromosomal aberrations (deletions duplications, inversions & translocations). 10Hrs

Unit 3: Variation in Chromosomal number: Polyploidy (Aneuploidy, euploidy, autopolyploidy, allopolyploidy with reference to *Raphano Brassica*) Character of Polyploidy & significance of Polyploidy. 05Hrs

Unit 4: Nucleic Acids: Chemical composition of DNA & RNA. **RNA** - Occurrence, types, structure & functions. **DNA**:-Occurrence, types, structure (double helix model), mechanism of DNA replication (semi conservative method). 06Hrs

Unit 5: Gene: *Concept of Gene:* Gene expression & regulation – exons, introns, inducible & repressible genes; the operon concept; lac operon (inducible) & repressible operon (tryptophan). *Gene Mutations:* Mutations & Mutagens (Spontaneous, induces, Point mutations). *Genetic Code:* Code dictionary, properties of genetic code. *Protein Synthesis:* Central dogma: mechanism of protein synthesis, transcription & translation: colinearity. 09Hrs

Unit 6: Mendelian genetics: Biography of Mendel in brief: Mendel's experiments: Monohybrid cross – law of dominance , law of segregation, purity of gametes . Homozygous, heterozygous, phenotype, genotype, monohybrid test cross, Dihybrid cross-law of independent assortment, dihybrid test cross, incomplete dominance (*Mirabilis jalapa*, Snapdragon). **Modification of Mendelian Ratios:** (With reference to plant examples). Interaction of genes epistasis (dominant & recessive); supplementary factors, complementary factors: Polygenic inheritance in Maize (Self Sterility in *Nicotiana*), Linkage & Crossing over (in Maize). **Sex determination:** Chromosomal mechanism of sex determination methods. XX –XY, ZZ – ZW & XX – XO (Sex determination in Melandrium). 10Hrs

List of Genetic Problems.

1. In garden peas the effect of the tall allele (T) is dominant over that of dwarf (t) & the effect of the smooth seeded allele (S) is dominant over that of wrinkled (s). These two gene pairs also are known to assort independently of each other.
 - a. What proportions of phenotypes would be expected among the progeny off tall smooth seeded F1 Plants crossed to each other, if each such F1 plant was derived from a cross between pure breeding tall smooth seed variety (TTSS) & dwarf wrinkled seeded variety (ttss)?
 - b. What proportions of phenotypes in the F2 generation be changed if the F1 plants of (a) we crossed between a tall wrinkled seeded variety & a dwarf smooth variety.
 - c. What phenotype results would be expected if the F1 plants (a) were crossed to a dwarf seeded plant.

2. A round seeded. Dwarf pea plant was crossed with a wrinkled seeded, tall one. In the F₂ 32 round tall, 115 round dwarf 120 wrinkled tall & 36 wrinkled dwarf were produced decided whether these characters are showing independent assortment.
3. In tomatoes, yellow fruit & dwarf characters are due to recessive alleles of genes which the more common red fruited tall plant. If the pollen from a pure dwarf plant bearing red fruit placed on the pistil of a pure tall plant bearing yellow fruit, what type of off springs be expected in the F₁? If these are crossed among themselves , what off springs would be expected in the.
4. A tall red when crossed with dwarf red plant produce a dwarf white plant. Give the genotypes parents.
5. What type of gametes will be formed by the pea plants involved in the following crosses? Determine the phenotype ratio of the offspring.
 - i. Yy Rr yyrr-----Yy RR X yyrr
 - ii. YyRr X YyRR ----- YyRr X Yyrr
 - iii. Yyrr X yyRR ----- Yy Rr X Yy Rr

Note : Select any two pairs for setting

6. In pea tallness (T) is dominant over dwarfness (t). A tall plant crossed with dwarf , produces off springs of which about 50% are tall & 50% are dwarf. What are the genotypes of the progeny?
7. In tomatoes red fruit colour (R) is dominant over yellow (r). A pure red fruited plant is crossed to a yellow fruited one. What will be the appearance of F₁ ? The F₁ are interbreed & Produce 320 offsprings in the F₂ . How many of them will be red & how many yellow? What will be genotype of F₂ & in what number?
8. 9:7 Ratio.

The two non-allelic dominant genes C & P alone produce white flowers in pea plants. When both the dominant genes at least in single dose are [present together in a genotype they produce

1. Purple flowers parent X white flowered parent
- ii. White flowered plant X white flowered plant

9. 12:3:1

The white fruit colour in summer squash is controlled by a dominant gene (W) & coloured controlled by its recessive allele (w). Yellow fruit is governed by an independently assorting hypostatic gene (G) & green by its recessive allele (g). When dihybrid plants are crossed , the offsprings appear in the ratio of 12 white : 3 yellow : 1 green . What fruit colour ratios are expected from the crosses given below?

I) WWgg X WwGG II) WwGg X wwgg

10. Linkage & Crossing over.

In corn there is a dominant gene for colored gene for full seed. Then recessive alleles of these genes produce colorless seed & shrunken seed. Plants homozygous for colored full seed are crossed with colorless shrunken & the test cross of the F₁ yields the following results.

Colour full 190 Colour less 198

Colour Shrunken 01 Colourless full 05

Would you say that these two genes are linked ? If so what is the percentage of crossing over?

11. Problems on Polygenic Inheritance

Note: - In tomato genotype aabbcc Produces 100gms of tomato and AABBCC Produces 160gms of tomato. So each gene (Capital Letter) raising an increasing of 10gms.

What is the wt of tomato in the Parents and Progenies in the following cross.

1. AAbbcc X aaBBcc

THIRD YEAR B.Sc. Botany
Fifth Semester Practical- 5.2 Cell Biology & Cytogenetics
Practical Question Paper – VI

- | | |
|--|----|
| 1. Prepare Squash/ smear of Material 'A' sketch and label any two stages you showed to the examiner with reasons | 10 |
| 2. Prepare of material 'B' and Identify | 06 |
| 3. Identify the slides 'C' & 'D' 'E' (One from mitosis & two from meiosis) | 09 |
| 4. Solve the genetic problem 'F' & 'G' | 10 |
| Record | 05 |

THIRD YEAR B.Sc Botany
Fifth Semester Practical- VI 5.2 Cell Biology & Cytogenetics
Scheme of Evaluation

Q1-	Preparation	=	05
	Sketch & Label	=	03
	Reasons	=	02
Q2.	Cytological examination of special type of chromosomes – bar body, lampbrush, polytene chromosomes, and Ring chromosome in <i>Rhoeo</i>		
	Preparation	=	05
	Identification	=	01
Q3-	Identify the slides 'C', 'D' & 'E' (3+3+3)		
	Identification	=	01
	Characters	=	02
Q4.	Genetic Problems		
	Monoybrid / Dihybrid / Interaction Factors / Incomplete Dominance / Crossing over, Polygenic inheritance F & G	=	05
Q5.	Record	=	05

Reference Books :-

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, I.D. 1999. Molecular Biology of Cell. Garland Publishing Co., Inc., New York.
2. Atherly, A.G., Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.
3. Gupta, P.K. 1999. A Text-Book of Cell and Molecular Biology. Rastogi Publications Meerut.
4. Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York.
5. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology. W.H. Freeman & Co., New York.
6. Russel, P.J. 1998. Genetics. The Benjamin/Cummings Publishing Co. Inc. USA.
7. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics. John Wiley & Sons, Inc. USA.
8. Stent, G.S. 1986. Molecular Genetics. CBS Publications.
9. Wolfe, S.L. 1993. Molecular and Cell Biology. Wadsworth Publishing Co., California, USA.
10. Stickburger, M. 1990. Genetics. (3rd edition). MacMillan Publishing Co.
11. Bendre & Kumar, Economic Botany Rastogi Publication, Meerut.
12. Singh & Jain, Taxonomy of Angiosperm, Rastogi Publication, Meerut.
13. Saxena & Saxena, Plant Taxonomy, Pragati Prakashan, Meerut.

B.Sc. Botany, Sixth Semester Practical- 6.1

Code: BOT-601

Univ Code:

Contact Hours: 50 Hours

Workload: 3 hours per week

Credit Points:

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination- 80 marks

Paper: VII – Plant Breeding, Biotechnology and Plant Tissue Culture

Unit 1. Plant Breeding: Principles and objectives: Methods of plant breeding (Mass selection, Single plant or pure line selection, clonal selection, progeny selection, recurrent selection).

Significance of plant breeding – increase in yield, resistance to diseases and insect pests. Plant breeding in producing new and improved varieties of medicinal plants and economically important plants. Pollen banks, Quarantine methods, industrial importance and its maintenance. **12 Hrs**

Unit 2. Hybridization: Objectives, techniques of emasculation, artificial pollination, intraspecific and intergeneric crosses. **Propagation** – Cutting, Gooing (air layering), Grafting, Wedge grafting, approach grafting, bud grafting. **06 Hrs**

Unit 3. Biotechnology: - Introduction, Scope of Genetic Engineering (DNA technology), Tools and techniques in recombinant DNA technology, DNA finger printing and its applications. Production of Polyclonal and Monoclonal antibodies. Gene therapy & Stem cell culture. Genetic manipulation through tissue culture, Gene mapping.

Application of Biotechnology - in pharmaceutical, agriculture, industrial, environmental oil spill (Green peace movement, Waste disposal management and sewage water treatment). ELISA method to detect plant diseases.

Transgenic plants – BT Cottons, Tomato, *Arabidopsis thaliana* **22Hrs**

Unit 4. Tissue Culture: Aim and scope, Totipotency, callus culture, organogenesis through callus culture, somatic embryogenesis, haploid culture (Example anther culture). Application of tissue culture in agriculture and human welfare. **10 Hrs**

Reference Books :-

1. Chahal. Principles and procedures of Plant Breeding. L.B. Publications.
2. Gopalakrishnan, T.S., Itta Sambasivaiah and Kamalakar Rao. Principles of organic evolution
3. Gupta, P.K. Cytology, Genetics and Evolution. Rastogi publications, Meerut .
4. Khanna, S.S. Genetics, Heridity and Evolution.
5. Sinha and Sinha. Cytogenetics, Plant Breeding and Evolution. Vikas Publications.
6. Joshi, P. Genetic engineering and its applications. Panima Book Distribution, Bangalore.
7. Menetre, S.S. Molecular basis of cytoplasmic male sterility in crop plants. International Book Distribution.
8. Purohit, S.S. Molecular Biology and Biotechnology. Daya Publishing House, New Delhi.
9. Ratledge. Basic Biotechnology. L.B. Publications.
10. Sawahel and Wagley, 1997. Plant Genetic Engineering. Daya Publishing House, New Delhi.
11. Vyas, S.P. and Kohi, D.V. Methods in Biotechnology and Bioengineering. Daya Publishing House, New Delhi.
12. Yadav. Biotechnology. L.B. Publications.
13. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers, The Netherlands.

14. Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier
 15. Collins, H.A. And Edwards, S. 1998. Plant Cell Culture. Bios Scientific Publishers, Oxford, UK.
 16. Old, R.W. and Primrose, S.B. 1989. Principles of Gene manipulation. Blackwell Scientific Publications, Oxford, UK.

B.Sc. Botany, Sixth Semester
Plant Breeding, Biotechnology and Plant Tissue Culture
Practical Question Paper – 6.1

Time: 3 Hrs	Max Marks: 40
Q1- Show the technique of Hybridization - 'A'	05
Q2. Procedure of the inoculation techniques 'B' or MS media preparation procedure	05
Q3. Comment on C, D, E and F	16
Q4. Project work – Submission of any one topic you have studied from (I semester to VI semester)	09
Q5. Records	05
	Total 40

B.Sc. Botany, Sixth Semester
Plant Breeding, Biotechnology and Plant Tissue Culture
Scheme of Evaluation Paper – 6.1

1. 'A' – Technique of hybridization Emasculation and bagging	05
2. 'B' Procedure of MS media or method of inoculation	05
3. 'C'- Biotechnology Products – Antibiotics, Rhizobium, Penicillin	
'D'- Photographs from Genetic Engineering	
'E'- Photographs or charts from plant breeding, Biotech and genetic engineering.	
'F'- Plant propagation – Cutting, Gooting, Layering, Budding	16
4. Project work – Submission of any 01 topic you have studied from 1semester to 6 th Semester	09
5. Record Submission	05
	Total 40

B.Sc. Botany, Sixth Semester

Code: BOT-602

Univ Code:

Contact Hours: 50 Hours

Workload: 3 hours per week

Credit Points:

Evaluation: Continuous Internal Assessment - 20 marks
Semester and Examination- 80 marks

Paper-6.2: Plant Physiology

Unit 1. Plant water relations: Significance of water for plants. Solutions, Colloidal systems Osmosis (OP, TP, DPD and water potential, Plasmolysis, exosmosis, deplasmolysis ad endosmosis). 03Hrs

- Unit 2. Absorption of water:** Mechanism of active osmotic and active non-osmotic and passive absorption. 02Hrs
- Unit 3.** Ascent of sap, path of ascent of saps (only *Balsam* plant Expt.) Mechanism, Root pressure theory, Dixon's and Jolly's theory of cohesion. 03Hrs
- Unit 4. Absorption of Mineral salts:** Mechanism of absorption – Passive absorption (Diffusion, Mass flow, Ion exchange, Donnan's Equilibrium), Active absorption (Lundergardh and Burstrom Cytochrome Pump theory, Lecithin Cycle, Carrier concept). 03Hrs
- Unit 5. Mineral Nutrition:** Essential and non essential elements, Micro and Macro nutrients. Role and deficiency symptoms of N, P, K and Mg, Fe, Cu. 03Hrs
- Unit 6. Transpiration:** Types of transpiration, Mechanism of stomatal transpiration-structure of stomata, Mechanism of stomatal movements, Starch Sugar theory and Proton transport concept. Significance of transpiration, Factors affecting transpiration. Guttation and wilting point. 04Hrs
- Unit 7. Translocation of solutes:** - Types (Upward, radial and downward), path (phloem Ringing Expt ., Protoplasmic streaming theory and Munch Flow theory). 03Hrs
- Unit 8. Enzymes:** Nomenclature, Structure, Classification and Mode of enzyme action. 02Hrs
- Unit 9. Photosynthesis:** Structure and functions of chloroplast, Photosynthetic pigments, Photosystem I and Photosystem II. The Z scheme – the light and dark reactions, C3, C4 pathway and CAM plants. The law of limiting factors, Factors affecting photosynthesis. Photosynthesis in Bacteria. 10Hrs
- Unit 10. Respiration:** Introduction, Types, biochemical pathways of respiration- Glycolysis. TCA Cycle, Electron Transport System and Terminal oxidation. An account of anaerobic respiration and fermentation. Significance as an industrial process. **Carbohydrate Metabolism:** Importance of Carbohydrates, definition, classification, common carbohydrates in plants – Glucose, Fructose, Sucrose, Cellulose, Pentose metabolism. An account of photorespiration and its significance. 10Hrs
- Unit 11. Plant Growth Regulators:** Definition, types of growth regulators, Physiological and Practical application of Auxins (IAA), Gibberellins (GA₃), Cytokinins, Ethylene and Abscissic acid (ABA). Physiology of Flowering: Photoperiodism, types, role of phytochrome, vernalization, seed dormancy. 05Hrs
- Unit 12. Plant Movement:** Introduction, Classification, tropic movements (Hydro, Geo, Phototropic) and Sismonastic. 02Hrs

**B.Sc. Botany, Sixth Semester, Plant Physiology
Practical Question Paper – 6.2**

Time: 03 Hrs

Max Marks: 40

- | | |
|---|----|
| 1. Perform the Physiology expt. 'A' and show to examiner (Major Expt.). | 10 |
| 2. Perform the physiology expt. 'B' and show to examiner (Minor Expt). | 07 |
| 3. Conduct a micro chemical test in specimen 'C' and identify the cell Inclusions | 03 |
| 4. Identify and comment on the physiological expt. D , E , F, G & H | 15 |
| 5. Submission of Records | 05 |

Total	40
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B.Sc. Botany, Sixth Semester Scheme of Evaluation

Paper-6.2: Plant Physiology

1. Physiology (A)	- Principle, Procedure	05
	- Setting of Expt.	05
2. Physiology (B)	- Principle, Procedure	04
	- Setting of Expt.	03
3. Cellulose, Lignin, Starch, Protein, Cystoliths and Raphides		03
4. Aim of the expt., Principle D, E, F, G and H		15
5. Submission of Records		05
Total		40

Reference Books :-

- Dennis, D.T., Turpin, D.H. Lefebvre, D.D. and Layzell (eds). 1997. Plant Metabolism (2nd edition). Longman, Essex, England.
- Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verland, New York.
- Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons., Inc., New York.
- Lea, P.J. and Leegod, R.C. 1999. Plant Biochemistry and Molecular Biology. John Wiley Sons, Chinchester, England.
- Mohr, H. and Schopfer, P. 1995. Plant Physiology. Springer-Verland, Berlin.
- Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California.
- Taiz, L. and Zeiger, E. 2002. Plant Physiology (3rd edition). Sinauer Associates, Inc., Punishers, Massachusetts, USA.
- P.K.Gupta , Elements of Biotechnology , Rastogi Publications , Meerut.
- V.K.Jain , Fundamental of Plant Physiology , S. Chand & Co. New- Delhi.
- P.S.Gill , Plant Physiology , S. Chnad & Co. New Delhi.
- H. Srivastava, Plant Physiology , S. Chnad & Co., New Delhi.