



Department of Collegiate Education

## **GOVERNMENT COLLEGE, KARWAR**

**(Autonomous Institution under Karnataka University, Dharwad)**

**SYLLABUS**

**BOTANY**

**OPTIONAL SUBJECT IN B. Sc. COURSE**

**(06 SEMESTERS)**

**With effect from 2016-17**



## COURSE STRUCTURE

### B.Sc. with Botany as an Optional Subject

Semester-wise Paper Topics	Teaching hours per week	Exam duration (Hours)	Marks		
			I.A	Exam	Total
<b>SEMESTER - 1</b>					
Microbiology, Algae and Fungi – Theory(T)	5	3	20	80	100
Microbiology, Algae and Fungi – Practicals (P)	4	4	10	40	50
<b>SEMESTER - 2</b>					
Histology, Bryophytes, Peridophytes and Gymnosperms - T	5	3	20	80	100
Histology, Bryophytes, Peridophytes and Gymnosperms - P	4	4	10	40	50
<b>SEMESTER - 3</b>					
Angiosperm Morphology , Taxonomy and Utilisation- T	5	3	20	80	100
Angiosperm Morphology , Taxonomy and Utilisation- P	4	4	10	40	50
<b>SEMESTER - 4</b>					
Anatomy and Embryology of Angiosperms - T	5	3	20	80	100
Anatomy and Embryology of Angiosperms - P	4	4	10	40	50
<b>SEMESTER - 5</b>					
Cell biology, Molecular Biology and Genetics-T	3	3	20	80	100
Plant Physiology and Phytochemistry -T	3	3	20	80	100
Cell biology, Molecular Biology and Genetics-P	4	4	10	40	50
Plant Physiology and Phytochemistry -P	4	4	10	40	50
<b>SEMESTER - 6</b>					
Evolution, Plant breeding and Plant Biotechnology - T	3	3	20	80	100
Ecology and Environment - T	3	3	20	80	100
Evolution, Plant breeding and Plant Biotechnology - P	4	4	10	40	50
Ecology and Environment - P	4	4	10	40	50

**Note:**

1. IA marks to be awarded based on 02 tests and seminars/home assignments/group projects/ any other activities in theory and one practical test, in practicals.
2. Individual or group projects may be introduced in Semester VI instead of regular practicals in any one paper. Report of the project may be assessed for 50 marks.
3. Study of developmental aspects of the various type studies included in the syllabus of Semesters I and II not necessary .
4. Field study/ Industrial Tours / Visit to Research Institutes to be undertaken wherever necessary and specified to provide experiential learning opportunities and first hand exposure to students

### SEMESTER – I

## Microbiology, Algae & Fungi (Theory)

Unit	Topics	Teaching Hours
I	<p><b>Introduction to Botany</b>                      Introduction to Botany, its branches and scope. A brief history of Botany.                      Botany in Ancient India. Contributions of Indian Botanists – J. C. Bose, Birbal Sahni, P. Maheshwari, B.G.L. Swamy, E. K. Janaki Ammal and M. S. Swaminathan.                      A brief study of historical developments of Kingdom system of classification. Whittaker's Five kingdom system of classification of organisms with examples.                      General classification of Plants - Cryptogams (Thallophyta, Bryophyta, Pteridophyta) and Phanerogams (Gymnospermae and Angiospermae) with examples.</p>	06
II	<p><b>Viruses, Viroids and Prions:</b>                      Historical aspects of Virology (Contributions of Mayer, Iwanowsky, Beijerinck, Stanley, Bawden &amp; Pierie), General characters (living and non-living features), classification (Baltimore and ICTV systems up to groups/orders). Ultra structure and multiplication of TMV. Viral plant diseases- general symptoms and control measures. Study of Banana Bunchy top disease, Tobacco Mosaic Disease in Cucumber and Yellow Mosaic of Beans (specific symptoms and Control measures).                      A brief account of Viroids and Prions (Discovery, structure, multiplication and diseases)</p>	08
III	<p><b>Bacteria &amp; Phytoplasma:</b>                      Historical aspects of Bacteriology (contributions of Leeuwenhoek, Pasteur, Jenner, Koch and Bergeys), Classification according to Bergey's manual (only major groups). Types based on cellular morphology, Flagellation and mode of Nutrition. Ultra structure of Bacterial cell. Reproduction- Binary fission and Endospore formation. Genetic recombination in Bacteria - Conjugation, Transformation and Transduction (generalized).                      Economic importance of Bacteria (Useful and harmful aspects).                      Plant diseases caused by Bacteria- Crown gall and Citrus canker (Symptoms and Control measures).                      A brief account of Phytoplasma (Discovery, structure, multiplication and diseases).</p>	14
IV	<p><b>Cyanobacteria:</b>                      General characters and Classification up to orders with examples (Fritsch). Ultra structure of cyanobacterial cell and heterocyst.                      General methods of reproduction: Vegetative- Fission, Fragmentation and Hormogone formation; Asexual - Endospore, Exospore, Nannospore and Akinetes. Thallus structure of Nostoc, Gloeotrichia and Oscillatoria.                      Economic importance of Cyanobacteria with special reference to algal blooms, biofertilisers and single cell proteins.</p>	08
V	<p><b>Algae:</b>                      General account- Occurrence (aquatic, terrestrial and extreme habitats), Thallus organization with examples, Pigmentation, General methods of reproduction with examples - vegetative, asexual and sexual, Types of life cycles (only schematic representations) with examples (haplontic, diplontic, isomorphic, heteromorphic and triphasic).                      Classification up to classes with examples excluding myxophyceae (Fritsch).                      Study of thallus structure and life cycle of Volvox, Oedogonium, Chara, Sargassum, Ectocarpus and Batrachospermum.                      Economic importance of Algae - useful aspects (food, industrial products, medicine, sewage treatment, energy source), harmful aspects.                      A brief account of algal culture.</p>	14

VI	<p><b>Fungi:</b>  General account- General characters, thallus structure (unicellular and mycelial), General methods of reproduction with examples - vegetative, asexual and sexual. Classification up to classes with examples (Alexopoulos).  Study of thallus structure and life cycle of Albugo, Penicillium, Peziza and Puccinia.  Fungal diseases in plants- Koleroga of arecanut and Tikka diseases of groundnut (symptoms and control measures)  Economic importance of Fungi - useful activities (food, industrial products, medicine, bio control agents) and harmful activities (pathogens, food spoilage, toxins).  A brief account of mushroom cultivation technique.</p>	14
VII	<p><b>Plant-Microbial Interactions:</b>  Introduction - Positive/symbiotic and negative interactions with examples.  Lichens- Morphological types, internal structure of thallus, methods of reproduction and economic importance.  Mycorrhizae - Types, structure and economic importance.</p>	06
<b>Total</b>		<b>70 Hours</b>

**SUGGESTED REFERENCE BOOKS:**

1. SURESH NARAYAN & PULLAIAH, 2010, **EMINENT INDIAN BOTANISTS – PAST AND PRESENT**, REGENCY PUBLICATIONS, NEW DELHI.
2. DUBEY, R. C., & MAHESHWARI, D. K., 2009, **A TEXT BOOK OF MICROBIOLOGY**, S CHAND PUBLISHERS.
3. SINGH, PANDE & JAIN, 2015, **A TEXT BOOK OF BOTANY**, RASOGI PUBLICATIONS
4. DEY S. N. & P. S. TRIVEDI. 1977. **A TEXT BOOK OF BOTANY VOL I** VIKAS.
5. GANGULEE, DAS & DATTA 2002, **COLLEGE BOTANY VOL II** NCBA (P) LTD
6. SUNDARA RAJAN S.,2009, **COLLEGE BOTANY VOLUME 1**, HIMALAYA PUBLICATIONS
7. KUMAR H. D. & H.N. SINGH. 1996. **A TEXT BOOK OF ALGAE**, EAST WEST PRESS. NEW DELHI.
8. PELCZAR M. J., E.C.S CHAN & N. R. KRIEG. 2008. **MICROBIOLOGY** 5<sup>TH</sup> EDITION. MC GRAW HILL.
9. PUROHIT S. S 1989, **VIRUSES, BACTERIA & MYCOPLASMAS**, AGROBOTANICAL PUBL.
10. SMITH G. M. 1955. **CRYPTOGAMIC BOTANY VOL I. ALGAE & FUNGI**. MCGRAW HILL BOOK CO. INC. 2<sup>ND</sup> EDITION.
11. SMITH K. M 1990. **PLANT VIRUSES** 6<sup>TH</sup> EDITION UNIVERSAL BOOK STALL NEW DELHI.
12. VASHISTHA B.R., SINHA A. K. & SINGH V.P. 2004. **BOTANY FOR DEGREE STUDENTS, ALGAE**
13. ALEXOPOULOS C.J. 1962. **INTRODUCTORY MYCOLOGY** WILEY EASTERN LTD.,
14. DUBE H.C 1983, **AN INTRODUCTION TO FUNGI** VIKAS PUBLICATIONS.
15. BENDRE A. M. AND A. KUMAR, 2014. **PRACTICAL BOTANY VOLUME – 1**, RASTOGI PUBLICATIONS

## Microbiology , Algae & Fungi (Practicals)

Practical No.	Experiment
1	Microscopy technique: Study of Light compound and Dissecting microscopes – Parts, working Principle, handling and preparation of temporary mountings
2	Study of Viral Diseases: Banana Bunchy top disease, Tobacco Mosaic Disease in Cucumber and Yellow Mosaic of Beans (specific symptoms and Control measures)- with the help of specimens or photographs.
3	Microscopic observation of Bacteria by simple staining (Positive-Crystal violet, Negative-Nigrosine or Indian Ink) and Grams staining methods.
4	Study of Bacterial and Phytoplasmal Diseases- Crown gall, Citrus canker, Sandal spike and Little leaf of brinjal (using specimens or photographs).
5	Laboratory culture of Bacteria – isolation from soil by serial dilution method
6	Study of thallus structure of Nostoc, Gloeotrichia and Oscillatoria using specimens and permanent slides
7	Study of thallus and reproductive structures of Volvox, Oedogonium and Chara.
8	Study of thallus and reproductive structures of Sargassum, Ectocarpus and Batrachospermum using specimens and permanent slides
9	Study of Albugo and Penicillium using specimens and permanent slides
10	Study of Peziza and Puccinia using specimens and permanent slides
11	Fungal diseases in plants- Koleroga of arecanut and Tikka disease of groundnut with the help of specimens or photographs
12	Study of Lichens- morphological types, internal structure and reproductive structures using specimens and permanent slides
13	Microscopic observation of mycorrhizae and root nodule bacteria
14	Study/observation of mushroom culture/algal culture methods by visiting functioning facilities or Demonstration of mushroom culture / algal culture

### EXAMINATION PATTERNS AND ASSESSMENT GUIDELINES

PATTERN OF QUESTION PAPER FOR THEORY SEMESTER END EXAMINATION  
(COMMON FOR ALL SEMESTERS)

**Max. Time: 3 hrs**

**Max. Marks: 80**

Q. Nos	Type and number of questions	Total Mark
01 to 12	12 questions of short answer types (to be answered in 2-3 sentences). Any 10 to be answered.	2 X 10=20
Q 13 to 20	08 questions of 5 marks each (short notes). Any 6 to be answered	5X6 = 30
Q 21 to 23	Questions of descriptive answers with internal choice (A or B). All 3 to be answered. Each question may be divided into sub questions	10 X 3 = 30
	<b>Total</b>	<b>80</b>

PATTERN OF PRACTICAL EXAMINATION AND ASSESSMENT CRITERIA

**Semester I**

Q. No.	Questions	Mark
01	Identify and Classify material materials <b>A,B,C</b> and <b>D</b> with labeled sketch and reasons.	4X4=16
02	Identify and comment on the pathological materials <b>E</b> and <b>F</b>	2X2=04
03	Prepare a stained slide of the given bacterial sample <b>G</b> by Simple Positive/ Simple Negative / Grams Staining technique. Show the preparation to the examiner (No written answer is required).	03
04	Identify, sketch and describe the given slides/specimens <b>H,I,J</b> and <b>K</b> .	3X4 = 12
05	Practical Record	05
	Total	40

### Instruction to Examiners:

1. At least 01 specimen each from cyanophyta, algae and fungi
2. One each pathology material infected by bacteria and Virus / Phytoplasma (colour photographs may also be used)
3. Bacterial culture/curd sample
4. At least 01 slide / specimen each from cyanophyta, algae, fungi, lichens/mycorrhiza
5. 5 minutes to be given to each student for answering each question of 02 and 04.

### Assessment Guidelines:

Q. No.	Assessment Criteria	Total
01	IDENTIFICATION= 1/2, CLASSIFICATION 1, LABELED SKETCH = 1, IDENTIFYING FEATURES (Min. 03) = 1½	4
02	IDENTIFICATION OF DISEASE WITH PATHOGEN NAME = 1, 02 SYMPTOMS = 1	2
03	STAINING PROCEDURE = 2, SLIDE APPEARANCE=1	3
04	IDENTIFICATION= ½, LABELED SKETCH= 1, REASONS=1½	3
05	90-100% Practicals = 5, 80-90% = 4, 70-80%=3	5

## SEMESTER – II

### Plant Histology, Bryophytes, Pteridophytes and Gymnosperms (Theory)

Unit	Topics	Teaching Hours
I	Plant Histology: Introduction to tissues, General classification of tissues. Meristematic tissues: Definition; classification based on origin, function and position; theories of shoot and root apical meristem organization (apical cell theory, histogen theory, tunica-carpus theory). Permanent Tissues: Structure, types and functions of simple permanent tissues -	14

	parenchyma, sclerenchyma and collenchyma. Structure, composition and functions of complex permanent tissues – xylem and phloem. Secretory tissues: Glandular trichomes, Nectars, glands, laticifers and resin ducts.	
II	Bryophytes: Origin, affinities with algae and pteridophytes; General characters, general life cycle, Classification up to orders (Rothmaler) with examples. Morphological and anatomical structure, reproduction and life cycle of Riccia, Marchantia, Anthoceros and Funaria. Evolution of sporophytes in bryophytes – theory of progressive sterilization and simplification.	14
III	Pteridophytes: Origin, affinities with gymnosperms; General characters, general life cycles (homosporous and heterosporous types), Classification up to orders (Sporne) with examples. Morphological and anatomical structure, reproduction and life cycle of Psilotum, Lycopodium, Selaginella, Equisetum, Angiopteris and Marselia. Stelar variations in pteridophytes, Heterospory and its significance.	14
IV	Gymnosperms: Origin, affinities with angiosperms; General characters, general life cycle, Classification up to orders (Bierhorst) with examples. Morphological and anatomical structure, reproduction and life cycle of Cycas, Pinus and Gnetum Economic importance of Gymnosperms	14
V	Palaeobotany: Introduction, significance of fossils, geological time scale, Fossilisation, types of plant fossils – compressions, impressions, incrustations, petrifications and actual remains; Palaeobotanical techniques Introduction to Fossil Pteridophytes, Morphology and anatomy of Rhynia, Lepidodendron and Calamites. Introduction to Fossil Gymnosperms, study of Lyginopteris and Williamsonia	14
<b>Total</b>		<b>70 Hours</b>

## SEMESTER – II

### Histology, Bryophytes, Pteridophytes and Gymnosperms (Practicals)

Practical No.	Experiment
1	Plant Sectioning and temporary slide preparation -training in free hand sectioning of plant parts, staining and mounting.
2	Microtomy technique
3	Study of shoot apex, root apex and different types of meristematic tissue using permanent slides

4	Study of simple permanent tissues – types of parenchyma, sclerenchyma, collenchyma using permanent slides/sections/macerations
5	Study of complex permanent tissues – xylem and phloem using permanent slides/sections/macerations
6	Study of secretory tissues
7	Study of structure and reproduction of Riccia and Marchantia
8	Study of structure and reproduction of Anthoceros and Funaria
9	Study of structure and reproduction of Psilotum and Lycopodium
10	Study of structure and reproduction of Selaginella and Equisetum
11	Study of structure and reproduction of Angiopteris and Marselia
12	Study of structure and reproduction of Cycas and Pinus
13	Study of structure and reproduction of Gnetum
14	Study of different types of fossils using specimens/slides/photographs. Observation of fossil slides related to Rhynia, Lepidodendron, Calamites, Lyginopteris and Williamsonia.

#### SUGGESTED REFERENCE BOOKS:

1. ESAU, K. (1980) : PLANT ANATOMY, (2ND EDITION) WILEY EASTERN LTD., NEW DELHI, BANGALORE, BOMBAY, CALCUTTA, MADRAS, HYDRABAD
2. FAHN, A. (1997) : PLANT ANATOMY PERGAMON PRESS, OXFORD-
3. GANGULEE, DAS & DUTTA 2002, **COLLEGE BOTANY VOL IINCBA(P) LTD.**
4. PANDEY S.N, S.P MISRA & P.S RIVEDI 1972. **A TEXT BOOK OF BOTANY VOL II.** 2/3 VIKAS PUBL.
5. KUMARESAN & ANNIE REGINALD, 2013, PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY, SARAS PUBLICATIONS
6. VASHISHTA, PC, 1990, GYMNOSPERMS
7. SRIVASTAVA H.N., PANDEY S.N. S.P MISRA & P. S TRIVEDI 1972. **A TEXT BOOK OF BOTANY VOL II.** 2<sup>ND</sup> EDITION VIKAS PUBLICATIONS.
8. SRIVASTAVA H.N 1998. **BRYOPHYTA.**
9. VASHISTA P.C 1994, **PLANT ANATOMY**, PRADEEP PUBLICATIONS ,NEW DELHI
10. SINGH, PANDE & JAIN, 2015, A TEXT BOOK OF BOTANY, RASTOGI PUBLICATIONS
11. TAYAL, M.S., 2012, PLANT ANATOMY, RASTOGI PUBLICATIONS
12. SINGH, PANDE & JAIN, 2015, STRUCTURE, DEVELOPMENT AND REPRODUCTION IN ANGIOSPERMS, RASTOGI PUBLICATIONS
13. SUNDARA RAJAN S.,2009, COLLEGE BOTANY VOLUME 2, HIMALAYA PUBLICATIONS
14. SUNDARA RAJAN S.,2009, COLLEGE BOTANY VOLUME 3, HIMALAYA PUBLICATIONS
15. BENDRE A. M. AND A. KUMAR, 2014. PRACTICAL BOTANY VOLUME – 1& 2, RASTOGI PUBLICATIONS

#### PATTERN OF PRACTICAL EXAMINATION AND ASSESSMENT CRITERIA

##### Semester II

Q. No.	Questions	Mark
01	Identify and Classify material materials <b>A,B,</b> and <b>C</b> with labeled sketch and reasons.	4X3=12
02	Prepare a stained temporary slide of material D. Identify the material and	5X1=5



	describe the anatomical features	
03	Identify, sketch and describe the given slides E and F	3X2=6
04	Identify, sketch and describe the given slides/specimens G, H,I and J.	3X4 = 12
05	Practical Record	05
	Total	40

### Instruction to Examiners:

1. 01 specimen each from Bryophyta, Pteridophyta and Gymnosperms
2. Fresh stem / leaves /roots from Pteridophyte or Gymnosperms
3. Permanent slides of tissues (01 simple tissues, 01 complex/meristematic tissues)
4. At least 01 slide / specimen each from Bryophyta, Pteridophyta, Gymnosperms and , Fossils
5. 5 minutes to be given to each student for answering each question of 03 and 04

### Assessment Guidelines:

Q. No.	Questions	Total
01	IDENTIFICATION= 1/2, CLASSIFICATION 1, LABELED SKETCH = 1, IDENTIFYING FEATURES (Min. 03) = 1½	4
02	SLIDE PREPARATION 2, IDENTIFICATION /ANATOMICAL DESCRIPTION = 2 , LABELLED SKETCH = 1	5
03	IDENTIFICATION= ½, LABELED SKETCH= 1, REASONS=1½	3
04	IDENTIFICATION= ½, LABELED SKETCH= 1, REASONS=1½	3
05	90-100% Practicals = 5, 80-90% = 4, 70-80%=3	5

## Government Arts and Science College (Autonomous), Karwar Department of Botany

PATTERN OF QUESTION PAPER FOR THEORY SEMESTER END EXAMINATION (COMMON FOR ALL SEMESTERS)

**Max. Time: 3 hrs**

**Max. Marks: 80**

Q. Nos	Type and number of questions	Total Mark
01 to 12	12 questions of short answer types (to be answered in 2-3 sentences). Any 10 to be answered.	2 X 10=20
Q 13 to 20	08 questions of 5marks each (short notes). Any 6 to be answered	5X6 = 30
Q 21 to 23	Questions of descriptive answers with internal choice (A or B). All 3 to be answered. Each question may be divided into sub	10 X 3 = 30

	questions	
	<b>Total</b>	<b>80</b>

### UNIT-WISE WEIGHTAGE OF MARKS (COMMON FOR ALL SEMESTERS)

Unit No.	No. of 2 Mark Questions	No. of 5 Mark Questions	No. of 10 Mark Questions
Unit 1	3	2	-
Unit 2	2	1*	2 (Internal Choice)
Unit 3	2	1*	2 (Internal Choice)
Unit 4	2	1*	2 (Internal Choice)
Unit 5	3	2	-
<b>Total</b>	<b>12</b>	<b>7 + *1 from unit 2 or 3 or 4</b>	<b>6</b>

Chairman, BOS in Botany

### SEMESTER – III Angiosperm Morphology, Taxonomy and Utilization

Unit	Topics	Teaching Hours
I	Origin and evolution of Angiosperms, Structure of a typical angiosperm, differences between monocot and dicot plants. Morphology and modifications of root, stem and leaf. Morphology of flower, Floral formula and floral diagram. Morphology of inflorescences, special inflorescences. Morphology of fruits and seeds.	14 hrs
II	Introduction and a brief history of angiosperm taxonomy Botanical nomenclature - Binomial nomenclature, a brief introduction to ICBN and ICN (Melbourne Code) – principles and rules, ranks of taxa, taxonomic types. Systems of Classification – artificial (Carlous Linnaeus), natural (Bentham & Hooker), phylogenetic (Engler and Prantl), A brief study of APG III system. Herbarium, Botanical gardens and Botanical Survey of India.	14 hrs
III	Study of distinguishing features, local examples and economic importance of the following families of angiosperms ( according to Bentham and Hooker system):	14hrs

	Dicot Families: Polypetalae: Annonaceae, Malvaceae, Rutaceae, Meliaceae, Combretaceae, Fabaceae, Rhizophoraceae Gamopetalae: Rubiaceae, Asteraceae, Sapotaceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae.	
IV	Study of distinguishing features, local examples and economic importance of the following families of angiosperms ( according to Bentham and Hooker system): Monochlamydeae: Amaranthaceae, Euphorbiaceae, Monocot families: Orchidaceae, Liliaceae, Arecaceae and Poaceae. Modern trends in plant taxonomy – cytotaxonomy, chemotaxonomy, numerical taxonomy and molecular taxonomy, DNA barcoding of plants.	14hrs
V	General account of the following categories of plant products and origin, botany, processing (if applicable) and uses of the examples mentioned in each category: Cereals: rice and wheat Pulses : green gram, tur dal Spices : Clove, black pepper, cardamom Beverages: Tea, Coffee and cocoa Oils and Fats: Groundnut, sesame Fiber Plants: Cotton, coir Rubber: Hevea Medicinal plants: Brahmi, Madhunashini, Guduchi (Amritha), Gokshura and Arjuna A general account of ethnobotany.	14 hrs
<b>Total</b>		<b>70 Hours</b>

#### SUGGESTED REFERENCE BOOKS:

1. S.K .Jain-1995- Manual of Ethnobotany. Scientific publishers.
2. Dutta, S.C 1988. Systemic Botany, Wiley Eastern, New Delhi.
3. Sing. G 1999. Plant Systematics; Theory and Practical. Oxford and IBH, New Delhi
4. S. Sundar Rajan-2004. College Botany Vol-III. Himalaya Publishing House.
5. Susil Kumar Mukharjee -2004. College Botany Vol-III. New Central Book agency, London
6. A.V.S.S Sambamurthy-2009. Taxonomy of Angiosperm. I.K International Pvt. Ltd. New Delhi
7. B.K. Verma 2011. Taxonomy of Angiosperms. PHI Learning Pvt.Ltd. New Delhi.
8. Saxena and Saxena 2014. Plant Taxonomy, PragatiPrakashan Meerut.
9. B P Pandey -2014. Modern Practical Botany Vol II. S. Chand Publication
10. P.Vasanth Kumar-2014. **Economic Botany**. Sonali Publications New Delhi.
11. A.K Sharma 2015. Taxonomy of Angiosperms and Utilization of Plants. PragatiPrakashan Meerut.
12. O.P Sharma-2016. Plant Taxonomy. Mc.Graw Hill Education. Pvt. Ltd. New Delhi.

### SEMESTER – III

#### Angiosperm Morphology, Taxonomy and Utilization (Practicals)

Practical No.	Experiment
1	Study of root and stem morphology and modifications

2	Study of leaf and inflorescence morphology
3	Study of flower morphology and fruits
4 -11	Study of angiosperm plant families mentioned in theory syllabus.
12-13	Study of economically useful plants/visit to processing units
14	Field visit to study the local angiosperm diversity and submission of Report / Digital herbaria of at least 10 species

## PATTERN OF PRACTICAL EXAMINATION AND ASSESSMENT CRITERIA

### Semester III

Q. No.	Questions	Mark
01	Assign the plants A, B, C and D to their respective plant families giving diagnostic features. Write the classification up to the level of family.	4X4=16
02	Write the floral formula and draw the floral diagram of the specimen E	4
03	Identify and describe the morphological features of specimens G, H, I and J.	4X2 = 8
04	Give the botanical name, family and economic importance of materials K & L	2X2=4
05	Field Report	03
06	Practical Record	05
	Total	40

#### **Instruction to Examiners:**

1. 01 specimen each from Polypetale, Gamopetalae, monochlamydeae and monocot groups.
2. Twig with flower buds to be given
3. One each from root, stem, leaf, inflorescence/fruits.
4. Any two economic botany samples.

## Assessment Guidelines:

Q. No.	Questions	Total
01	IDENTIFICATION= 1 CLASSIFICATION 1, DIAGNOSTIC FEATURES = 2	4
02	FLORAL FORMULA = 2 MARK, FLORAL DIAGRAM = 2 MARK	4
03	IDENTIFICATION= ½, MORHOLOGICAL FEATURES (Min. 3) = ½ each	2
04	BOTANICAL NAME & FAMILY = 1 MARK, USES (MIN. 2) = ½ MARK EACH	2
05	90-100% Practicals = 5, 80-90% = 4, 70-80%=3	5

## SEMESTER – IV Anatomy and Embryology of Angiosperms

Unit	Topics	Teaching Hours
I	Tissue systems – Introduction and classification. Dermal tissue system – structure, types and functions of epidermis, stomata and trichomes Ground tissue system – structure and functions of cortex, endodermis, pericycle and pith Vascular tissue system- types of vascular bundles	14 hrs
II	Primary anatomy of Dicot and monocot root, stem and leaf. Normal secondary growth in dicot stem and root. Anamalous secondary growth in dicot stem (boehraavia), dicot root (Beta vulgaris), monocot stem (Dracaena). Structure and types of wood, a brief aspect of dendrochronology	14hrs
III	Structure ofmatute Anther, microsporogenesis, structure and development of male gametophyte, male germ unit. Structure of pollen. Structure and types of ovule, megasporogenesis (tenuinucellate and crasinucellate types), Structure and development of female gametophyte – monotypic (Polygonum), bisporic (Allium) and tetrasporic (Adoxa), female germ unit.	14hrs
IV	Pollination – self and cross pollination, adaptations for self and cross pollination, types of pollination based on agents ( Hydrophilly, anemophily, zoophilly). Special mechanisms – lever and piston types. Fertilization – stages, double fertilization, triple fusion. Endopserm – development of cellular, free nucellar and helobial endosperms, functions of endosperm.	14 hrs
V	Structure of dicot and monocot embryos, development of dicot embryo (crucifer type), development of monocot embryo (Triticum). Polyembryony – introduction, types (cleavage and adventive), causes and practical applications. Apomixis – introduction, types (vegetative reproduction, agamospermy and	14 hrs

	apospory) and significance.	
<b>Total</b>		<b>70 Hours</b>

**SUGGESTED REFERENCE BOOKS:**

1. Bhoojwani S.S and Bhatnagar S.P 2000. The Embryology of Angiosperms –Vikas Publishing House New Delhi
- 2.M.S Tayal 2016; Plant Anatomy- Rastogi Publications
3. Charles B.Beck -2011 : An Introduction to Plant Structure and Development Cabridge University Press
4. Dr.Manisha Majumdar-2011; Plant Anatomty – PHI Publishers
5. B.P. Pandey-2008: Botany for Degree students-S. Chand Publications
6. Shukla A.K – 1999 Biology of Pollen. Atlas Books and Periodicals.
7. B.P. Pandey-2000: Simplified course in Botany -S. Chand Publications

**SEMESTER – IV**  
**Anatomy and Embryology and Angiosperms**  
**(Practicals)**

Practical No.	Experiment
1	Study of Epidermal tissue system- Mounting of different types of stomata and trichomes.
2	Study of various types of vascular bundles with the help of fresh sections/ permanent slides.
3	Study of Primary anatomy of dicot Stem ( <b>Tridax</b> ) and Monocot stems ( <b>Grass</b> ) with the help of hand cut stained sections
4	Study of Primary anatomy of dicot and Monocot root with the help of hand cut stained sections
5	Study of double staining procedure
6	Study of Normal secondary growth in dicot stem and dicot root with the help of double stained hand cut sections
7	Study of anomalous secondary growth in dicot stem, dicot root and monocot stem with the help of double stained hand cut sections
8	Study of T.S of Anther-stages of microsporogenesis and pollen morphology with the help of permanent slides
9	Observation of pollen germination by hanging drop technique
10	Study of different types of ovules with the help of permanent slides.
11	Study of different types of pollination mechanism by using flowers and photographs.
12	Study of Dicot and monocot embryo(permanent slide) and mounting of embryo ( <b>Mimosa/Cucurbita</b> )

**PATTERN OF PRACTICAL EXAMINATION AND ASSESSMENT CRITERIA**

**Semester IV**

Q. No.	Questions	Mark
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01	Prepare a double stained temporary micro preparation of T.S of specimen A. Draw a labeled diagram and describe the anatomical peculiarities	8
02	Prepare a single stained temporary slide of T.S of specimen B. Identify the material	4
03	Mounting of specimen C (Stomata / Trichomes)	2
04	Mounting of specimen D (embryo)	3
04	Identify, sketch and describe the given slides/specimens G, H,I, J, K & L	3X6 = 18
05	Practical Record	05
	Total	40

### Instruction to Examiners:

1. Stem showing anomalous secondary growth
2. Primary stem or root (dicot/monocot)
3. Leaves/stem
4. Young Seeds of Mimosa or Cucurbita
5. 3 Permanent slides of anatomy (types of vascular tissues, primary anatomy, secondary growth, etc)and 3 slides related to embryology (stages of microsporogenesis, ovule types, photographs of pollination types, etc)
6. 5 minutes to be given to each student for answering each question of 5

### Assessment Guidelines:

Q. No.	Questions	Total
01	Slide Preparation with proper staining = 4, Drawing = 2, Description = 2	8
02	Slide preparation =3, Identification = 1	4
03	Mounting = 2	2
04	Mounting= 3	3
05	Identification =1, Description with a sketch = 2/2	3
05	90-100% Practicals = 5, 80-90% = 4, 70-80%=3	5

## Government Arts and Science College (Autonomous), Karwar Department of Botany

PATTERN OF QUESTION PAPER FOR THEORY SEMESTER END EXAMINATION (COMMON FOR ALL SEMESTERS)

**Max. Time: 3 hrs**

**Max. Marks: 80**

Q. Nos	Type and number of questions	Total Mark
01 to 12	12 questions of short answer types (to be answered in 2-3 sentences). Any 10 to be answered.	2 X 10=20
Q 13 to 20	08 questions of 5 marks each (short notes). Any 6 to be answered	5X6 = 30

Q 21 to 23	Questions of descriptive answers with internal choice (A or B). All 3 to be answered. Each question may be divided into sub questions	10 X 3 = 30
	<b>Total</b>	<b>80</b>

### UNIT-WISE WEIGHTAGE OF MARKS (COMMON FOR ALL SEMESTERS)

Unit No.	No. of 2 Mark Questions	No. of 5 Mark Questions	No. of 10 Mark Questions
Unit 1	3	2	-
Unit 2	2	1*	2 (Internal Choice)
Unit 3	2	1*	2 (Internal Choice)
Unit 4	2	1*	2 (Internal Choice)
Unit 5	3	2	-
<b>Total</b>	<b>12</b>	<b>7 + *1 from unit 2 or 3 or 4</b>	<b>6</b>

### SEMESTER –V PAPER-I Cell biology, Genetics and Molecular Biology

Unit	Topics	Teaching Hours
I	<b>Cell:</b> <ul style="list-style-type: none"> <li>Structure of Prokaryotic cell (Bacterial) and Eukaryotic cell (Plant cell) Differences between plant and animal cell.</li> <li>Ultra structure and functions of cell wall, cell membrane (Fluid mosaic model) Endoplasmic reticulum, Golgi body, Lysosome, Peroxisome, Ribosome, Mitochondrion, Plastid, Vacuole and Nucleus.</li> </ul>	07 hrs
II	<b>Cell Division and Chromosomes:</b> <ul style="list-style-type: none"> <li>Morphology and Ultra structure of Chromosome (Nucleosome model)</li> <li>Types of chromosomes based on the number and position of centromere, Autosomes and Allosome</li> <li>Mitosis, Meiosis and their significance.</li> <li>Chromosomal Aberrations-Deletion, Duplication, Inversion and translocation.</li> <li>Variation in chromosome number-Aneuploidy and Euploidy</li> </ul>	07hrs
III	<b>Nucleic Acids:</b> <ul style="list-style-type: none"> <li>Chemical composition, structure and types of DNA (A, B and Z DNA), RNA (genetic and Non genetic RNA)</li> <li>DNA replication-Semi-conservative method.</li> <li>Genetic code and its properties</li> </ul>	07hrs



	<ul style="list-style-type: none"> <li>Gene Expression-Transcription and Translation</li> <li>Regulation of gene expression- Lac operon model.</li> </ul>	
IV	<b>Genetic inheritance:</b> <ul style="list-style-type: none"> <li>Introduction to genetics, Mendel's life and Work in brief.</li> <li>Monohybrid cross and law of segregation, dihybrid cross and law of independent assortment.</li> <li>Gene Interaction-Allelic (Incomplete dominance and Multiple alleles with plant examples), Nonallelic- Complimentary (9:7) Supplementary (9:3:4) and Epistasis (Dominant -12:3:1) with plant examples.</li> <li>Linkage and its Types, Linkage in Maize.</li> <li>Sex determination: Different types in Plants.</li> </ul>	14 hrs
V	<b>Genetic variations and Extra nuclear genome:</b> <ul style="list-style-type: none"> <li>Gene mutations–Spontaneous and Induced (Physical and Chemical mutation) Molecular basis of mutation.</li> <li>Transposable genetic elements in Maize</li> <li>DNA damage and Repair</li> <li>Extra nuclear genome-features and functions of plastid and mitochondrial DNA</li> </ul>	07 hrs
<b>Total</b>		<b>42 Hours</b>

#### SUGGESTED REFERENCE BOOKS:

1. Alberts et al 1998 Essential Cell Biology Garland Publishers
- 2) Alberts et al 2008 Molecular Biology of the Cell Garland Publishers
- 3) Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7 th edition. Pearson Benjamin Cummings Publishing, San Francisco.
- 4) Gupta P.K 1999. A text book of Cell and Molecular Biology. Rastogi publication Meerut
- 5) Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, WashinPTon, D.C.; Sinauer Associates, MA.
- 6) De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- 7) Gardner, E.J., Simmons, M.J., Snustad, D.P. 2008. Principles of Genetics.8th Edition Wiley India.
- 8) Griffiths, AJF., Wessler, SR., Lewontin, RC. and Carroll, SB.. Introduction to Genetic Analysis. IX Edition W.H. Freeman and Co.
- 9) Hartl & Jones 2002 Essential Genetics: A Genomic Perspective Jones & Bartlet

## SEMESTER –V PAPER-I Cell biology, Genetics andMolecular Biology

### (Practicals)

Practical No.	Experiment
1	Study of Cell structure from Onion leaf peel and Study of Cyclosis by using Hydrilla Leaf
2	Comparative study of Bacterial and Cyanobacterial Cell using electeron micrograph
3	Study of Plant cell and Cell organelles using electron micrographs
4	Study of Cell inclusions- Cystolyth, Raphides and Inulin
5	Measurement of length and Breadth of cells by micrometry (Using Onion or Rheo leaf)
6	Study of Mitosis using Onion root tip
7	Study of Meiosis using Rheo or Onion flower buds
8	Observation of Permanent slides of Mitosis and Meiosis

9	Genetic problems related to laws of Mendelism and Incomplete dominance (Minimum 05 problems)
10	Genetic problems related to interaction of genes (Minimum 05 problems)

**PATTERN OF PRACTICAL EXAMINATION AND ASSESSMENT CRITERIA  
Semester V**

Q. No.	Questions	Mark
01	Make a temporary micro preparation of the squash/ smear of the material A. Draw labeled diagram of any two stages of cell division seen in your preparation and show it to the examiner.	08
02	Determine the length and breadth of the given material B by micrometric method.	06
03	Solve the genetic problem C and D	08
04	Identify and describe the cytological stage in the slides D,G and H	09
04	Viva-voce	04
05	Practical Record (Journal)	05
	Total	40

**Instruction to Examiners:**

1. Squash-Onion root tips Smear-Rheo or Onion flower buds
2. Onion /Rheo leaf peel
3. Any two genetic problems
4. One slide from Mitosis and two slides from Meiosis

**Assessment Guidelines:**

Q. No.	Questions	Total
01	Preparation 05marks, Diagram-03marks	08
02	Principle-01 marks,Calibration-02marks,diagram- 01 mark measurement-02marks	06
03	Any two genetic problems (04marks each)	08
04	One slide from Mitosis and two slides from Meiosis (Identification01mark, description-02marks and diagram -01mark)	09
05	Viva-voce 04 questions to be asked to each candidate each carries 01 mark	04
06	Journal- 90-100% Practical = 5, 80-90% = 4, 70-80%=3	05

**Government Arts and Science College (Autonomous), Karwar  
Department of Botany**

PATTERN OF QUESTION PAPER FOR THEORY SEMESTER END EXAMINATION (COMMON FOR ALL SEMESTERS)

**Max. Time: 3 hrs**

**Max. Marks: 80**

Q. Nos	Type and number of questions	Total Mark
01 to 12	12 questions of short answer types (to be answered in 2-3	2 X 10=20

	sentences). Any 10 to be answered.	
Q 13 to 20	08 questions of 5 mark each (short notes). Any 6 to be answered	5X6 = 30
Q 21 to 23	Questions of descriptive answers with internal choice (A or B). All 3 to be answered. Each question may be divided into sub questions	10 X 3 = 30
	<b>Total</b>	<b>80</b>

### UNIT-WISE WEIGHTAGE OF MARKS (COMMON FOR ALL SEMESTERS)

Unit No.	No. of 2 Mark Questions	No. of 5 Mark Questions	No. of 10 Mark Questions
Unit 1	02	02	-
Unit 2	03	02	01
Unit 3	02	01*	01
Unit 4	03	02	02 (Internal choice)
Unit 5	02	01*	02 (Internal choice)
<b>Total</b>	<b>12</b>	<b>08</b>	<b>06</b>

## SEMESTER –V PAPER-II Plant Physiology and Phytochemistry

Unit	Topics	Teaching Hours
I	Plant – Water relations <ul style="list-style-type: none"> <li>➤ Diffusion, Imbibition and Osmosis (Endosmosis and Exosmosis) Plasmolysis and Deplasmolysis. Concept &amp; components of Water potential.</li> <li>➤ Water absorption by plants- Mechanism of water absorption: Passive and Active absorption. Path of water movement: symplast, apoplast and transmembrane movement of water.</li> <li>➤ Ascents of sap, Transpiration pull theory.</li> <li>➤ Transpiration and its types. Structure of stomata, Theories of transpiration Factors influencing transpiration. Antitranspirants.</li> </ul>	07 hrs
II	<b>Mineral Nutrition and Enzymes</b> <ul style="list-style-type: none"> <li>➤ Essential elements-Macro and Micronutrients and role in plant metabolism and deficiency symptoms of macro- N, P and Mg and Micronutrients-Zn, Mn and B.</li> <li>➤ Mineral ion uptake (active and passive transport).</li> <li>➤ Enzymes: General characteristics, classification (IEC), mechanism of enzyme action and factors regulating enzyme action.</li> </ul>	07hrs
III	<b>PHOTOSYNTHESIS</b> <ul style="list-style-type: none"> <li>➤ Ultra structure of Chloroplast, Photosynthetic pigments, Concept of Photo systems, photosynthetic light reactions, Dark reaction- carbon assimilation pathways: C3, C4, and CAM (brief account), Factors influencing on Photosynthesis</li> <li>➤ Photorespiration and its significance. Blackmann's law of limiting factors.</li> </ul> <b>RESPIRATION:</b> <ul style="list-style-type: none"> <li>➤ Ultra structure of Mitochondrion</li> <li>➤ Aerobic respiration- Glycolysis, TCA cycle, electron transport system. Mechanism of Phosphorylation-substrate level and oxidative phosphorylation (Chemi-osmotic theory).</li> <li>➤ Anaerobic respiration- Fermentation and its types. Respiratory quotient. Factors influencing</li> </ul>	14hrs

	on respiration.	
IV	<b>GROWTH AND DEVELOPMENT</b> <ul style="list-style-type: none"> <li>➤ Growth and development: Phases and kinetics of growth.</li> <li>➤ Physiological effects of phytohormones - Auxins, Gibberellins, Cytokinins, ABA and Ethylene.</li> <li>➤ Physiology of flowering -Photoperiodism, role of Phytochrome in flowering; Vernalization.</li> <li>➤ Physiology of Senescence</li> <li>➤ Dormancy in seeds- Types, causes and method of breaking seed dormancy.</li> </ul>	07 hrs
V	<b>Phyto-chemistry and Pharmacognosy</b> <ul style="list-style-type: none"> <li>➤ Plant metabolites (primary and secondary), Secondary metabolites of medicinal value –Alkaloides, Glycosides and Tannins</li> <li>➤ History, classification (Taxonomical, Morphological, Pharamcological and Chemical) and scope of pharmacognosy.</li> <li>➤ Adulteration and Evaluation of plant Drugs (Organoleptic, Microscopic, Physical, Chemical and Biological evaluation)</li> </ul>	07 hrs
<b>Total</b>		<b>42 Hours</b>

#### SUGGESTED REFERENCE BOOKS:

1. Mukherjee, S. A.K. Ghosh(1998) Plant Physiology ,Tata McGraw Hill Publishers(P) Ltd., New Delhi.
2. Salisbury, F.B & C.W. Ross (1999): Plant Physiology CBS Publishers and Printers, New Delhi.
3. Pandey, SN and Sinha, BK (2001). Plant Physiology. Third revised edition, Vikas publishing House Pvt. Ltd, New Delhi
4. Devlin, RM (1974). Plant Physiology, Affiliated East West Press Pvt. Ltd
5. Noggle, GR. and Fritz, GJ (1976). Introductory Plant Physiology, Prentice-Hall, India.
6. Jain, VK (2007).Fundamentals of plant physiology, S. Chand & Company Ltd, New Delhi.
7. Nobel, PS (1970). Introduction to Biophysical Plant Physiology. W. H. Freeman and Company, San Francisco
8. Verma,V(2008).Text book of plant Physiology, Ane's student edition, Newdelhi

### SEMESTER – V PAPER-II

## Plant Physiology and Phytochemistry (Practicals)

Practical No.	Experiment
1	Effect of chemical on Membrane permeability
2	Determination of rate of transpiration using cobalt chloride paper Determination of rate of transpiration using Garreau's potometer
3	Demonstration of suction force due to transpiration.
4	Separation of plant pigments by paper chromatography.
5	To study the effect of light intensity on Photosynthesis by using Wilmott's bubbler
6	To study the effect of and concentration of CO <sub>2</sub> on Photosynthesis by using Wilmott's bubbler
7	Measurement of rate of respiration in germinating seed using Simple and Pair of Respiroscope
8	Study of Phloem Transport by Ringing Experiment. Experiment to demonstrate the effect of Auxin (Apical dominance) and Gibberellins (Bolting)
9	Study of Hydrotropism, Geotropism and Phototropism. Seismonasty and Thigmonasty
10	Determination of P <sup>H</sup> of Plant Samples by using P <sup>H</sup> meter.
11	Qualitative Test for Starch, Protein, and Lipids. Preliminary Phytochemical test s for major secondary metabolites.
12	Microscopic features of some common drugs –Adathoda, Ginger and Alstonia

**PATTERN OF PRACTICAL EXAMINATION AND ASSESSMENT CRITERIA**  
**Semester IV**

Q. No.	Questions	Mark
01	Set up an experiment as per slip A. Write requirements, principle involved procedure and conclusion. (Show the set up of the experiment to the examiner.	12
02	Perform and write the phytochemical test of the given sample B for _____ (show the result to the examiner)	4
03	Determine the P <sup>H</sup> of the given sample C. Show the preparation to the examiner. Write the procedure and result.	4
04	Identify, mention the part used and describe microscopic features of the given powdered drug D.	3
05	Identify and comment on the physiological phenomenon involved in the experiments E, F and G.	4X3 = 12
06	Practical Record (Journal)	05
	Total	40

**Instruction to Examiners:**

1. One experiment as per the slip. ( Requirements-2 marks, setting-4 marks, procedure -4 marks, conclusion-2marks)- (Expt. No. 2,4,5,6 and 7)
2. Preliminary tests – Alkaloids, Tannins, Saponin, Terpenoids etc
3. Determination of P<sup>H</sup> using P<sup>H</sup> meter –plant extract must be provided
4. Identification of powdered drug of - Adathoda, Ginger and Alstonia
5. 5 minutes to be given to each student for answering each question of 5 (Expt. No.1,2,8 and 9)

**Assessment Guidelines:**

Q. No.	Questions	Total
01	1. Requirements-2 marks, setting-4 marks, procedure -4 marks, conclusion-2marks)	12
02	Procedure -2marks, result 2 marks	4
03	Determination of P <sup>H</sup> -1marks, Procedure-2marks, Inference-1mark	4
04	Identification of powdered drug -1mark, Mentioning the part-1mark, microscopic feature-1mark	3
05	Identification-1mark, procedure/principle-1mark, Diagram-1mark and conclusion-1mark	4X3 = 12
06	Journal- 90-100% Practicals = 5, 80-90% = 4, 70-80%=3	5

**Government Arts and Science College (Autonomous), Karwar**  
**Department of Botany**

PATTERN OF QUESTION PAPER FOR THEORY SEMESTER END EXAMINATION (COMMON FOR ALL SEMESTERS)

**Max. Time: 3 hrs**

**Max. Marks: 80**

Q. Nos	Type and number of questions	Total Mark
01 to 12	12 questions of short answer types (to be answered in 2-3 sentences). Any 10 to be answered.	2 X 10=20
Q 13 to 20	08 questions of 5 mark each (short notes). Any 6 to be answered	5X6 = 30
Q 21 to 23	Questions of descriptive answers with internal choice (A or B). All 3 to be answered. Each question may be divided into sub questions	10 X 3 = 30
	<b>Total</b>	<b>80</b>

**UNIT-WISE WEIGHTAGE OF MARKS (COMMON FOR ALL SEMESTERS)**

Unit No.	No. of 2 Mark Questions	No. of 5 Mark Questions	No. of 10 Mark Questions
Unit 1	3	1*	1
Unit 2	2	2	1
Unit 3	3	1	2 (Internal Choice)
Unit 4	2	1	2 (Internal Choice)
Unit 5	2	3*	-
<b>Total</b>	<b>12</b>	<b>08</b>	<b>06</b>

**SEMESTER –VI PAPER-I**  
**Evolution, Plant breeding and Plant Biotechnology**

Unit	Topics	Teaching Hours
I	Origin and Evolution of life: Theory of Chemical origin, Lamarckism, Darwinism, Mutational theory and Neo-darwinism concept.	07 hrs
II	Plant Propagation and Plant Breeding <ul style="list-style-type: none"> <li>• Methods of Plant propagation-Cutting (Root, Stem and Leaf), Grafting (Wedge, Whip, Approach, Crown) and Layering (Underground and Air Layering methods)</li> </ul>	14hrs

	<ul style="list-style-type: none"> <li>History and Objectives of plant breeding</li> <li>Methods of Plant breeding-Selection (Pure line, Clonal and Mass line), Polyploidy breeding, Mutational Breeding and Hybridization types and technique.</li> <li>Male sterility-Types, production and significance in plant breeding.</li> <li>Plant quarantine methods, Germplasm conservation-methods and significance</li> </ul>	
III	<b>Plant tissue culture</b> <ul style="list-style-type: none"> <li>History and Scope and concept of cellular totipotency.</li> <li>Tissue culture laboratory and Equipments</li> <li>Basic aspects of plant tissue culture- Sterilization, Culture media and its preparation. Role of growth hormones in plant tissue culture.</li> <li>Types of cultures-Callus culture and Organogenesis. Protoplast culture, Pollen culture, Embryo culture. Somatic embryogenesis and synthetic seeds.</li> <li>Protoplasm fusion technique.</li> <li>Application of plant tissue culture in Agriculture, Forestry, Industries and plant conservation</li> </ul>	14hrs
IV	<b>Plant Genetic Engineering:</b> <ul style="list-style-type: none"> <li>Introduction of Plant Genetic Engineering. Tools used in Genetic engineering (Enzymes and Vectors)</li> <li>Direct and vector mediated gene transfer (Ti plasmid)</li> <li>Transgenic plants, Its application and threats. Steps involved in the production of golden rice and Bt cotton</li> <li>PCR and its application in genome analysis</li> <li>Immunofluorescence and its application in plant biotechnology.</li> </ul>	07 hrs
<b>Total</b>		<b>42 Hours</b>

**SUGGESTED REFERENCE BOOKS:**

- Allard R.W(1999): The Principles of Plant Breeding, John & Wiley and Sons.
- Poelman J.M: Breeding Field Crops, Springer.
- George Acquaah(2012):Principles of Plant Genetics & Breeding: Wiley-Blackwell.
- Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
- Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
- Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. institution)
- Pullaiah. T. and M.V.Subba Rao. 2009. Plant Tissue culture. Scientific Publishers, New Delhi.
- Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
- Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
- Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
- Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

**SEMESTER –VI PAPER-I**  
**Evolution, Plant breeding and Plant Biotechnology**  
**(Practicals)**

Practical No.	Experiment
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1	Study of organic evolution using charts
2	Study of plant propagation methods-Cutting, Layering and Grafting
3	Techniques of emasculation, artificial pollination and bagging
4	Estimation of percentage of pollen viability ( <i>In-vitro</i> method) by hanging drop method.
5	Study of morphology and anatomy of Hollow and Solid styles
6	Study of tissue culture lab equipments
7	Preparation of Synthetic seeds by alginate encapsulation
8	Preparation of tissue culture media (MS), surface sterilization, Inoculation and callus induction.
9	Demonstration of DNA isolation from plant tissues.
10	Demonstration of DNA Electrophoresis.
11	Study of transgenic plant production with the help of charts.

**PATTERN OF PRACTICAL EXAMINATION AND ASSESSMENT CRITERIA  
SEMESTER –VI PAPER-I**

Q. No.	Questions	Mark
01	Estimate the percentage of pollen viability in the given flower A by hanging drop method.	08
02	Demonstrate the plant propagation method.....in the given material B. Show the preparation to examiner. Draw diagram and write the procedure.	06
03	Prepare synthetic seed by Alginate encapsulation method using provided embryo C. Show the preparation to the examiner and write the procedure.	5
04	Identify and comment on the specimens D, E, F and G	16
05	Practical Record (Journal)	05
	Total	40

**Instruction to Examiners:**

Q I - Unopened flowers (Catheranthus/Dattura/ Alamonda) with intact anthers must be provided

Q II - Layering/Grafting /Emasculation

Q III - Green embryo removed from fresh dicot seed must be provided

Q IV – 01material from Organic evolution (Photos of Darwin/Lamarck or chart showing organic evolution

- 01 material each from plant propagation and plant breeding (Emasculated flower, T.S of style, Hybridization type/technique, Transgenic plant photo)
- 01 or 2 materials from Tissue culture and plant biotechnology ( Laboratory equipments,Culture media, Callus photo, Electrophoresis)

**Assessment Guidelines:**

Q. No.	Questions	Total
01	Preparation -03 marks, Procedure-03 marks, Diagram -01 mark Inference-01 mark	08
02	Preparation -02 marks, Procedure-02 marks, Diagram -02 mark	06
03	Preparation -02 marks, Procedure-02 marks,	4



04	Identification -01 mark, Explanation-02/03(Evolution), Diagram 0 (Evolution) /1	16
05	Journal- 90-100% Practicals = 5, 80-90% = 4, 70-80%=3	5

**Government Arts and Science College (Autonomous), Karwar**  
**Department of Botany**

PATTERN OF QUESTION PAPER FOR THEORY SEMESTER END EXAMINATION (COMMON FOR ALL SEMESTERS)

**Max. Time: 3 hrs**

**Max. Marks: 80**

Q. Nos	Type and number of questions	Total Mark
01 to 12	12 questions of short answer types (to be answered in 2-3 sentences). Any 10 to be answered.	2 X 10=20
Q 13 to 20	08 questions of 5 mark each (short notes). Any 6 to be answered	5X6 = 30
Q 21 to 23	Questions of descriptive answers with internal choice (A or B). All 3 to be answered. Each question may be divided into sub questions	10 X 3 = 30
	<b>Total</b>	<b>80</b>

**UNIT-WISE WEIGHTAGE OF MARKS (COMMON FOR ALL SEMESTERS)**

Unit No.	No. of 2 Mark Questions	No. of 5 Mark Questions	No. of 10 Mark Questions
Unit 1	2	1	-
Unit 2	4	2	2 (Internal Choice)
Unit 3	3	3	2 (Internal Choice)
Unit 4	3	2	2 (Internal Choice)
<b>Total</b>	<b>12</b>	<b>08</b>	<b>06</b>

**SEMESTER –VI PAPER-II**  
**Ecology and Environment**

Unit	Topics	Teaching Hours
I	Plants and Environment: <ul style="list-style-type: none"> <li>Atmosphere (Gaseous composition), Water (Properties of water cycle), Light (Global radiation, photosynthetically active radiation.) and soil (development, soil profiles, physico-chemical properties).</li> <li>Morphological, anatomical and physiological responses of plants to water (hydrophytes, xerophytes and epiphytes) and salinity (Hydrophytes/Halophytes). Response of plants to temperature (Thermoperiodicity) and light (Heliophytes and Sciophytes)</li> </ul>	07 hrs
II	Population and Community Ecology <ul style="list-style-type: none"> <li>Population characteristics (Population size and density, Patterns of Population dispersion, Age structure, Natality, Mortality, Biotic Potentials, Ecotypes and Ecades.</li> <li>Community and Characters used in community structure (Quantitative characters of plant</li> </ul>	07hrs

	community- Frequency, Density, Abundance, Cover and Basal area. Qualitative characteristics of plant community-Physiognomy, Phenology, Stratification, Abundance, Sociability, Vitality and Life forms) <ul style="list-style-type: none"> <li>Ecological succession-General process of succession. Hydrarch and Xerarch</li> </ul>	
III	Ecosystem <ul style="list-style-type: none"> <li>Introduction and Types of Ecosystem (Terrestrial and Aquatic, Natural and Artificial)</li> <li>Structure of ecosystem- Biotic and Abiotic components</li> <li>Ecosystem functions and processes- Food chain, Food web, Ecological pyramids (Pyramid of Energy, Biomass and Number).</li> <li>Principles of Energy flow in ecosystem</li> <li>Bio-geo chemical cycles –Gaseous cycle (carbon and nitrogen) and Sedimentary (Phosphorus)</li> </ul>	07hrs
IV	Vegetation types and distribution <ul style="list-style-type: none"> <li>Phyto-geographical regions of India</li> <li>Vegetation of India and Karnataka (Types, Characteristics and geographical areas)</li> <li>Remote sensing for vegetation analysis: Types of remote sensing, Principles of Active remote sensing system and uses.</li> </ul>	07 hrs
V	Forest and Forest Management <ul style="list-style-type: none"> <li>Ecological and Economical importance of forest (Major and Minor forest products).</li> <li>Deforestation: Causes and its ecological Effects of Deforestation.</li> <li>Social forestry: Types (Farm forestry, Extension forestry, Recreational forestry and Reforestation of degraded forests), Agencies making social forests, Plants cultivated in social forests and Advantages of social forestry.</li> <li><i>In-situ</i> and <i>Ex-situ</i> methods of forest and wild life conservation.</li> </ul>	07hrs
VI	Pollution and Global climatic changes <ul style="list-style-type: none"> <li>A brief account of causes, consequences and control of Air, Water and Soil pollution</li> <li>Green house effect, ozone depletion and international efforts to control them</li> <li>Global climatic changes and its consequences</li> </ul>	07 hrs
<b>Total</b>		<b>42 Hours</b>

#### SUGGESTED REFERENCE BOOKS:

1. Daubenmire, R.F. ( ): Plants & Environment (2nd Edn.,) John Wiley & Sons., New York 22
2. Puri, .G.S. (1960): Indian Forest Ecology (Vol.I & II) Oxford Book Co., New Delhi & Calcutta.
3. Billings, W.B. (1965): Plants and the Ecosystem Wadsworth Publishing Co., Inc., Belmont.
4. Misra, R. (1968): The Ecology work Book Oxford & INH Publishing Co., Calcutta
5. Odum E.P. (1971): Fundamentals of Ecology (2nd Edn.,) Saunders & Co., Philadelphia & Natraj Publishers, Dehradun.
6. Odum E.P. (1975): Ecology By Holt, Rinert & Winston.
7. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
8. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
9. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
10. Kumar H.D. (2000): Biodiversity & Sustainable Conservation Oxford & IBH Publishing Co Ltd. New Delhi.
11. Newman, E.I. (2000): Applied Ecology Blackwell Scientific Publisher, U.K.
12. Chapman, J.L&M.J. Reiss (1992): ecology (Principles & Applications). Cambridge University Press, U.K.

## SEMESTER –VI PAPER-I Ecology and Environment

### (Practicals)

Practical No.	Experiment
1	Study of frequency and density of herbaceous plants by quadrat method.
2	Determination of moisture content and water holding capacity of sandy and clayey soils
3	Determination of pH and temperature of different water bodies.
4	Estimation of salinity of water samples.
5	Study of Ecological instruments.
6	Morphological and Anatomical adaptations in Hydrophytes (any three), Xerophytes (one succulent and one non-succulent), Epiphyte and Halophyte (one each).
7	Study of vegetation types of Karnataka by using photographs
8	Collection of Minor forest products
9	Field visits to study the local vegetation (Coastal, Evergreen and Semi-evergreen Forest)
10	Study of Ecosystems- Natural (Pond) and artificial (Garden)

#### PATTERN OF PRACTICAL EXAMINATION AND ASSESSMENT CRITERIA SEMESTER –VI PAPER-II

Q. No.	Questions	Mark
01	Mention Morphological and Anatomical ecological adaptations (four each) of specimen A and mention the habitat to which it belongs	06
02	Estimate the salinity of the given sample B. Write the procedure, result and inference	06
03	Determine the P <sup>H</sup> of given water sample C	04
04	Identify and comment on the slide/specimen/Photo D and E	3*2=06
05	Describe the use and working mechanism of ecological instrument F	03
06	Viva-voce	05
07	Field report	05
08	Practical Record	05
	Total	40

#### Instruction to Examiners:

QI - One Specimen from Xerophyte / Hydrophyte/Epiphyte/Halophyte

Q II – Any water sample

Q III – Any water sample

Q IV – 01 slide / specimen from ecological adaptation. 01 minor forest product/photo of vegetation

QV-Ecological instrument studied.

#### Assessment Guidelines:

Q. No.	Questions	Total
01	External adaptation- 02 marks, Internal adaptations-02marks, Diagram 01 mark, mentioning habitat-01 mark	06
02	Procedure -02 marks, record of reading-02 marks Conclusion and result	06

	02 marks	
03	Setting of instrument 02 marks, record of reading 01 marks, Conclusion 01 marks	4
04	D an E Identification -01 mark, Explanation 02 marks	06
05	Identification -01, Working principle- 02 mark	03
06	Viva-voce- 05 questions to be asked on vegetation, Minor forest product an Ecology	05
07	Field report	05
08	Journal- 90-100% Practicals = 5, 80-90% = 4, 70-80%=3	05

**Government Arts and Science College (Autonomous), Karwar**  
**Department of Botany**

PATTERN OF QUESTION PAPER FOR THEORY SEMESTER END EXAMINATION (COMMON  
FOR ALL SEMESTERS)

**Max. Time: 3 hrs**

**Max. Marks: 80**

Q. Nos	Type and number of questions	Total Mark
01 to 12	12 questions of short answer types (to be answered in 2-3 sentences). Any 10 to be answered.	2 X 10=20
Q 13 to 20	08 questions of 5 mark each (short notes). Any 6 to be answered	5X6 = 30
Q 21 to 23	Questions of descriptive answers with internal choice (A or B). All 3 to be answered. Each question may be divided into sub questions	10 X 3 = 30
	<b>Total</b>	<b>80</b>

**UNIT-WISE WEIGHTAGE OF MARKS (COMMON FOR ALL SEMESTERS)**

Unit No.	No. of 2 Mark Questions	No. of 5 Mark Questions	No. of 10 Mark Questions
Unit 1	2	01	01
Unit 2	2	01	01
Unit 3	2	02	01
Unit 4	2	01	01
Unit 5	2	02	01
Unit 6	2	01	01
<b>Total</b>	<b>12</b>	<b>08</b>	<b>06</b>

**For 10 marks internal choice from unit 1&2 (02 questions), 3&4(02 questions) and 5&6 (02 questions)**

