MANGALORE UNIVERSITY

BOTANY

(CORE, ELECTIVE AND SKILL COURSES)

SYLLABUS FOR

B.Sc. UNDER GRADUATE (UG) PROGRAMME

UNDER SEP SCHEME

With effect from

Academic Year 2024-25

Botany

Programme Outcome:

- **Students will be proficient to comprehend classification, morphology, anatomy, and physiology of various groups of plants.**

- **Students will be able to understand the contribution of botany for human welfare with potential uses of plants along with their conservation and sustainable development.**

- **Students will be enriched by various skills related to Gardening and Floriculture, preparation of biofertilizers, mushroom cultivation and ethnobotanical knowledge.**

- **Students will be able to understand and relate physical features of the environment to the structure of population, community, ecosystem, and sustainable conservation strategies.**

COURSES AND CREDITS: B.Sc. with Botany as an Optional Subject

	Semester-wise Course Topics	Teaching hrs/ week	Exam duration (hrs)	Marks			No. of Credits
				I.A	Exam	Total	
SEMESTER – I							
Group I	BSCBOCS 101: Diversity of Microbes, Algae and Fungi **(T)**	4	3	20	80	100	03
	BSCBOPS 101: Diversity of Microbes, Algae and Fungi **(P)**	4	3	10	40	50	02
SEMESTER – II							
Group I	BSCBOCS 201: Diversity of non-flowering plants and Plant anatomy **(T)**	4	3	20	80	100	03
	BSCBOPS 201: Diversity of non-flowering plants andPlant anatomy **(P)**	4	3	10	40	50	02
SEMESTER – III							
Group I	BSCBOCS 301: Angiosperm Morphology and Reproductive Botany **(T)**	4	3	20	80	100	03
	BSCBOPS 301: Angiosperm Morphology and Reproductive Botany **(P)**	4	3	10	40	50	02
Group II	BSCBOCES 301: **Elective** Course: Medicinal Botany	2	2	10	40	50	02
SEMESTER – IV							
Group I	BSCBOCS 401: Plant Taxonomy and Economic Botany (**T**)	4	3	20	80	100	03
	BSCBOPS 401: Plant Taxonomy and Economic Botany **(P)**	4	3	10	40	50	02
Group II	BSCBOCES 401: **Elective** Course: Nursery and Gardening Techniques	2	2	10	40	50	02
	BSCBOCSS 401: **Skill** Paper 1: Floriculture	2	2	10	40	50	02
SEMESTER – V							
Group I	BSCBOCS 501: Ecology and Conservation Biology **(T1)**	3	3	20	80	100	03
	BSCBOCS 502: Genetics, Cell and Molecular Biology **(T2)**	3	3	20	80	100	03
	BSCBOPS 501: Ecology and Conservation Genetics, Cell and Molecular Biology **(P)**	4	3	10	40	50	02
	BSCBOCSS 501: **Skill** Paper 2: Mushroom Cultivation Technology	2	2	10	40	50	02
SEMESTER – VI							
Group I	BSCBOCS 601: Plant Physiology **(T1)**	3	3	20	80	100	03
	BSCBOCS 602: Plant Breeding and Biotechnology **(T2)**	3	3	20	80	100	03
	BSCBOPS 601: Plant Physiology& Plant Breeding and Biotechnology **(P)**	4	3	10	40	50	02
	BSCBOCSS 601: **Skill** Paper 3: Seed Technology	2	2	10	40	50	02
	T= Theory, **P**=Practical				**Total Credits**		**46**

MANGALORE UNIVERSITY

BOTANY SYLLABUS FOR UG PROGRAMS

w. e. f. 2024-25

DISCIPLINE CORE PAPERS (DSC)

Sl. No.	Semester Details	Subject
1	Semester I	Diversity of Microbes, Algae and Fungi
2	Semester II	Diversity of non-flowering plants and Plant Anatomy
3	Semester III	Angiosperm Morphology and Reproductive Botany
4	Semester IV	Plant Taxonomy and Economic Botany
5	Semester V	Ecology and Conservation Biology
		Genetics, Cell, and Molecular Biology
6	Semester VI	Plant Physiology
		Plant Breeding and Biotechnology

ELECTIVE and SKILL PAPERS

Sl No.	SemesterDetails	Subject: Botany	Credits
1	Semester III - Elective	Medicinal Botany	02
2	Semester IV - Elective	Nursery and Gardening Techniques	02
	Semester IV - Skill paper 1	Floriculture	02
3	Semester V - Skill paper 2	Mushroom Cultivation Technology	02
4	Semester VI - Skill paper 3	Seed Technology	02

SEMESTER – I

Diversity of Microbes, Algae and Fungi –Theory

Course Objectives:

- To explore and identify microbes and lower plants, and to gain adequate knowledge on the comparative account of these organisms.
- To impart knowledge about the occurrence, distribution, structure, and life history of microbes and lower plants such as algae, fungi, and lichens.
- To acquaint students with a wide spectrum of plant diseases, their causes, symptoms, and control measures.

Course Outcomes:

After completion of the course, the students will be able to:

- Understand the diversity of microbes in nature.
- Know the diversity of algae, fungi, lichens, and their uses.
- Identify and classify algae and fungi.
- Develop practical skills in staining techniques and slide preparation.
- Identify plant disease symptoms and apply management techniques.

Unit	Topics	Teaching Hours
I	**Introduction to Botany:** Branches and scope, Major historical developments in Botany including contributions of Indian Botanists (Sir J. C. Bose, P. Maheshwari, B.G.L. Swamy, E.K. Janaki Ammal and M. S. Swaminathan) Career opportunities in Botany. Five kingdom and Three domain systems of classification of organisms with examples **Viruses:** Classification based on hosts and nature of genetic material. Ultra-structure and multiplication of TMV and T4 Phage. A brief account of Viroid's and Prions. **Bacteria:** Types based on cellular morphology, flagellation and modeof nutrition. Ultra structure of a Bacterial cell. Reproduction: binary fission and endospore formation. Genetic recombination in bacteria - conjugation, transformation and transduction (generalized type), Economic importance of Bacteria.	12

II	**Algae -1:** Occurrence, thallus organization and general methods of reproduction with examples. Pigmentation in algae, Fritsch'sclassification of algae up to the level of classes with examples. **Cyanophyceae:** Ultra structure of a cyanobacterial cell andheterocyst. Structure and reproduction of *Nostoc.* **Chlorophyceae:** Thallus structure and reproduction of *Oedogonium* **Bacillariophyceae:** Types of diatoms with examples- Pennales and Centrales. Thallus structure and reproduction of a Pennate diatom (*Pinnularia)*	**12**
III	**Algae-2:** **Phaeophyceae:** Thallus structure and reproduction of Sargassum **Rhodophyceae**: Thallus structure and reproduction of Polysiphonia. **Economic importance of algae:** Useful aspects- food, SCP, industrial products, medicine, sewage treatment, bio-fertilizers, pollution indicators and energy source. Harmful aspects- algal blooms, algal toxins, and parasitic algae. **Fungi:** Salient features, occurrence, mycelial organization- prosenchyma, pseudo parenchyma, rhizomorph and sclerotium. General methods of reproduction with example. Alexopoulos system of classification up to the level of classes with examples. Thallus structure and reproduction of Rhizopus (Zygomycetes), Penicillium (Ascomycetes) and Agaricus (Basidiomycetes). **Economic importance of Fungi:** food value, industrial products, medicinal products, bio control agents and Fungal toxins.	**12**
IV	**Plant Pathology:** Introduction, causes and disease management of Sandle spike disease (phytoplasma), Katte disease of Cardamom (virus), Bacterial blight of paddy (bacteria) and Stem bleeding disease of coconut (fungi). **Mycorrhizae**: definition, types – ecto, endo (VAM) and ectendomycorrhizae, Ecological and economic significance of mycorrhizae. **Lichens**: Classification- asco and basidio-lichens. Morphological types with examples- crustose, foliose and fruticose. Internal structure of thallus – homeomerous and heteromerous types. Structure of fruiting bodies - soredium, isidium, apothecium and perithecium, Economic importance of lichens.	**12**
	Total	**48 hrs**

REFERENCE BOOKS:

1. Suresh Narayan, & Pullaiah, T. (2010). *Eminent Indian botanists – Past and present*. Regency Publications.
2. Dubey, R. C., & Maheshwari, D. K. (2009). *A text book of microbiology*. S. Chand Publishers.
3. Dey, S. N., & Trivedi, P. S. (1977). *A text book of botany: Vol. I*. Vikas Publishing.
4. Gangulee, H. C., Das, K. S., & Datta, C. T. (2002). *College botany: Vol. II*. NCBA (P) Ltd.
5. Kumar, H. D., & Singh, H. N. (1996). *A text book of algae*. East West Press.
6. Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2008). *Microbiology* (5th ed.). McGraw Hill.
7. Purohit, S. S. (1989). *Viruses, bacteria and mycoplasmas*. Agrobotanical Publications.
8. Singh, V., Pandey, P. N., & Jain, D. K. (2015). *A text book of botany*. Rasogi Publications.
9. Smith, G. M. (1955). *Cryptogamic botany: Vol. I. Algae and fungi* (2nd ed.). McGraw Hill Book Co. Inc.
10. Smith, K. M. (1990). *Plant viruses* (6th ed.). Universal Book Stall.
11. Sundara Rajan, S. (2009). *College botany: Volume 1*. Himalaya Publications.
12. Suresh Narayan, & Pullaiah, T. (2010). *Eminent Indian botanists – Past and present*. Regency Publications.
13. Vashistha, B. R., Sinha, A. K., & Singh, V. P. (2004). *Botany for degree students*. S. Chand Publishing.

SEMESTER – I

Diversity of Microbes, Algae and Fungi –Practical

Practical No.	Title of practical exercise/experiment
1	Microscopy technique: Study of compound and Dissection microscopes – parts, working principle, handling and preparation of temporary mountings
2	Microscopic observation of Bacterial cells by simple staining (Positive-Crystal violet, Negative- Nigrosine or Indian Ink). Differential staining of Bacteria - Gram's staining.
3	Study of thallus structure of *Nostoc, Oscillatoria* and *Scytonema*
4	Study of thallus structure of *Volvox, Oedogonium* and *Cladophora*
5	Study of thallus and reproductive structures of *Chara* and structures of *pennate Diatoms*
6	Study of thallus and reproductive structures of *Sargassum* and *Polysiphonia*
7	Study of vegetative and reproductive structures of Penicillium*, Rhizopus* and *Puccinia*
8	Study of symptoms, causative organism and control measures of Banana Bunchy Top Disease, Citrus Canker and Root Knot of Brinjal, with the help of specimens /photograph.
9	Study of symptoms, causative organism and control measures of Koleroga of Areca Nut, Blast Disease of Rice and Rust of Coffee.
10	Study of Lichens- morphological types, internal structure and reproductive structures
11	Study of local diversity of algae/fungi and preparation of an inventory with photographs/microphotographs (any five not mentioned in practical syllabus)
12	Listing and Study of common fungal/bacterial/viral diseases of local cropplants/plantation crops (any five not mentioned in practical syllabus)

Mangalore University
B.Sc. I Semester -Practical Examination
Diversity of Microbes, Algae and Fungi
Question paper and Scheme of evaluation

Time: 3hrs. Batch…….. Date…… Time: ……..am/pm Max. Marks: 40

1. Prepare a stained slide of specimen **A**. Sketch, label and identify with reasons. Leave the preparation for inspection. 06
2. Identify **B** & **C** giving reasons, 3+3 = 06
3. Identify **D** & **E** with reasons and labeled sketches. 3+3 = 06
   Prepare a stained slide of the given bacterial sample **F**. Show the preparation to the examiner and write the procedure. 03
4. Sketch, label and identify the slides **G, H** & **I** with reasons. 3+3+3 = 09
5. Record Submission and Field Notes. 7+3 = 10

1	A		Prep. Sk Id Cl Reasons 2 1½ ½ ½ 1½ = 6	Reg. No. of Candidates Assigned
2	B		Id. Reasons 1 2 = 3 each	
	C			Reg. No. of Absentees:
3	D		Id Sk. Reasons. ½ 1 1½ = 3 each	
	E			Total examined:
4	F		Prep - 1 Procedure – 2	Name and Signature of Examiners:
5	G		SkId ~~Cl~~ Reasons 1 ½ ~~½~~ 1½ = 3each	1. Internal
	H			
	I			
6		Record with Field report	7+3 = **10**	2. External

Instruction to Examiners:
A - Any algal specimen
B and **C**- One algal and one fungal specimen
D and **E**- Any Pathological specimen/Morphological types of lichens
F - Bacterial culture/curd sample/root nodule suspension
G, H and **I**- Slides (Lichen/Algae/Fungi -one each)

SEMESTER – II

Diversity of Non-Flowering Plants and Plant Anatomy – Theory

Course objectives:

- To study the structure and function of various tissues and their location in the plantbody
- To provide relevant information about Pteridophytes and Gymnosperms along withtheir evolutionary history, their phylogenetic relationships and fossil wealth of the world and economic importance of selected forms.
- To ascertain the importance of fossilization to relate life forms of earlier era

Course Outcome:

On completion of this course, the students will develop the following skills:

- To identify and classify non-flowering plants.
- Will gain basic knowledge of GTS and plant fossils.
- Observation of variations that exist in the internal structure of various parts of a plant andamong different plant groups in support of the evolutionary concept.
- Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
- Induction of the enthusiasm towards the internal structure of locally available plants.

Unit	Topics	Teaching Hours
I	**Plant Histology and Anatomy:** Introduction to tissues, general classification of tissues. Meristematic tissues: definition, classification based on origin, function, and position. Theory of shoot organization – tunica corpus theory, Theory of root organization - histogen theory. Permanent Tissues: simple permanent tissues - structure, types and functions of parenchyma, sclerenchyma, and collenchyma. Complex permanent tissues - structure, composition and functions of xylem and phloem. Secretory tissues: Glandular trichomes, nectars, glands, laticifers and resin ducts. Primary anatomy of dicot and monocot root, stem, and leaf. Normal secondary growth in dicot stem.	**12**
II	**Bryophytes:** Occurrence, General characteristics, Rothmaler's classification up to the level of classes with examples. Thallus morphology, anatomy, and reproduction of *Riccia, Anthoceros* and *Funaria.* Evolution of sporophytes and gametophytes in bryophytes – theories of progressive sterilization and simplification. Importance of bryophytes.	**12**

III	**Pteridophytes:** Occurrence, General characteristics, G. M. Smith's classification up to the level of classes with examples. Morphology, anatomy and reproduction in *Psilotum*, *Equisetum* and *Pteris*, Stelar variations in pteridophytes, Heterospory and seed habit. Economic importance of pteridophytes.	**12**
IV	**Gymnosperms:** Occurrence, Salient features, Sporne's system of classification up to the levelof classes with examples. Morphology, anatomy, and reproduction in *Cycas* and *Gnetum.* Economic importance of Gymnosperms. **Paleobotany:** Introduction, significance of fossils, Geological time scale and Evolution of plant groups, Types of plant fossils – compressions, impressions, incrustations, petrification with examples. Fossil dating- direct and indirect. Fossil Pteridophytes- *Rhynia* – Morphology of sporophyte. Fossil Gymnosperms- *Cycadeoidea*- Morphology.	**12**
	Total	**48 hrs**

REFERENCE BOOKS

1. **Pandey, B. P.** (2001). *College Botany: Volume I*. S. Chand Publishing. ISBN: 8121905931
2. **Sundara Rajan, S.** (2011). *College botany (Vol. 3)*. Himalaya Publishing House
3. **Kumaresan, V., & Reginald, A.** (2013). *Pteridophytes, gymnosperms and paleobotany*. Saras Publications. ISBN: 9789381927779
4. **Vashishta, P. C.** (2013). *Botany for degree students: Gymnosperms* (Revised ed.). S. Chand Publishing. ISBN: 9788121926188
5. **Johri, B. M.** (2015). *Embryology of angiosperms*. Springer. ISBN: 9788132208591
6. **Sambamurthy, A. V. S. S.** (2005). *Textbook of bryophytes, pteridophytes, gymnosperms and palaeobotany*. J.K. International Publishers. ISBN: 9788187134966

SEMESTER – II

Diversity of Non-Flowering Plants and Plant Anatomy – Practical

Practical No.	Title of exercise /experiments
1	Study of structure and reproduction of *Riccia, Anthoceros* and any moss
2	Study the morphology, anatomy, and reproductive structure of *Selaginella* and *Equisetum*
3	Study the morphology, anatomy, and reproductive structure of *Pteris* and *Marselia*
4	Study the morphology, anatomy, and reproductive structure of *Cycas*
5	Study the morphology, anatomy, and reproductive structure of *Pinus*
6	Study the morphology, anatomy, and reproductive structure of *Gnetum*
7	Study of simple and complex permanent tissues
8	Study of dicot and monocot stem (T. S)
9	Study of dicot and monocot root (T. S)
10	Study of Normal secondary growth in dicot stem (T. S)
11	Study of dicot and monocot leaf (T. S)
12	Study of local diversity of Bryophytes / Pteridophytes/Gymnosperms and preparation of an inventory with photographs to be recorded in Record book.

Mangalore University
B.Sc. II Semester - Practical Examination
Diversity of Non-Flowering Plants and Plant Anatomy
Question paper and Scheme of evaluation

Time: 3 hrs. Batch…….. Date…… Time… .....am/pm Max. Marks:40

1. Prepare a temporary stained section of the material **A**. sketch, label and identify with reasons. Leave the preparation for inspection 06
2. Identify **B** and **C** with reasons 3+3 = 06
3. Write critical notes on **D** and **E** with labelled sketches 3+3 = 06
4. Identify, sketch and label the slides **F, G, H & I** with reasons 3+3+3+3 = 12
5. Record with field report 7+3 = 10

1	A		Prep. Sk Id Reasons 2 1½ ½ 2 = **6**	Reg. No. of Candidates Assigned
2	B		Id Rea 1 2 = 3 each	
	C			
3	D		Id Sk Crt.Nts. ½ 1 1½ = 3 each	Reg. No. of Absentees:
	E			Total examined:
4	F		Sk Id Reasons 1 ½ 1½ = 3each	Name and Signature of Examiners: 1. Internal
	G			
	H			
	I			
5		Record with Field report	10	2. External

Instruction to Examiners:

A from dicot or monocot stem/root

B and **C** one specimen each from Bryophyta and Gymnosperms

D and **E** from Pteridophyta

F, G, H and **I** - one slide each from Histology, Bryophyta, Pteridophyta, Gymnosperms

SEMESTER –III

Angiosperm Morphology and Reproductive Botany - Theory

Course objectives:

- To study the morphological variations & modifications in vegetative and floral plants
- To study the reproductive methods and life cycle of angiosperms
- To understand the steps involved in embryogenesis in plants.

Course Outcome: On completion of this course, the students will develop the following skills:

- Observation and classification of the floral variations in different plants.
- Able to understand the various reproductive methods and the life cycle of flowering plants
- Observation and classification of the embryological variations in angiosperms.
- Enthusiasm to understand the evolution based on various methods of reproduction.

Unit	Topic	Teaching Hrs
I	**Morphology of Vegetative Structures** Parts of a typical flowering plant. Morphology of vegetative organs: **Root**: Characteristics, types - tap and adventitious, root modification- storage, mechanical support and vital functions. **Stem**: Characteristics, functions, modification – underground, sub aerial and aerial. **Leaf**: Parts of typical leaf, venation and modifications of leaf, Phyllotaxy.	12
II	**Morphology of Reproductive Structures** **Inflorescence**: Racemose, cymose and special types. **Flower**: Parts of a typical flower, forms of thalamus, androphore, gynophore, gynandrophore, insertionof floral whorls on the thalamus (hypogyny, perigyny and epigyny), structure,function and modification of calyx, corolla, aestivation, androecium and variations gynoecium and its variations, placentation.	12
III	**Reproductive Botany I** **Microsporangium**: Morphology and Anatomy of the mature anther; Anther wall layers; Tapetum -types, structure and functions; sporogenous tissue. **Microsporogenesis** - Microspore mother cells, microspore tetrads and their types; structure of mature pollen; Pollinia. Microgametogenesis – structure and development of male gametophyte. Pollen embryosac (Nemec phenomenon). **Megasporangium** – Ovule and types of ovules - Anatropous, Orthotropous, Amphitropous and Campylotropous. Detailed Structure of Orthotropous ovule. **Megagametogenesis**– Female gametophyte /embryosac -tenuinucellate and crassinucellate; monosporic - Polygonum type (in detail), bisporic – Allium type, tetrasporic - Fritillaria type (Just mentioning the types in brief). Structure of mature 7-celled embryo sac.	12

IV	**Reproductive Botany II** **Pollination**: Definition, self and cross-pollination and their types, contrivances for self and cross-pollination; types of pollination based on agents and their characteristic features. **Fertilization**: Process and significance of double fertilization, Post fertilization events. Endosperm – Types- Free nuclear (*Cocos nucifera*), cellular (*Cucumis*) and helobial. Significance of endosperm. Ruminate endosperm. **Embryogenesis**: Dicot (*Capsella bursa-pastoris*) and Monocot (*Najas*) embryo development. **Fruits**: Types - simple, aggregate and multiple fruits. Fruit and Seed dispersal strategies. **Seed**: Structure of Dicot and Monocot seed.	**12**
	Total	**48 hrs**

References:

1. Bhojwani, S. S., Bhatnagar, S. P., & Dantu, P. K. (2015). *The embryology of angiosperms* (6th ed., 376 pp.). Vikas Publishing House. ISBN: 9789325981294
2. Pandey, B. P. (2001). *A textbook of botany: Angiosperms* (Illustrated ed., 821 pp.). S. Chand Publishing. ISBN: 9788121904049
3. Bhojwani, S. S., & Soh, W. Y. (Eds.). (2001). *Current trends in the embryology of angiosperms* (544 pp.). Dordrecht: Kluwer Academic Publishers. ISBN: 0-7923-6888-6
4. Eames, A. J. (1961). *Morphology of the angiosperms* (518 pp.). McGraw-Hill.
5. Raghavan, V. (2012). *Developmental biology of flowering plants* (Illustrated ed., 354 pp.). Springer Science & Business Media. ISBN: 9781461212348
6. Saxena, M. R. (1993). *Palynology: A treatise* (127 pp.). New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
7. Nair, P. K. K. (1970). *Pollen morphology of angiosperms: A historical and phylogenetic study* (160 pp.). Scholar Publishing House. ISBN: 9780389042044
8. Johri, B. M. (Ed.). (1984). *Embryology of angiosperms* (Illustrated ed., 830 pp.). Springer-Verlag. ISBN: 9780387127392
9. Shukla, A. K., Vijayaraghavan, M. R., & Chaudhry, B. (1998). *Biology of pollen* (133 pp.). APH Publishing. ISBN: 9788170249245
10. Maheshwari, P. (1950). *An introduction to the embryology of angiosperms* (453 pp.). McGraw-Hill.

SEMESTER - III

ANGIOSPERM MORPHOLOGY AND REPRODUCTIVE BOTANY – PRACTICAL

Practical No.	Title of exercise /experiments
1	Morphology and modification of root
2	Morphology and modification of stem
3	Study of inflorescences- Racemose, Cymose and special types
4	Study of fruits- simple, aggregate and multiple fruits
5	Study of flower and its parts; epigynous, perigynous and hypogynous flowers
6	Pollination types and seed dispersal mechanisms (including appendages - aril and caruncle)using photographs and/ specimens).
7	a. Structure of anther (young and mature) using permanent slides. b. Types of placentation and types of ovules (anatropous, orthotropous, campylotropous) using permanent slides.
8	a. Estimation of pollen viability (*in vitro* method) by hanging drop method. b. Study of pollen grains from any five flowers.
9	Female gametophyte: Polygonum (monosporic) type of Embryo sac Development (Permanent slides/photographs). Ultrastructure of mature egg apparatus cells through electron micrographs.
10	Dissection and mounting of the embryo from developing seeds (monocot and dicot).
11&12	Mini project: Mini project work in groups of 2- 4 students/individual, from the following list. This is to be recorded in the practical record book. i. Leaf morphology (Monocot and Dicot) types and phyllotaxy. ii. Placentation types. iii. Variation in calyx and corolla and their significances. iv. Variation in androecium and gynoecium and their significances. v. Seed dispersal methods. vi. Types of fruits vii. Modification of root/stem/leaves viii. Any topic relevant to the title

Mangalore University
B.Sc. III Semester - Practical Examination
ANGIOSPERM MORPHOLOGY AND REPRODUCTIVE BOTANY
Question paper and Scheme of evaluation

Time: 3 hrs. Batch…….. Date…… Time…..... am/pm Max. Marks: 40

1. Estimate the percentage of pollen viability in the given material **A** by hanging drop method. Write the procedure. Leave the preparation for inspection. 07
2. Dissect and mount the embryo from the given material **B** and draw a labelled sketch. Identify by giving reasons. 04
3. Identify the specimens **C, D and E**, draw a labelled diagram and comment on the morphology/ modification 08
4. Identify the slides **F** and **G** with labelled diagram and reasons. 08
5. Identify the structure in the given photograph/slide **H** with reasons and labelled sketch. 03
6. Practical Record and project report 10

1	A		Slide - 02, Procedure- 02, Tabulation, Calculation & result- 02 = **06**	Reg. No. of Candidates Assigned:
2	B		Mounting, Id, Labl sk, Reason 01 01 01 01	
3	C D E		Id, Labl sk, Reason 01 01 01 **3x3 = 9**	Reg. No. of absentees:
4	F G		Id, Labl sk, Reason 01 01 02 **4x2 = 8**	Total Examined:
5	H		Id, Labl sk, Reason 01 01 01 **3x1 = 3**	Examiners: 1. External
6		Practical Record with Project Report	**7+3=10**	2. Internal

Note to the Examiners:

A – Vinca/Impatiens/any suitable flower.

B – Sweet corn (tender seed)/Crotalaria/ Mustard (tender)/ any seeds.

C – Root/Stem modification; & D – Inflorescence, E- Fruit

F & G – Anther, ovule type/Placentation type

H - Electron micrograph of - Ultrastructure of mature egg apparatus/photograph of-pollen grain/ pollen types and dispersion showing ornamentation and aperture.

Open Elective Course: Semester – III: Medicinal Botany

Course outcome: After the successful completion of the course, the student will be able to:

- Understand the medicinal properties of plants and different systems of medicines
- Understand the adulterations in herbal drugs and evaluation of an herbal drug
- Develop interest in the cultivation and conservation of medicinal plants.

Unit	Topics	Teaching Hours
I	Introduction to medicinal Botany, Role of plants in traditional medical systems - Ayurveda, sidda, unani and folk medicine. Diversity of medicinal plants of India. A medicinally useful plant part with examples – root, stem, leaf, and fruits/seeds. Chemical constituents of herbal drugs with examples- carbohydrates, alkaloids, glycosides, oils, resins, lipids and fibres. Study of morphology, medicinal uses and commercial products of important Indian traditional medicinal plants (List to be given) Aloe vera, Turmeric, Neem, Tulsi, and Zinger.	12
II	Concept of herbal neutraceuticals and cosmeceuticals. Collection and processing of herbal drugs – harvesting, drying, garbling, packing, storage, quality management and documentation. Importance of cultivation and conservation of medicinal plants. Ethnobotany and its significance Adulteration of herbal drugs. Methods of evaluation of herbal drugs – organoleptic, microscopical, chemical, physical, and biological.	12
Total		**24 Hours**

SUGGESTED REFERENCE BOOKS:

1. Jain, S. K. (2010). *Manual of ethnobotany* (2nd rev. ed.). Scientific Publishers. ISBN: 9387307859
2. Dutt, A. (2009). *An introduction to medicinal plants*. Adhyayan Publishers and Distributors. ISBN: 978-8184350623
3. Atal, C. K., & Kapoor, B. M. (1982). *Cultivation and utilization of medicinal plants*. Regional Research Laboratory, Jammu Tawi.
4. Shah, B., & Seth, A. K. (2014). *Textbook of pharmacognosy and phytochemistry*. Elsevier. ISBN: 9788131234737
5. Trivedi, P. C. (2009). *Medicinal plants: Utilization and conservation*. Avishkar Publishers. ISBN: 8179102857
6. Akerele, O., Heywood, V., & Synge, H. (1991). *The conservation of medicinal plants*. Cambridge University Press. ISBN: 9780521392005
7. Chaudhary, A. B. (2007). *Endangered medicinal plants*. Daya Publishing House. ISBN: 8170354605
8. Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2018). *Pharmacognosy* (58th ed.). Nirali Prakashan. ISBN: 9789387669123

SEMESTER – IV

Taxonomy and Economic Botany –Theory

Course objectives:

- To study the methods of identification, classification, and nomenclature of angiosperms.
- To know economically important plants and their uses.

Course outcome:

After the successful completion of the course, the student will be able to:

- Understand the different systems of plant classification
- Identify, classify, and describe a plant in scientific terms, thereby, identification of plants using dichotomous keys, skill development in identification and classification of flowering plants.
- Interpret the rules of ICN in botanical nomenclature
- Recognize the importance of herbarium and digital herbarium,
- Recognize locally available angiosperm families and plants of economic importance.

Unit	Topics	Teaching Hours
I	**Introduction to Taxonomy**: History, objectives and scope of Taxonomy **Systems of classification**: Artificial - Carolus Linnaeus's, Natural- Bentham and Hooker's, Phylogenetic - Engler and Prantl's, their merits and demerits. A brief study of APG system of plant classification with focus to latest APG IV system and its significance **Plant identification**: Taxonomic dichotomous keys; brief account of intended (yoked)and bracketed keys. **Botanical nomenclature**: Binomial nomenclature, a brief introduction to ICBN-principles and rules, ranks of taxa and taxonomic types. Brief introduction to cyto-taxonomy, chemo-taxonomy, numerical taxonomy and molecular taxonomy, DNA barcoding of plants.	12
II	Herbaria and herbarium techniques, digital herbaria. Botanical Survey of India, Botanical gardens, and their functions. Distinguishing features with economic importance of any five local examples from the following families of angiosperms, according to Bentham and Hooker system: **Polypetalae-**, Malvaceae, Fabaceae and its sub-families, Rutaceae, Anacardeaceae, Cucurbitaceae and Apiaceae.	12
III	Distinguishing features with economic importance of **any five** local examples from the following families of angiosperms according to Bentham and Hooker system: **Gamopetalae**- Rubiaceae, Asteraceae, Apocynaceae, Solanaceae and Lamiaceae. **Monochlamydeae**–Amaranthaceae, Euphorbiaceae and Moraceae **Monocotyledonae**- Orchidaceae, Arecaceae and Poaceae.	12

IV	**Economic Botany:** Introduction to economic botany: Definition and significance **Cereals**: Botany*, products and uses of Rice and Wheat. Brief account of millets.Pulses/ Legumes: Botany and uses of Mung bean and Pigeon pea Brief account of fodder legumes. **Spices and condiments**: Definition. Botany and uses of Cinnamon, Clove, Black pepper, Cardamom, Ginger, and Coriander. **Beverages**: Definition. Botany*, processing and uses of Tea and Coffee **Oil yielding plants**: Types of plant oils with examples -fatty oils and essential oils. Botany*, extraction/processing and uses of Coconut and Sandalwood oil. Fib**er yielding plants**: Classification based on origin of fibers. Morphology, extraction anduses of Cotton and Coir fibers. **Timber yielding plants**: Important timber yielding plants of India (any five) and their uses. **Rubber yielding plants**: Botanical source, extraction/processing, and uses of Hevea rubber **Medicinal plants**: Botany* and uses of *Rauwolfia serpentina, Centella asiatica, Tinospora cordifolia* and *Aloe vera* A general account of outdoor and indoor ornamental plants. A general account of ethnobotany: definition and its significance. **Note**: ***Botany includes botanical name, family, place of origin and parts used***	12
	Total	48 hrs

Reference Books:

1. **Jain, S. K**. (2010). *Manual of ethnobotany* (2nd rev. ed.). Scientific Publishers. ISBN: 9387307859
2. **Datta, S. C.** (1989). *Systematic botany*. New Age International. ISBN: 8122400132, 9788122400137
3. **Singh, G.** (2019). *Plant systematics: Theory and practice* (3rd ed.). CBS Publishers & Distributors Pvt. Ltd. ISBN: 9788120417632.
4. **Soundar Rajan, S.** (2007). *College botany Vol. V, Part 1: Taxonomy and economic botany*. Himalaya Publishing House.
5. **Mukherjee, S. K.** (2004). *College botany (Vol. III)*. New Central Book Agency.
6. **Pandey, B. P.** (1999). *Economic botany* (5th ed.). S. Chand Publication. ISBN: 978-8121903417
7. **Bhat, K. G.** (2014). *Flora of South Kanara: Dakshina Kannada and Udupi districts of Karnataka*. Taxonomy Research Centre. ISBN: 9789383765126
8. **Bhat, K. G.** (2014). *Flora of Udupi*. Taxonomy Research Centre. ISBN: 9788190251413
9. **Singh, V.** (1981). *Taxonomy of angiosperms*. Rastogi Publications. ISBN: 9788171338498
10. **Kochhar, S. L.** (2011). *Economic botany in the tropics* (4th ed.). Macmillan Publishers India Ltd.

SEMESTER – IV

Taxonomy and Economic Botany -Practical

Practical No.	Experiments
1	Study of Malvaceae
2	Study of Fabaceae sub- families
3	Study of families Myrtaceae and Apiaceae
4	Study of families Rubiaceae and Asteraceae
5	Study of families Apocynaceae and Lamiaceae
6	Study of families Amaranthaceae and Euphorbiaceae
7	Study of families Arecaceae and Poaceae
8 & 9	Botany and uses of economically important plants with observation of plants/plant products listedas follows: Rice, wheat, Ragi, Bengal gram Cinnamon, Clove, Black pepper, Cardamom, Ginger and Coriander, Tea powder, Coffee powder, Cocoa fruit, Cotton, Coir and Jute fibers, Rubber, Jaggery, Brahmi (*Centella asiatica)* and *Aloe vera*.
10	Study of outdoor and indoor ornamental plants with photographs (two each).
11 &12	Mini project report in groups of 2- 4 students, from any one of the following lists to be recorded in the practical record. a) Study of the members of the family Cucurbitaceae (any 5) b) Study of the members of the family Anacardiaceae (any 5) c) Study of Orchid flower. d) Preparation of digital herbarium for plant specimens (any 2) e) Chart preparation on processing/extraction of any one essential oil f) Any relevant topic

Activities:

Field visit to study the botanical name, family, common names and economic/ ethno-botanical importance of local angiosperms. A brief report of such field visit with the list of plants observed and field photographs/diagrams should be included in the practical record.

Mangalore University
B.Sc. IV Semester- Practical Examination
TAXONOMY and ECONOMIC BOTANY
Question Paper and Scheme of evaluation

Time: 3hrs. Batch…….. Date…… Time… .....am/pm Max. Marks: 40

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1. Derive and describe the specimen **A, B & C** taxonomically **(3 x 4)** **12**
2. Explain the specimen **D** using technical terms with the family and Botanical name **05**
3. Write the floral diagram and floral formula of the given specimen **E** **05**
4. Write botanical name, common name, family and part used of **F, G, H & I (4 x 2)** **08**
5. Practical Record with field visit and mini project report **10**

1	A B C		Derivation Family and Botanical name Description	01 01 02 04 **3x4 = 12**	Reg. No. of Candidates Assigned
2	D		Family and Botanical name Technical description	01 04 **05**	Reg. No. of absentees:
3	E		Floral formula Floral diagram	02 03 **05**	
4	F G H I		Botanical name Common name Family name Part used	½ ½ ½ ½ **4x2 = 8**	1. External
5		Practical Record with field visit &Project report		**10**	2. Internal

Note:

A B & C Each from Polypetalae, Gamopetalae and Monochlamydeae

D Plant specimen with inflorescence/flower from any of the family studied.

E Plant Specimen from any of the family studied.

F, G, H & I Plant/plant product from any of the specimen mentioned in the practical syllabus.

Open Elective Course: Semester - IV

Nursery and Gardening Management

Course outcome: After the successful completion of the course, the student will be able to:

- To introduce students to the principles and practices involved in nursery and garden management.
- To develop skills in planning, design, establishment, and maintenance of nurseries and gardens
- Understand the nursery techniques and management
- Develop the knowledge of different types of gardens and garden plants and their management

Unit	Content of Theory Elective Course	Teaching Hours
I	**Nursery: Definition, Objectives, and Scope** of Nursery. **General Practices**: Seed collection, sowing, watering, weeding, fertilization, pest and disease control. **Infrastructure Requirements**: Site selection, layout planning, fencing, irrigation systems, storage, work sheds. **Seasonal Planning and Activities**: Calendar-based nursery activities—sowing, transplanting, pruning, etc. **Planting Techniques**: Direct seeding vs. transplanting methods. **Growth Media**: Soil-based and soilless media (e.g., cocopeat, perlite, vermiculite). Synthetic growth media for pots and nursery beds. **Hardening of Plants**: Methods to acclimatize nursery plants before field planting. **Protected Structures**: Greenhouse, Mist chamber, Shade net house / Shed roof, Glasshouse. **Bonsai Techniques**: Cultural requirements, Tools and materials, Art and aesthetics of bonsai creation and maintenance.	**12hrs**
II	**Gardening: Definition, Objectives, and Scope** of Gardening. **Principles of Gardening**: Unity, balance, simplicity, rhythm, and proportion. **Garden Components**: Paths, hedges, fences, gates, seating, arches, pergolas. **Adornments and Accessories**: Garden lights, sculptures, birdbaths, fountains. **Lawn Making and Maintenance**: Site preparation, Grass selection, Sowing/turfing, Irrigation and mowing. **Design of Special Features**: Rockery, Water garden. **Types of Gardens**: Vertical gardens, Roof gardens, Public parks and gardens, Indoor gardening, Therapeutic/Healing gardens, Japanese gardens, Mughal gardens, Zen gardens (as special types).	**12hrs**
	Total	**24 Hours**

Text Books and References

1. Agrawal, P.K. (1993). Hand Book of Seed Technology. New Delhi, Delhi: Dept. of Agriculture andCooperation, National Seed Corporation Ltd.
2. Bose T.K., Mukherjee, D. (1972). Gardening in India. New Delhi, Delhi: Oxford & IBH Publishing.
3. Jules, J. (1979). Horticultural Science, 3rd Edition. San Francisco, California: W.H. Freeman and Co.
4. Kumar, N. (1997). Introduction to Horticulture. Nagercoil, Tamil Nadu: Rajalakshmi Publications.
5. Musser E. Andres. (2005). Fundamentals of Horticulture. New Delhi, Delhi: Mc Graw Hill Book Co.

B.Sc. BOTANY – IV Semester
Skill Paper 1
Floriculture

Objectives:

- To have a basic idea about floriculture.
- To learn the commercial aspects of floriculture.
- To learn certain arts related to floriculture.
- To learn methods involved in the cultivation of commercially important plants for cut flowers.

Learning outcome:

After completing this course, the learner will be able to;

- Distinguish among the various Ornamental and indoor plants.
- Understand various commercial aspects of floriculture.
- Diagnose the various diseases and pests of ornamental plants.

Unit	Content of Theory Skill Course	Teaching Hours
I	**Introduction**: Importance and scope of floriculture. **Ornamental Plants**: Flowering annuals; perennials; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and fern allies. Cultivation of plants in pots; Indoor gardening. Floriculture and greenhouse technology.	**12hrs**
II	**Commercial Floriculture:** Factors affecting flower production; Production and packaging of cut flowers; Commercial aspects and exporting of flowers and ornamental plants. Flower arrangements, Ikebana in brief. Methods to prolong vase life. Cultivation of Important cut flowers (Carnation, Jasmine, Anthurium, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolus, Marigold, Rose, Lilium, Orchids). Diseases and Pests of Ornamental Plants. Quarantine and testing requirements	**12hrs**
	Total	**24 Hours**

Reference

1. **1. Randhawa, G. S., & Mukhopadhyay, A.** (1986). *Floriculture in India* (Illustrated ed.). Allied Publishers. ISBN: 8170230578.
2. **Adams, C. R., & Early, M. P.** (2004). *Principles of horticulture* (4th ed.). Routledge. ISBN: 780080480350

SEMESTER V – Paper -V

Ecology and Conservation Biology – Theory

Course objectives:

- To make the students understand the interactions between environment and organisms
- To increase the awareness among students about global environmental concerns.
- To make the students appreciate the concepts of ecological issues and conservation methods.

Course outcome:

After the successful completion of the course, the student will be able to:

- Understand the role of various factors in developing the ecology of an area.
- Understand the stability of an ecosystem.
- Learn the conservation measures

Unit	Topics	Teaching Hours (36)
I	**Introduction to Ecology and Ecosystem Ecology** Definitions, Principles and scope of Ecology. **Ecological factors:** Climatic factors: light, temperature, precipitation and humidity. **Edaphic factors**: Soil and its types, soil texture, soil profile, physico-chemical properties of soil-mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms. **Ecological groups of plants and their adaptations:** Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes. **Ecosystem Ecology:** Types of ecosystems with examples – terrestrial and aquatic **Ecosystem functions and processes.** **Ecological succession**: Definition, types - primary and secondary. General stages of succession. **Community Ecology:** Community and its characteristics, Concept of Ecotone and Ecotypes.	12
II	**Unit-II: Phytogeography and Environmental issues** **Phyto geographical regions** - concept, phyto geographical regions of India. **Vegetation types of Karnataka** – Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shoal forests. **Ecological methods and techniques:** Methods of sampling plant communities –transects and quadrates. Remote sensing as a tool for vegetation analysis, land use land cover mapping. **Water pollution**: Causes, effects and control of water pollution. **Air pollution**: Causes, effects and control measures. **Soil pollution**: Causes, effects and control measures.	12

III	**Unit-III: Biodiversity and Conservation** **Biodiversity**: Definition, types of biodiversity - habitat diversity, species diversity and genetic diversity, Global and Indian species diversity in brief. NTFP, Values of Biodiversity, Threats to biodiversity. **Concept of Biodiversity Hotspots**, Biodiversity hotspots of India. Concept of endemism and endemic species. ICUN plant categories with special reference to Karnataka/Western Ghats. **Biodiversity Conservation**-Indian Forest conservation act, Biodiversity bill (2002). Conservation methods. *In-situ* and *ex-situ* methods. *In-situ* methods – Biosphere reserves, National parks, Sanctuaries, Sacred grooves. *Ex-situ methods*-Botanical gardens, Seed bank, Gene banks, Pollen banks, Culture collections, Cryopreservation. **Soil and Water conservation practices:** Soil management, Rain water harvesting and watershed management.	12
	Total	36 hrs

REFERENCES:

- Bendre A. M. & Pande P. C. 2006. Introductory Botany, Rastogi Publications.
- Chapman, J.L&M.J. Reiss 1992. Ecology (Principles & Applications). Cambridge University Press, U.K.
- Kaushik A. & Kaushik C.P. 1990. Perspectives in Environmental Studies. New Age International Publishers
- Kochhar, P.L. 1975. Plant Ecology. (9th Edn.,) New Delhi, Bombay.
- Kumar, H.D. 1992. Modern Concepts of Ecology (7th Edn.) Vikas Publishing Co., New Delhi.
- Mohan P. Arora. 2002. Ecology, Himalaya Publishing House.
- Odum E.P. 1975. Ecology by Holt, Rinert & Winston.
- Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications, New Delhi.
- Shukla, R.S. and Chandel, P.S. 2005. A Textbook of Plant Ecology: Ethnobotany and Soil Science. 10th edition. S Chand publication, New Delhi.
- Verma P.S. & Agarwal V.K. 2010. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand & Company Pvt. Ltd.
- Weaver J. E. & Clements F. E.: Plant Ecology, Tata McGraw-Hill Publishing Company Ltd. New Delhi.

SEMESTER –V; Paper-VI

Genetics, Cell and Molecular Biology -Theory

Course objectives:

- To study the structure and functions of a cell and its organelles.
- To understand cell division and plant growth
- To know the inheritance in plants
- To study the plant at its molecular level

Course outcome:

After the successful completion of the course, the student will be able to:

- Understand the significance of a cell and its organelles
- Distinguish the two types of cell division and its role in plants growth and development.
- Understand the plants at molecular level

Unit	Topics	Teaching Hrs. (36)
I	**Cytology:** Structure of plant cell, Ultra-structure and functions of cell wall, plasma membrane- fluid-mosaic model, endoplasmic reticulum, chloroplast, ribosomes, golgi complex, mitochondria, peroxisome, plastids and vacuole. Ultra structure of nucleus - nuclear membrane, nuclear pore complex and nucleolus. Ergastic substances in plant cells. **Cell Division and Chromosomes:** Types of chromosomes based on centromere position, Autosomes and Allosomes, structure of metaphase chromosome, Ultra structure of Chromosomes-Nucleosome model. Cell cycle, Mitosis in plant cells– karyokinesis and cytokinesis, Meiosis in plant cells, significance of mitosis and meiosis.	12

II	**Structure, Chemistry and Expression of Gene:** Experiments to prove DNA as genetic material – Griffith experiment, Avery. McCarty and MacLeod experiments, Hershey - Chase experiment. DNA: Chemical composition, types -A, B and Z-DNA, structure-Watson & Crick model, Semiconservative replication of DNA. RNA: Structure and functions of m RNA, t RNA and r RNA. Structure of Gene: Cistron, recon and muton concept. Prokaryotic and eukaryotic genes. Genetic code and its properties. Regulation of gene expression in prokaryotes- Lac operon model. Gene regulation in eukaryotes- Transcription and Translation, process of Gene splicing, post transcriptional changes.	12
III	**Genetics:** Introduction to genetics, Brief history of Mendel and his experiments on pea plants. Monohybrid cross and law of segregation, dihybrid cross and law of independent assortment. Test cross and back cross-monohybrid and dihybrid. Incomplete dominance- flower color in *Mirabilis*. Multiple alleles – self sterility in tobacco. Gene Interactions with plant examples: Complementary - 9:7, Supplementary - 9:3:4 and Dominant Epistasis –, 12:3:1 ratio. Polygenic inheritance - kernel color in wheat. Linkage and its types – cis and trans, complete and incomplete. Linkage in Maize. Mechanisms of sex determination in Plants – *Melandrium* and *Coccinia indica,* Gene mutations: Spontaneous mutations, Induced mutations -Physical and chemical mutations. Molecular basis of mutations- base substitutions and frameshift mutations.	12
	Total	36 hrs

REFERENCE BOOKS:

1. S Sundara Rajan, 2004, Genetics, Anmol Publications Ltd.
2. Gupta P.K 1999. A text book of Cell and Molecular Biology. Rastogi Publication Meerut
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition.ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8thedition. Lippincott Williams and Wilkins, Philadelphia.
5. Gardner, E.J., Simmons, M.J., Snustad, D.P. 2008. Principles of Genetics.8th Edition Wiley India.
6. Griffiths, AJF. Wessler, SR., Lewontin, RC. and Carroll, SB. 2012. Introduction to Genetic Analysis. IX Edition W.H. Freeman and Co.
7. Burns G.W. 1983. The Science of Genetics - An Introduction to Heredity. 5th edition Mac Mill. Publ.
8. David Freifilder 1996. Essentials of Molecular biology Panima Publishing company New Delhi.
9. Gardner E.J., M.J. Simmons & D.P. Snustad. 1991. Principles to Genetics 8th edition. John Wiley
10. Gupta P.K. 2000 Genetics and Cytogenetics. Rastogi Publishers.
11. lug W.S. & M.R. Gummings. 2003. Concepts of Genetics 7th Edition. Pearson Edition
12. Kumar H.D. 2000. Molecular Biology. Vikas Publishers.
13. Malacinski G.M. & D. Freifelder. 1998. Essentials of Molecular Biology. Jones & Bartlatt Publishing Boston. 3rd Edition.
14. Powar C.B. 2005, Cell Biology 3 edition Himalaya Publishing New Delhi.
15. Sambamurty A.V.S.S. 1999. Genetics, Narosa Publishing House.

SEMESTER –V

Ecology, Genetics, Cell and Molecular Biology– Practical

Practical No.	Experiments
1	Hydrophytes: Morphological adaptations in *Pistia, Eichhornia, Hydrilla, Nymphaea* and Anatomical adaptations of Hydrophytes -*Hydrilla* and *Nymphaea*.
2	Xerophytes: Morphological adaptations in *Asparagus, Casuarina, Acacia, Aloe vera, Euphorbia tirucalli* and Anatomical adaptations of *Casuarina phylloclade/ Acacia phylloclade.*
3	Epiphytes: Morphological adaptations in *Acampe, Bulbophyllum, Drynaria* and Anatomical adaptations of epiphytic root of *Acampe/ Vanda.* Halophytes: Vivipary and Pneumatophores
4	Demonstration of different types of vegetation sampling methods – transects and quadrats. Field visits to study different types of local vegetations/ecosystems and the report to be written in practical record book
5	Project work Ecology
6	Project work
7	Study of ergastic substances - starch (potato), aleurone (wheat grain), calcium oxalate (Pistia), calcium carbonate (Ficus leaf), oil globules (castor seed) and Raphides (Colocasia petiole). Observation of permanent slides of mitosis and meiosis
8	Study of different stages of mitosis by squash technique using Onion root tip
9	Study of different stages of meiosis using permanent slides.
10	Measurement of length and breadth of cells by micrometry technique (Using Onion or Rhoeo leaf cells)
11	Genetic problems related to Mendel's law and incomplete dominance (any Four)
12	Genetic problems related to interaction of genes (any Four)

Mangalore University

III B. Sc. Semester - V, Practical Examination

Ecology, Genetics, Cell and Molecular Biology

Question paper and Scheme of evaluation

Time: 3 hrs. Batch…….. Date…… Time……..am/pm Max. Marks: 40

1. Prepare a stained temporary mount of the T.S. of material **A**. Draw a neat labeled diagram. Leave the slide for inspection. 05
2. Prepare a squash of **B** for the study of mitosis. Leave the slide for inspection. 06
3. Identify the ecological group of **C** and **D**. Comment on their ecological adaptation. 04
4. Identify the slides **E & F** and Comment on it. 06
5. Solve the genetic problem **G** 04
6. Practical Record with field visit report 10
7. Project work report 05

1	**A**		Prep. 02 Sk 01 Features 02 05	Reg. No. of Candidates Assigned:
2	**B**		Prep. & Stage 03 Sk 01 Comments 02 06	
3	**C**		Ecol.Group 01 Ecol.Features 01 02 each	Reg. No. of absentees:
	D			
4	**E**		Identification 01 Sk 01 Comment 01 03 each	Total examined:
	F			Examiners:
5	**G**		Problem solve 03 Conclusion 01	1.External
6		Practical Record with field visit report	10	2.Internal
7		Project report	05	

Instruction to Examiners:

A from Hydrophyte/Xerophyte/ Epiphyte

B Mitosis squash

C and **D** Specimen from Hydrophyte/Xerophyte/ Epiphyte/Halophyte

E- Stages of Meiosis and **F**-Ergastic substance

G -Any one genetic problem mentioned in the practical syllabus

B.Sc. BOTANY – V Semester
SKILL PAPER -II
Mushroom Cultivation Technology

Learning outcomes:

After completion of the course, the students will be able to;

- Understand the various aspects of mushroom cultivation the diversity of microbes in nature.
- Understand the storage of methods of cultivated mushrooms
- Know the nutritional benefits of edible mushrooms

Unit	Topics	Teaching Hours
I	Introduction – Edible and non-edible mushrooms. Edible mushrooms commercially cultivated in India – *Volvariella volvacea, Pleurotus citrinopileatus* and *Agaricus bisporus.* Cultivation Technology: History. Infrastructure- substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, stove, sieves, culture rack, mushroom unit (Thatched house), water sprayer, tray. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, banana leaves, areca sheath and coconut leaves. Composting technology in mushroom production.	12
II	Storage and nutrition: Short-term storage (Refrigeration – up to 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions. Chemical composition and their nutritional values: Proteins - amino acids, minerals, carbohydrates, vitamins and crude fiber. Food Preparation: Types of foods prepared from mushrooms. Research Centers - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.	12
	Total	24 hrs

References:

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore -560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol.II.

SEMESTER – VI; Paper-VII

PLANT PHYSIOLOGY – Theory

Course objectives: To understand the various physiological life processes in plants

To study the importance of the physiological processes and their mechanism

To study the role of various metabolites and their importance

Course outcome: **After the successful completion of the course, the student will be able to:**

- Compare the various metabolic activities taking place in plants.
- Evaluate the various factors affecting the plant activities.

Unit	Topics	Teaching Hrs (36)
I	Plant water relations: Mechanism of water absorption, Factors affecting water absorption. Mechanism of ascent of sap: Vital and physical force theories. Transpiration. Types and process. Mechanism of guard cell movement. K^+ ion exchange mechanism. Antitranspirants. Guttation. Translocation of organic solutes: Transport of organic solutes. path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis. Mineral nutrition: Essential elements: Classification - Macro and Micronutrients. Functions and deficiency symptoms of macro elements- N, P, K and Mg. Functions and deficiency symptoms of Micronutrients-Zn, Mn and B. Hydroponics and its applications. Mechanism of mineral salt absorption: Passive absorption – diffusion, ion exchange. Active absorption- Cytochrome pump theory, Protein Lecithin theory. Enzymes - classification, kinetics and mechanism of action. Bioenergetics: Definition, examples for major bioenergetic processes.	12
II	Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration (C2 pathway). Respiration: Glycolysis, TCA cycle; Oxidative phosphorylation, Glyoxylate cycle, Oxidative Pentose Phosphate Pathway. Anaerobic respiration – alcoholic and lactic acid fermentation. ATP yield during aerobic and anaerobic respirations. Respiratory quotient.	12

III	Carbohydrate metabolism–General account of carbohydrates. Metabolism of sucrose and starch. Nitrogen metabolism - physical and biological nitrogen fixation and mechanism of biological nitrogen fixation- asymboitic and symbiotic, Nitrate reduction and amino acid synthesis. Fat metabolism - General account of fats, synthesis of glycerol, synthesis of fatty acids, and condensation of fatty acid and glycerol, fat degradation, β (Beta) - oxidation, glyoxylate cycle and its significance, plant waxes. Plant growth regulators: Definition and classification, Role of Auxins, Gibberlins, cytokinins, ABA and ethylene on plant growth and development. Practical utility in agriculture and horticulture, Synthetic growth regulators. Plant movements: Nastic movements – nyctinasty, chemo nasty and seismonasty. Tropic movements –phototropic, hydrotropic, geotropic and thigmotropic. Brief account of seed dormancy: Causes and breaking of seed dormancy	12
	Total	36 Hours

References:

1. Wilson, K. and Walker, J. 1994. Fundamentals of Biochemistry 2nd Ed, John Wiley and Sons Inc.
2. JainV K, 2008. Fundamentals of Plant Physiology. S Chand and Co.
3. Kochhar P L, Krishnamoorthy H N. Plant Physiology. Atmaram and sons, Delhi.
4. Kumar and Purohit. Plant Physiology: Fundementals and Applications. Agrobotanical Publishers.
5. Malik CP, 2002. Plant Physiology. Kalyani publishers.
6. Mukherjii S, Ghosh AK, 2005. Plant Physiology. New Central Book Agency, Calcutta.
7. Noggle GR, Fritz GJ, Introductory Plant Physiology. Prentice Hall of India.
8. Pandey SN, Sinha BK, 2006. Plant Physiology. Vikas Publishing House, New Delhi.
9. Salisbury F B, Ross C W, 1992. Plant Physiology. CBS publishers and Distributers, New Delhi.
10. Verma V, 2007. Text book of plant physiology, Ane books India.

SEMESTER – VI; Paper-VIII

Plant Breeding and Biotechnology

Course outcome: **After the successful completion of the course, the student will be able to:**

Understand the plant breeding methods and importance

Understand the methods of plant tissue culture and plant biotechnology

Unit	Topics	Teaching Hrs. (36)
I	**Plant Breeding:** History of plant breeding, Objectives, and major contributions of plant breeding. Centres of origin and evolution of crop plants. Genetic basis of breeding self- and cross-pollinated crops. Role of plant genetic resources in plant breeding. Methods of Plant breeding: Introduction, Selection- Pure line, Clonal and Mass line. Polyploidy breeding, Mutation Breeding, Hybrid breeding – concept of heterosis and inbreeding, types andtechniques of hybridisation. Self-incompatibility and Male sterility in crop plants -types, production, and significance in plant breeding. Cultivar development, Plant Breeders rights and Farmers rights	12
II	**Plant Tissue Culture:** History and Scope, concept of cellular totipotency.Tissue culture laboratory and Equipments Basic aspects of plant tissue culture- Sterilization, Culture media and its preparation. Role ofgrowth hormones in plant tissue culture. Types of cultures-Callus culture and Organogenesis. Pollen culture and haploid plant production. Embryo culture. Somatic embryogenesis and synthetic seeds. Protoplast culture andsomatic hybridization techniques. Application of plant tissue culture in Agriculture, Forestry, Industries and plant conservation.	12

III	**Plant Biotechnology:** Introduction to Plant Genetic Engineering. Tools used in genetic engineering: Enzymes- Restriction endonucleases, DNA ligase, Vectors -pBR 322, Ti and Ri plasmid vectors, artificial chromosomes, difference between cloning and expression vectors. General steps of recombinant DNA technology using plasmid vectors and bacterial host cell. Gene transfer methods to plant cells: Agrobacterium based gene transfer technique, Direct genetransfer – microinjection, electroporation, microprojectile techniques. Plant regeneration fromtransformed cells. Transgenic plants: Definition and examples, Steps involved in the production of golden rice and Bt cotton. Applications and threats from transgenic plants.	12
	Total	36 hrs

SUGGESTED REFERENCE BOOKS:

1. Allard R.W (1999): The Principles of Plant Breeding, John & Wiley and Sons.
2. Poelman J.M: Breeding Field Crops, Springer.
3. George Acquaah (2012): Principles of Plant Genetics & Breeding: Wiley-Blackwell.
4. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
5. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
6. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. institution)
7. Pullaiah. T. and M.V. Subba Rao. 2009. Plant Tissue culture. Scientific Publishers, New Delhi.
8. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
9. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
10. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
11. Gupta P.K. (2010), Plant Biotechnology, Rastogi Publications, Meerut.
12. Monica Jain (2014), Environmental Biotechnology, Narosa Publishing House, New Delhi.
13. Mohapatra, P. K. (2007), Textbook of Environmental Biotechnology, IK International, New Delhi.

SEMESTER –VI

Plant Physiology and Plant Breeding & Biotechnology

Practical No	Experiments
	Major experiments
1	Experiment to measure the solute potential of a cell sap by plasmolytic method.
2	Demonstration of transpiration pull/Suction force due to transpiration.
3	Separation of plant pigments by paper chromatography method.
4	Demonstration of CO_2 liberation during respiration using Ganong's respiroscope
	Minor Experiments
5	Potato osmoscope /Thistle funnel experiment to demonstrate osmosis Demonstration of imbibition pressure using germinating seeds
6	Demonstration of O_2 liberation during photosynthesis by bubbling method Demonstration of fermentation using Kuhne's Fermentation vessel
7	Demonstration of plant movements – Heliotropism, Geotropism, Hydrotropism Measurement of growth using arc auxanometer
8	Qualitative test for carbohydrates, Protein, fat, and oil
9	Study of plant propagation methods-Cutting, Layering and Grafting
10	Techniques of emasculation, artificial pollination, and bagging
11(a)	Study of Biotechnology lab equipment's – Autoclave, Laminar air flow cabinet, Hot air oven, Incubator, Colony counter, Hemocytometer
11 (b)	Preparation of Synthetic seeds by alginate encapsulation
12	Visits to local nurseries and institutions involved in plant breeding to study the various methods and techniques employed/ Biotechnology Lab or institutions/biofertilizer and biopesticide production sites and submit a report

Mangalore University

B. Sc – VI Semester, Botany Practical Examination

PLANT PHYSIOLOGY AND BIOTECHNOLOGY

Time: 3 hrs. Batch…….. Date…… Time……..am/pm Max. Marks: 40

1. Conduct Major Experiment **A** 12 marks
2. Comment on minor experiment**s B** and **C** 08 marks
3. Perform the Biochemical test **D** 04 marks
4. Identify and comment on **E** and **F** 06 marks
5. Practical Record and Field report 10 marks

1	A		Requirements - 02 Principle -01 Sketch-01 Procedure-02 Setting-04 Results and Inference-02 = 12	Register No. Assigned: Absentees: Total Examined: Examiners 1. 2.
2	B		Procedure -02 Sketch -01 Results and Inference 01 04 each	
	C			
3	D		Procedure-02 Prep -01 Results and Inference-01	
4	E		Identification 01 Sk 01 Comment 01 03 each	
	F			
5		Practical Record with field visit report	7+3=10	

Instruction to Examiners:
A Physiology Major Experiment by picking lots
B and **C** Physiology minor experiments
D- Biochemical test
E-Plant propagation methods/techniques; **F -**Any one biotechnological instrument

B.Sc. BOTANY – VI Semester
SKILL PAPER -III
Seed Technology

Course Outcome:

- Understanding the fundamentals of seed germination. viability and vigour
- Learning about seed production, processing, and quality control.
- Exploring the role of seed technology in agricultural productivity.

Unit 1: Introduction to Seed Technology

- **Introduction to Seed Technology:** Definition, scope, and importance. Historical perspective of seed technology in agriculture.
- **Seed Development and Germination:** Structure and development of seeds. Factors affecting seed germination and dormancy.
- **Seed Viability and Vigor:** Concepts of seed viability and vigor. Methods of testing seed viability and vigor.

Unit 2: Seed Production and Processing

- **Principles of Seed Production:** Genetic and agronomic principles. Seed production techniques for self-pollinated and cross-pollinated crops.
- **Seed Certification and Quality Control:** Objectives and procedures of seed certification. Seed standards and quality control measures.
- **Seed Processing and Storage:** Principles and techniques of seed processing. Seed storage and its importance in maintaining seed quality.

Unit 3: Advances in Seed Technology

- **Biotechnological Approaches in Seed Technology:** Role of biotechnology in seed improvement. Genetic engineering and molecular markers in seed technology.
- **Seed Health:** Importance of seed health in agriculture. Methods of seed treatment and protection.
- **Seed Industry and Trade:** Overview of the seed industry in India. National and international seed trade regulations and policies.

Assessment:

- Internal Assessment Test: 10%
- Assignments/Projects: 10%
- End-Semester Examination: 80%

Recommended Readings:

1. Agarwal, R.L., Seed Technology, Oxford & IBH Publishing Co. Pvt. Ltd.
2. Bewley, J.D., and Black, M., Seeds: Physiology of Development and Germination, Springer.
3. McDonald, M.B., and Copeland, L.O., Seed Production: Principles and Practices, Chapman & Hall.
4. Basra, A.S., Seed Quality: Basic Mechanisms and Agricultural Implications.

Question Paper Pattern for Theory

Reg. No. | | | | | | | | | | | |

BSCBO XX 000

_ _ Semester B. Sc. Degree Examination, _____ 202

(SEP) (2024-25 batch onwards)

BOTANY

Title of the Course

Time: 3 hrs. **Max. Marks: 80**

Instructions**: 1) Answer Part - **A** and Part – **B

*2) Answer any four full questions from Part- **B** choosing **one** full question from each unit*

*3) **All** questions on Part – B carry **equal** marks*

*4) Draw diagrams **wherever** necessary*

Part - A

I. Answer **any ten** of the following: **(10 x 2 = 20)**

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.

Part – B

Unit - 1

13. a) 3
    b) 5
    c) 7

OR

14.	a)		4
	b)		4
	c)		7

Unit - II

15.	a)		3
	b)		5
	c)		7

OR

16.	a)		4
	b)		4
	c)		7

Unit - III

17.	a)		3
	b)		5
	c)		7

OR

18.	a)		4
	b)		4
	c)		7

Unit - IV

19.	a)		3
	b)		5
	c)		7

OR

20.	a)		4
	b)		4
	c)		7

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