HAVERI UNIVERSITY, HAVERI

B.Sc. (BOTANY)

SYLLABUS

With Effect from 2024-25

DISCIPLINE SPECIFIC CORE COURSE (DSC) FOR SEM I - VI,

SKILL ENHANCEMENT COURSE (SEC) FOR SEM IV/V/VI and ELECTIVE COURSES FOR SEM V AND VI

AS PER N E P (Revised):2024

Haveri University, Haveri

B.Sc. in BOTANY

Effective from 2024-25 Onwards

Sem.	Type of Course	Theory/ Practical	Course Code	CourseTitle	Instruction hour/ week	Total hours / sem	Duration of Exam	Marks			Credits
								Formative	Summative	Total	
				Discipline Specific Core							
I	DSC-1	Theory	C 1 BOT 1 T 1	Diversity of Viruses, Microbes, Algae, Fungi and their applications	04hrs	60	03 hrs	20	80	100	04
	DSC-2	Practical	C 1 BOT 1 P 1	Diversity of Viruses, Microbes, Algae, Fungi and their applications	04 hrs	56	03 hrs	10	40	50	02
II	DSC-3	Theory	C 2 BOT 1 T 1	Diversity and applications of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany	04hrs	60	03 hrs	20	80	100	04
	DSC-4	Practical	C 2 BOT 1 P 1	Diversity and applications of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany	04 hrs	56	03 hrs	10	40	50	02
III	DSC-5	Theory	C 3 BOT 1 T 1	Plant Anatomy and Developmental Biology	04hrs	60	03 hrs	20	80	100	04
	DSC-6	Practical	C 3 BOT 1 P 1	Plant Anatomy and Developmental Biology	04 hrs	56	03 hrs	10	40	50	02
1V	DSC-7	Theory	C 4 BOT 1 T 1	Genetics and Plant Breeding	04hrs	60	03 hrs	20	80	100	04
	DSC-8	Practical	C 4 BOT 1 P 1	Genetics and Plant Breeding	04 hrs	56	03 hrs	10	40	50	02
				Discipline Specific Elective							
*V	DSC-9A	Theory	C 5 BOT 2 T 1	Plant Morphology and Plant Systematics	04hrs	60	03 hrs	20	80	100	04
	DSC-10A	Practical	C 5 BOT 2 P 1	Plant Morphology and Plant Systematics	04 hrs	56	03 hrs	10	40	50	02
	DSC-9B	Theory	C 5 BOT 2 T2	Plant Physiology and Phytochemistry	04hrs	60	03 hrs	20	80	100	04
	DSC-10B	Practical	C 5 BOT 2 P 2	Plant Physiology and Phytochemistry	04 hrs	56	03 hrs	10	40	50	02
*VI	DSC-11A	Theory-	C 6 BOT 2 T 1	Plant Ecology and Conservation Biology	04hrs	60	03 hrs	20	80	100	04
	DSC-12A	Practical	C 6 BOT 2 P 1	Plant Ecology and Conservation Biology	04 hrs	56	03 hrs	10	40	50	02
	DSC-11B	Theory-	C 6 BOT 2 T 2	Molecular Biology and Plant Biotechnology	04hrs	60	03 hrs	20	80	100	04
	DSC-12B	Practical	C 6 BOT 2 P 2	Molecular Biology and Plant Biotechnology	04 hrs	56	03 hrs	10	40	50	02
				Open Elective							
V	EC-1	Theory	C 5 BOT 5 T 1	Mushroom Cultivation Technology	03hrs	45	03 hrs	20	80	100	03
VI	EC-2	Theory	C 6 BOT 5 T 1	Medicinal and Aromatic Plants	03hrs	45	03 hrs	20	80	100	03
				Skill							
**IV/V/ VI	Skill	Practical	C 0 BOT 6 T 1	Nursery Management and Gardening	04 hrs	56	03 hrs	10	40	50	02

*Student shall either DSC 9A and DSC10A or DSC 9B and DSC10B in 5th semester. Similarly, DSC 11A and DSC12A or DSC 11B and DSC12B in 6th semester.

** Student shall study Skill of this subject either in 4th / 5th / 6th but not in all the semester.

Haveri University, Haveri
B.Sc. Botany

Programme Specific Outcomes (PSO):

On completion of the 03 years Degree in **Botany** students will be able to:

- Demonstrate, solve and understand the major concepts in all the disciplines of **Botany**.
- Understand practical skills so that they can understand and assess risks and work safely and competently in the laboratory.
- To apply standard methodology to the solutions of problems in **Botany**
- Provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes.
- Develop in students the ability to adapt and apply methodology to the solution of unfamiliar types of problems.
- Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of **Botany**
- To build confidence in the candidate to be able to work on his own in industry and institution of higher education.
- To develop an independent and responsible work ethics.
- The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and their professional career.
- To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules.
- The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDGs, green technologies, etc at the right opportunity.
- Skilldevelopmentforthecollection,preservation,andrecordingofinformationafterobservation and analysis- from simple illustration to molecular database development.
- To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC, and others.

B.Sc. Semester – I

Discipline Specific Course (DSC)

Course Title: Diversity of Viruses, Microbes, Algae, Fungi and their applications
Course Code: C 1 BOT 1 T 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Durationof Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-1	**Theory**	**04**	**04**	**60 hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs):

At the end of the course students will be able to:

CO 1: Develop an understanding of the concept of microbial nutrition, Classify viruses based on their characteristics and structures. Demonstrate an understanding of Algae.

CO 2: Develop a critical understanding of plant diseases and their remediation. Examine the general characteristics of bacteria and their cell reproduction/recombination.

CO 3: Increase the awareness and appreciation of human-friendly viruses, bacteria, algae, and their economic importance. Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.

CO 4: Demonstrate skills in laboratory, field, and glasshouse work related to mycology and plant pathology.

CO 5: Develop an understanding of microbes, fungi, and lichens and appreciate their adaptive strategies Identify the common plant diseases according to geographical locations and device control measures. Conduct experiments using skills appropriate to subdivisions .

Unit	Title	60 hrs/ sem
Unit I	**Viruses and Microbes** **Viruses** – History, Classification (Baltimore), Living and non-living features, Structure of DNA virus (T4 phage), Lytic and lysogenic cycle, RNA virus (TMV), Viroids and Prions, Viral plant diseases –Banana bunchy top, Yellow mosaic of beans, Tobacco mosaic disease. **Bacteria** – History, Classification, General characteristics of Archaebacteria and Eubacteria, Morphology and ultrastructure of bacterial cell, Nutrition (autotrophic & heterotrophic), Reproduction and Recombination, Plant diseases – Crown gall and Citrus canker. **Cyanobacteria** – Morphology (Unicellular to multicellular), Cell composition, Classification and distribution, Reproduction, Type study – Nostoc, Oscillatoria.	15 hrs
Unit II	**Algae** General characteristics, Distribution, Range of thallus organization, Pigmentation and Classification (according to G. M. Smith), Reproduction, Morphology and life-cycles of *Volvox, Oedogonium, Chara, Vaucheria, Sargassum, Batrachospermum, water bloom*	15 hrs
	Fungi General characteristics, Range of thallus organization, Cell wall composition,	15 hrs

Unit III	Nutrition, Reproduction and classification, (According to Alexopoulus) Life cycle of *Albugo* (Phycomycetes), *Rhizopus* (Zygomycetes), *Aspergillus* (Ascomycetes), *Puccinia* (Basidiomycetes), *Cercospora* (Deuteromycetes), Symbiotic Associations (Lichen). Kam Mycorrhiza: ectomycorrhiza and endomycorrhiza.	
Unit IV	**Applications** **Virus:** In biological study – Vaccines, As vectors (gene therapy). Monera: Fermentation, Bioremediation, Bioaccumulation, Vectors (Agrobacterium), N_2 fixation and Industrial Importance (Spirulina and Insulin production). **Algae:** In Agriculture, Economic importance of macroalgae (Sea weeds), In food, food chain in aquatic ecosystem. **Fungi:** Role of fungi in Biotechnology – Food (Fermented products, Mycoproteins and Mushroom cultivation), Industry (Organic acid –citric acid, Enzyme – Pectinase); Medicine-(Penicillin), Baking (Yeast); Biological Control –Mycoherbicides, Mycofungicides, Mycoinsecticides.	15hrs

Recommended books:

1. Kumar,H.D.(1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J.,Funke,B.R., Case,C.L.(2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A.10th edition.
3. Sethi, I.K. and Walia,S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos,C.J.,Mims,C.W.,Blackwell,M.(1996).Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B.,Losos, J.B.,Singer, S.R.,(2005).Biology. Tata Mc Graw Hill, Delhi, India.
6. Smith,G.M. 1971. Cryptogamic Botany. Vol.I Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.
7. Sharma,O.P. 1992.Text Book of Thallophytes. McGraw Hill Publishing Co.
8. Sharma,P.D. 1991.The Fungi. Rastogi & Co. ,Meerut.
9. Dube,H.C. 1990. An Introduction to Fungi. Vikas Publishing House Pvt. Ltd.,Delhi.
10. Clifton,A. 1958.Introduction to the Bacteria. McGraw Hill &Co., New York.
11. Aneja, K.R. 1993. Experiments in Microbiology, Pathology and Tissue Culture. Vishwa Prakashan, New Delhi.
12. Vashista, B.R. 1978. Algae. S. Chand & Co.Ltd., New Delhi.
13. Basu A.N. 1993. Essentials of plant viruses, vectors and plant diseases. New Age International, New Delhi.
14. Chopra,G.L. A text book of algae. Rastogi & Co., Meerut.
15. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
16. Rangaswamy,G. 1988. Diseases of crop plants in India. Prentice Hall of India, New Delhi.
17. Sundarajan, S. 1997. College Botany Vol.I. S Chand & Co.Ltd., New Delhi.
18. Alexopoulos, 1992 . An Introduction to Mycology. New Age International, New Delhi.
19. Vashista,B.R. 1978. Fungi. S Chand & Co.Ltd., New Delhi.
20. H.N. Srivastava, 2003. Algae Pradeep Publication, Jalandhar, India
21. Singh,Pande,Jain 2004-05. A Text Book of Botany. Rastogi Publication, Meerut
22. Anil K. Thakur & Susheel K. Bassi. Diversity of Microbes and Cryptogams. Chand Publication.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – I

Discipline Specific Course (DSC)

Course Title: Diversity Of Viruses, Microbes, Algae, Fungi and their Applications

Course Code: C 1 BOT 1 P 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Durationof Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-2	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs):

At the end of the course, students will be able to:

CO 1: Develop an understanding of the concept of microbial nutrition, Classify viruses based on their characteristics and structures.

CO 2: Develop a critical understanding of plant diseases and their remediation. Examine the general characteristics of bacteria and their cell reproduction/recombination.

CO 3: Increase the awareness and appreciation of human-friendly viruses, bacteria, algae, and their economic importance. Identify true fungi and demonstrate the principles and application of plant pathology in the control of plant disease.

CO 4: Demonstrate skills in laboratory, field, and glasshouse work related to mycology and plant pathology.

CO 5: Develop an understanding of microbes, fungi, and lichens and appreciate their adaptive strategies

CO 6: Identify the common plant diseases according to geographical locations and device control measures.

List of the Experiments, each will have 4rs / Week (Minimum 12 experiments)

1. Electron Micrographs / Models of Viruses – T_4 phage and TMV,
2. Line drawing photograph of lytic cycle and lysogenic cycle. Viral plant diseases.
3. Simple / differential staining (Gram Staining) of bacteria and Rhizobium from root nodules.
4. Demonstration of VAM in roots / VAM photographs
5. Khunes fermentation.
6. Study of vegetative and reproductive structure of Nostoc, Oscillatoria
7. Study of vegetative and reproductive structure of Volvox, Oedogonium,
8. Study of vegetative and reproductive structure of Chara, Vaucheria,
9. Study of vegetative and reproductive structure of Sargassum and Batrachospermum
10. Study of vegetative and reproductive structure of Albugo, Rhizopus,
11. Study of vegetative and reproductive structure of Aspergillus, Cercospora.
12. Study of vegetative and reproductive structure of Puccinia,
13. Study of vegetative and reproductive structure of Crustose, Foliose and Fruticose Lichen
14. Field Visit to study Common algae & Fungi, Lichens

Books recommended:

1. Ashok Bendre and Ashok Kumar (2009) A textbook of practical botany, Rostakge Publications.

2. Sharma, O.P., and Sharma, K. D. (2017) Practical Botany-I, Pragathi Prakashan, Meerut.

3. Raghuram, M, and Rao, M. V. (2018) B. Sc. Practical Book of Botany First Year, Technical Publishers.

4. Verghese, N., Joy, P.P. Microbiology Laboratory Manual, Kerala Agricultural University.

SEMESTER 1

CORE COURSE: BOTANY

CORE SUBJECT CODE: C 1 BOT 1 P 1

DIVERSITY OF VIRUSES, MICROBES, ALGAE, FUNGI AND THEIR APPLICATIONS) PRACTICAL

Time: 03Hours **Max.Marks:40 Marks**

Question Paper Pattern

Q.1.	Identify and classify the given specimen A, B, and C giving reasons	12 marks
Q.2.	Make a temporary slide and stain the given specimen D and show the preparation to the examiner (No written answer is expected).	03 marks
Q.3.	Identify the given specimen/slide/ photograph E, F G, and H giving reasons.	12 marks
	Viva-voce	05 Marks
	Field Report	03 marks
	Practical Record	05 Marks

Instructions to the Examiner

Q. 1. One Specimen each from Cyanobacteria, Algae, Fungi.

Q. 2. Simple/Differential staining / Rhizobium / VAM

Q. 3. One specimen/slide / Photograph, from Virus, Cyanobacteria, Algae, Fungi, Lichen

B.Sc. Semester – II

Discipline Specific Course (DSC)-

Course Title: - Diversity and Applications of Bryophytes, Pteriophytes, Gymnosperms and Paleobotany

Course Code: C 2 BOT 1 T 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
DSC-3	**Theory**	**04**	**04**	**60 hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs):

At the end of the course students will be able to:

CO1: Demonstrate an understanding of Bryophytes, Pteridophytes, and Gymnosperms.

CO2: Develop a critical understanding of morphology, anatomy, and reproduction of Bryophytes, Pteridophytes, and Gymnosperms.

CO3: Understanding of plant evolution and their transition to land habitat.

CO4: Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes and Gymnosperms.

CO 5: Economic importance of Bryophytes, Pteridophytes and Gymnosperms.

Unit	Title	60 hrs/ sem
Unit I	**Bryophytes:** General account, Classification (According to G.M. Smith) and Distribution. Structure and reproduction in *Riccia, Marchantia Anthoceros, Sphagnum* and *Funaria*. Evolutionary significance of Bryophytes, Evolution of Gametophyte and Sporophyte in Bryophytes	15 hrs
Unit II	**Pteriophytes:** Origin, general account distribution and classification. (According to G.M. Smith). Structure and reproduction of *Psilotum, Lycopodium, Selaginella, Equisetum, Adiantum* and *Marsilea.* Stelar evolution; Heterospory and Seed Habit in Pteridophytes.	15 hrs
Unit III	**Gymnosperms**: General account, classification (According to Sporne) and distribution. Structure and reproduction of *Cycas, Pinus* and *Gnetum, Ephidra.*	15 hrs
Unit IV	**Paleobotany:** Geological time scale, fossilization and study of fossil types – *Rhynia, Lepidodendron, Lepidocarpon, Calamites* and *Lyginopteris.* Economic importance of Bryophytes, Pteridophytes and Gymnosperms.	15hrs

Recommended books:

1. Smith, G.M. 1971. Cryptogamic Botany, Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
2. Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India, Ltd.
3. Puri, P. 1980. Bryophyta. Atma Ram & Sons, New Delhi.
4. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. 1. Bryophyta. Central Book Depot. Allahabad.
5. Sporne, K.R. 1966. Bryophytes.
6. Vashista, B.R. 1978. Bryophytes. S. Chand & Co., Ltd., New Delhi.
7. Bharnagar, S.P. and Moitra, A. 1966. Gymnosperms. New Age International Ltd., New Delhi.
8. Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of vascular plants. W.H. Freeman and Co., New York.
9. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd. London.
10. Stewart, W.M. 1983. Paleobotany and the Evolution of plants. Cambridge University press. Cambridge.
11. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and application in exploration of fossil fuels. Oxoford & IBH., New Delhi.
12. Parihar, N.S. 1977. The morphology of Pteridophytes. Central Book Depot. Allahabad.
13. Rashid, A. 1998. An Introduction to Pteridophyta. II Ed., Vikas Publishing House, New Delhi.
14. Sporne, K.R. 1966. The morphology of Pteridophytes. The structure of ferns and Allied plants. Hutchinson & Co., Ltd. London.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – II

Discipline Specific Course (DSC)

Course Title: - Diversity and Applications of Bryophytes, Pteriophytes, Gymnosperms and Paleobotany

Course Code: C 2 BOT 1 P 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-4	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs):

At the end of the course, students will be able to:

CO 1: Demonstrate an understanding of Bryophytes, Pteridophytes, and Gymnosperms.

CO 2: Develop a critical understanding of morphology, anatomy, and reproduction of Bryophytes, Pteridophytes, and Gymnosperms.

CO 3: Understanding of plant evolution and their transition to land habitat.

CO 4: Demonstrate proficiency in the experimental techniques and methods of appropriate analysis of Bryophytes, Pteridophytes and Gymnosperms.

CO 5: Economic importance of Bryophytes, Pteridophytes and Gymnosperms.

List of the Experiments, each will have 4rs / Week (Minimum 12 experiments)

1. Study of morphology, anatomy and reproductive structure of *Riccia*, *Marchantia* and *Anthoceros.*
2. Study of morphology, anatomy and reproductive structure of *Sphagnum* and *Funaria.*
3. Study of morphology, anatomy and reproductive structure of *Psilotum* and *Lycopodium.*
4. Study of morphology, anatomy and reproductive structure of *Selaginella* and *Equisetum.*
5. Study of morphology, anatomy and reproductive structure of *Adiantum* and *Marsilea.*
6. Study of morphology, anatomy and reproductive structure of *Cycas.*
7. Study of morphology, anatomy and reproductive structure of *Pinus.*
8. Study of morphology, anatomy and reproductive structure of *Gnetum* and *Ephidra*
9. Study of Geological Time Scale.
10. Observations of fossil impressions and slides of *Rhynia*, *Lepidodendron* and *Lepidocarpon.*
11. Observations of fossil impressions and slides of *Calamites and Lyginopteris.*
12. *One day compulsory study tour to nearby forest area / pond. Tour report and field note book in the study tour should be submitted during the practical end examination.*

Books recommended:

1. Ashok Bendre., and Ashok Kumar. (2009). A textbook of practical botany, Rostakge Publications.
2. Sharma, O.P., and Sharma, K. D. (2017) Practical Botany-I, Pragathi Prakashan, Meerut.
3. Raghuram, M, and Rao, M. V. (2018) B. Sc. Practical Book of Botany First Year, Technical Publishers.
4. Verghese, N., Joy, P.P. Microbiology Laboratory Manual, Kerala Agricultural University.

SEMESTER II

CORE COURSE: BOTANY

CORE SUBJECT CODE: C 2 BOT 1 P 1

PAPER II: DIVERSITY AND APPLICSTIONS OF BRYOPHYTES, PTERIOPHYTES AND GYMNOSPERMS

Time: 03Hours **Max.Marks:40 Marks**

SCHEME OF PRACTICAL EXAMINATION (DISTRIBUTION OF MARKS) : 40 MARKS FOR THE SEMESTER END EXAMINATION

Q.1.	Identify, classify and describe features observed in the given specimen A,B and C	09 Marks
Q.2.	Describe the internal structures of the given specimen D,E and F and show the preparation to the Examiner	09 Marks
Q.3.	Identification of Specimen/slides/Impressions G,H,I and J	08 Marks
	Viva-voce	04 Marks
	Practical Record	05 Marks
	Study Tour Report	05 Marks
	Total	40 Marks

GENERAL INSTRUCTIONS TO EXAMINERS:

Q1. Give specimen to take Morphology of vegetative/reproductive materials from Bryophytes, Pteridophytes, and Gymnosperms (A, B, and C)

Q2. Give specimen to take internal structure from Bryophytes/Pteridophytes/ Gymnosperms (D, E and F)

Q3. Specimen or Slides from Bryophytes/Pteridophytes/Gymnosperms/fossil (G, H, I and J)

Viva-voce.

Practical Record.

Study Tour Report.

Note: Same Scheme may be used for IA (Formative Assessment) examination and reduce to 10 marks

B.Sc. Semester – III

Discipline Specific Course (DSC)-

Course Title: - PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course Code: C3 BOT 1 T 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-5	**Theory**	**04**	**04**	**60 hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs):

At the end of the course students will be able to:

CO1: Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.

CO2: Skill development for the proper description of internal structure using botanical terms, their identification and further classification.

CO3: Induction of the enthusiasm on internal structure of locally available plants.

CO4: Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.

CO5: Understanding the various reproductive methods sub-stages in the life cycle of plants.

CO6: Observation and classification of the embryological variations in angiosperms.

CO7: Enthusiasm to understand evolution based on the variations in reproduction among plants.

Unit	Titles	60 hrs/ sem
Unit I	**Angiosperm Anatomy, Plant Cell Structure and Tissues:** Introduction, objectives and scope of Plant Anatomy, Plant cell structure – nature of plant cell wall. ***Tissue and tissue systems*** – apical meristematic tissue. Theories on organization of meristem (apical cell theory, Tunica-Corpus theory, histogen theory and Korper-Kappe theory), quiescent centre. Permanent tissue (Parenchyma, Collenchyma, Sclerenchyma, and Complex tissues). ***Tissue system*** (Epidermal tissue, ground tissue, vascular tissue, secretary tissue and mechanical tissue system).	15 hrs
Unit II	**Primary structures, normal and anomalous secondary growth** Types of vascular bundles and Vascular cambium, Origin, development, arrangement and diversity in size and shape of leaves. Structure of Dicot root, and stem: primary structures (Tridax/Sunflower), Structure of monocot root, and stem (Maize). Structure of Dicot and Monocot leaf primary structure (Tridax/Sunflower, Maize), Stomatal types.	15 hrs

	Normal secondary growth in dicot stem and root. Anomalous secondary growth: Aristolochia, Boerhaavia (dicot stem) Dracaena (monocot stem) Applications in systematics, forensics and Pharmacognosy.	
Unit III	**Developmental Biology** Differentiation and cell polarity in acellular (*Dictyostelium*), Unicellular (*Equisetum spore*) and multicellular system (root hair formation). Shoot Apical meristem (SAM): Origin, structure and function. Cytohistological zonation and Ultrastructure of meristems. Organogenesis: Differentiation of root, stem, leaf and axillary buds, bud dormancy. Mechanism of leaf primordium initiation, development and Phyllotaxis (Diversity in size and shape of leaves). Structure and function of root apical meristem (RAM): Root cap, quiescent centre and origin of lateral roots. Transition from vegetative apex into reproductive apex. Developmental patterns at flowering apex: ABC model specification of floral organs. Modification of gene action by growth hormones and cellular differences between floral organs. Senescence – a general account.	15 hrs
Unit IV	. **Reproductive Biology** Introduction, Scope and contributions of Indian embryologists: P. Maheswari, B G L Swamy and M.S. Swaminathan. **Microsporangium**: Development and structure of mature anther, Anther wall layers, Tapetum -types, structure and functions. **Microsporogenesis** - Microspore mother cells, microspore tetrads, Pollinia. **Microgametogenesis** – Formation of vegetative and generative cells, structure of male gametophyte. Pollen embryosac (Nemec phenomenon). **Megasporangium –** Structure of typical Angiosperm ovule. Types of ovules - Anatropous, Orthotropous, Campylotropous, Amphitropous and Circinotropous, Hemianatropous **Female gametophyte –** Embryosac- monosporic- *Polygonum* type, bisporic – *Allium* type, tetrasporic - *Fritillaria* type. Structure of mature embryosac. **Pollination and fertilization:** Structural and functional aspects of pollen, stigma and style. Post pollination events; Current aspects of fertilization and Significance of double fertilization, Post fertilization changes. **Endosperm** – Types and its biological importance. Free nuclear (*Cocos nucifera*), cellular (*Cucumis),* helobial types. Ruminate endosperm. **Embryogenesis –** Structure and composition of zygote, Dicot (*Capsella bursa-pastoris)* and Monocot (*Najas)* embryo development. A general account of seed development.	15hrs

Recommended books:

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms**,** Woong-Young Soh, Springer Netherlands,
3. Coutler E. G. 1969. Plant Anatomy – Part I Cells and Tissues – Edward Arnold, London.
4. Dickison, W.C. (2000). Integrative Plant Anatomy, Harcourt Academic Press, USA
5. Eames A. J. - Morphology of Angiosperms - Mc Graw Hill, New York.
6. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
10. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
11. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
12. Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
13. Nair P .K. Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
14. Pandey S.N. 1997, Plant Anatomy and Embryology. A. Chadha, Vikas Publication House Pvt Ltd;
15. Pandey, B. P., 1997. Plant Anatomy, S.Chand and Co. New Delhi
16. Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
17. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
18. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
19. Vashishta .P.C .,1984. Plant Anatomy – Pradeep Publications – Jalandhar
20. Vashishta, P.C. 1997. Plant Anatomy, Pradeep Publications.
21. N. N. Bhandari. The Microsporangium.
22. F. Bouman. The Ovule.
23. M. T. M. Willemse, J. L. van Went: The Female Gametophyte.
24. R. B. Knox : The Pollen Grain.
25. J. L. van Went, M. T. M. Willems :Fertilization.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – III

Discipline Specific Course (DSC)

Course Title: PLANT ANATOMY AND DEVELOPMENT BIOLOGY

Course Code: C 3 BOT 1 P 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-6	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs):

At the end of the course, students will be able to:

CO1: Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.

CO2: Skill development for the proper description of internal structure using botanical terms, their identification and further classification.

CO3: Induction of the enthusiasm on internal structure of locally available plants.

CO4: Understanding various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.

CO5: Understanding the various reproductive methods sub-stages in the life cycle of plants.

CO6: Observation and classification of the embryological variations in angiosperms.

CO7: Enthusiasm to understand evolution based on the variations in reproduction among plants.

List of the Experiments, each will have 4rs / Week (Minimum 12 experiments)

1: i) Study of meristem (Permanent slides/ Photographs).
ii) Study of Simple Tissues (Parenchyma, Collenchyma and Sclerenchyma) and Complex Tissues (xylem and phloem).

2: Maceration technique to study elements of xylem and phloem, Study of primary structure of dicot root, stem and leaf (Sunflower) and monocot root, stem and leaf (Maize).

3: Study of Normal secondary growth structure in dicot stem and root (Sunflower) and Anomalous secondary growth: *Aristolochia, Boerhaavia* (dicot stem) *Dracaena* (monocot stem).

4: Study of trichomes (any three types) and stomata (any three types) with the help of locally available plant materials.

5: Permanent slides of Microsporogenesis and male gametophyte. Mounting of Pollen grains of Grass and Hibiscus and Pollinia of Calotropis.

6: Pollen germination (hanging drop method) and Effect of Boron and Calcium on pollen germination.

7: Permanent slides/photographs of types of ovules, Megasporogenesis & embryosac development and types of placentation: Axile, Marginal and Parietal types.

8: Mounting of embryo: Tridax and Chilli, Mounting of endosperm: Cucumis/Crotalaria.

9: Observation of SAM and RAM.

10, 11 and 12: Mini project work in groups of 3-5 students, from the following list

a) Study of pollen morphology of different flowers with respect to shape, colour, aperture etc.

b) Pollen germination of different pollen grains and calculates percentage of germination.

c) Calculating percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.

d) Study of placentation of different flowers.

Scheme of Practical Examination (Distribution of Marks): 40 Marks for semester end Examination.

Q No. 1. Identify and describe the anatomical features of given material A	05 Marks
Q No. 2. Conduct the pollen germination test for given material B and calculate the percentage	05 Marks
Q NO. 3. Mount or expose from the given material C _____	05 Marks
Q NO. 4. Mount embryo/endosperm from given specimen D	05 Marks
Q NO. 5. Identify with reasons with given slide/specimen/photograph E, F, G and H	10 Marks
Viva voce	05 Marks
Practical Record	05 Marks

Note: The same scheme may be used for IA (Formative assessment) Examination.

General instruction to examiners:

1. Give specimen for anomalous secondary growth – A
2. Give flower buds for pollen germination – B
3. Give specimen for tylosis, epidermal outgrowths, simple tissues, complex tissues – C
4. Give specimen for embryo/endosperm mounting – D
5. Spotting 2 slides/specimen from anatomy and 2 slides/specimen developmental biology – E, F, G and H.
6. Viva voce.
7. Practical Record.

Books recommended:

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014.Current Trends in the Embryology of Angiosperms**,** Woong-Young Soh, Springer Netherlands.
3. Esau, K. 1990. Plant Anatomy, Wiley Eastern Pvt Ltd New Delhi
4. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
5. Johri, B.M. l., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
6. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
7. Nair P .K. Pollen Morphology of Angiosperms - Scholar Publishing House, Lucknow
8. Pandey S.N. 1997, Plant Anatomy and Embryology. A. Chadha, Vikas Publication House Pvt Ltd;
9. Raghavan, V. 2000. Developmental Biology of Flowering plants, Springer, Netherlands.

B.Sc. Semester–IV

Discipline Specific Course (DSC)-

Course Title:- Genetics and Plant breeding

Course Code: C4 BOT 1T1

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-7	**Theory**	**04**	**04**	**60hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO1: Understanding the basics of genetics and plant breeding

CO2: Ability to identify, calculate and describe crossing over, allelic generations and frequencies of recombination.

CO3: Interpret the results of mating and pollinations.

CO4: Classify Plant pollination methods.

CO5: Recognition of modes of inheritance of traits/phenotypes and Phenotype-genotype correlation.

Unit	Title:	60 hrs/ sem
Unit I	**Cell , Mendelian Genetics and Inheritance** The Cell; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components. Cell Organelles- (Nucleus, Mitochondria, chloroplast, ER, Golgi bodies), Cell cycle- Mitosis and Meiosis. Mendelian genetics and its extension Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and Co-dominance; Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Extra chromosomal Inheritance Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast.	15 hrs

Unit II	**Linkage, Crossing Over and Chromosome Mapping.** Linkage and crossing over: Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numerical based on gene mapping; Sex Linkage. Variation in chromosome number and structure: Gene mutations, Types of mutations; Molecular basis of Mutations, Mutagens–physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Role of Transposons in mutation. DNA repair mechanisms. Fine structure of gene (Population and Evolutionary Genetics, Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift). Genetic variation and Speciation Linkage, Mutations and Genes.	15 hrs
Unit III	**Basics of Plant Breeding and Crop Improvement** Plant Breeding: Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. Methods of crop improvement Introduction, Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization; Selection methods: For self-pollination, cross pollination and vegetative Propagation in plants; Hybridization: For self, cross and vegetative propagation in plants procedure, advantages and limitations.	15 hrs
Unit IV	**Quantitative Inheritance and Inbreeding Depression and Heterosis** Quantitative inheritance Concept, mechanism, examples of inheritance of Kernel colour in wheat, Monogenic vs polygenic inheritance Inbreeding depression and heterosis. History, genetic basis of inbreeding depression and heterosis; Applications. Crop improvement and breeding Role of mutations; Polyploidy; Distant hybridization and role of biotechnology in crop improvement. Breeding method for disease, insect and drought resistance.	15hrs

Recommended books:

1. Acquaah, G. (2007).Principles of Plant Genetics & Breeding. New Jearsey, U.S.: Blackwell Publishing.
2. Singh, B.D. (2005).Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.
3. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford – IBH.
4. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & sons

5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th edition. New York, NY: W.H. Freeman and Co.
6. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings
7. Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
8. Welsh, J.R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
9. Poehlman, J.M. (1987). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., West port, Connecticut
10. Chopra, V.L. (2000). Plant Breeding: Theory and Practice 2nd Ed. Oxford & IBH, New Delhi.

Formative Assessment for Theory	
Assessment Occasion / type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–IV

Discipline Specific Course (DSC)

Course Title:- Genetics and Plant breeding Practical

Course Code: C4 BOT 1P1

Type of Course	Theory /Practical	Credits	Instruction Hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-8	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO1: Students will have deep understanding to the structure, composition and function of the cell

CO2: To study the life cycle of cell

CO3: Students will learn how genes are involved in evolution

CO4: Evolution through mutations

CO5: Students get opportunity through plant breeding practices to make their own kitchen gardens/fields

CO6: They will understand various methods of plant breeding

List of the experiments, each will have 4hrs / Week (Minimum 12 experiments)

1. Study plant cell through temporary mount.
2. Study of photomicrographs of cell organelles.
3. Study of Mitosis (temporary mounts and permanent slides).
4. Study of Meiosis (temporary mounts and permanent slides).
5. Measure the cell size (either length or breadth/diameter) by micrometry.
6. Pollen germination by hanging drop culture method.
7. Pedigree analysis for dominant and recessive autosomal and sex-linked traits.
8. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1and 9:3:4).
9. Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes.
10. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.
11. Reproductive biology, self and cross pollinated plants; Vegetative reproduction.
12. Hybridization: Emasculation, bagging, pollination and production of hybrids and pollen fertility.

Note: Submission of permanent slides (mitosis 2 slides and meiosis 3 slides)

Books recommended:

1. Acquaah, G. (2007).Principles of Plant Genetics & Breeding. New Jearsey, U.S.: Blackwell Publishing.
2. Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.
3. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford – IBH.
4. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & sons
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th edition. New York, NY: W.H. Freeman and Co.
6. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings
7. Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
8. Welsh, J.R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
9. Poehlman, J.M. (1987). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., West port, Connecticut
10. Chopra, V.L. (2000). Plant Breeding: Theory and Practice 2nd Ed. Oxford & IBH, New Delhi.

PATTERN OF BOTANY PRACTICAL
EXAMINATION SEMESTER I

COURSE CODE: C4 BOT 1P1

GENETICS AND PLANT BREEDING PRACTICAL

Question paper pattern

Time: 03 Hours Max. Marks: 40

1. Make a temporary micro preparation of Squash/ smear of the given specimen **A**	06 Marks
2. Test the percentage of pollen viability of the given material by hanging drop technique **B**	04 Marks
3. Determine the length and breadth of the given material **C** by micrometric method	04 Marks
4. Conduct the experiment on hybridization technique from given specimen **D**	06 Marks
5. Solve the genetic problem E	04 Marsk
6. Identification of Specimen/slides/Photographs **F and G**	06 Marks
7. Viva Voce	05 Marks
8. Practical Record	05 Marks

General instructions to examiners:

Q1. Squash preparation - onion root tips, Smear preparation - Rheo/Onion flower buds Bud – A

Q2. For pollen germination material are Cassia/Hibiscus/Vinca/Datura etc – B

Q3. Length and breadth – onion peel, pollen grains – C

Q4. Flower twigs cassia, peltoforum D

Q5. Any one genetic problem – E

Q6. Experiments- 7, 9, 10 & 11

Viva Voce

Practical Record

B.Sc. Semester – V

Discipline Specific Course (DSC)-

Student shall select DSC 9A & 10 A or 9B & 10 B for 06 credits only

Course Title:- Plant Morphology and Plant Systematics

Course Code: C 5 BOT 2 T 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Durationof Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-9A	**Theory**	**04**	**04**	**60 hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs):At the end of the course students will be able to:

CO1. Understanding the main features in Angiosperm evolution

CO2. Ability to 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.

CO3. Interpret the rules of ICN in botanical nomenclature.

CO4. Classify Plant Systematic and recognize the importance of herbarium and Virtual Herbarium, Evaluate the Important herbaria and botanical gardens.

CO5. Recognition of locally available angiosperm families and plants and economically important plants. Appreciation of human activities in conservation of useful plants from the past to the present.

Unit	Title:	60 hrs/ sem
Unit I	**Morphology** Root, Stem and Leaf. Their modifications for various functions. Inflorescence – types. Structure and variations of flower. Fruits–types. Floral diagram and floral formula. **Introduction to Taxonomy**: History, objectives, scope and relevance of Taxonomy **Systems of classification**: Artificial, Natural and Phylogenetic; brief account of Linnaeus', Bentham & Hooker's, Engler and Prantl's system and APG IV System (2016).-Merits and demerits of classification. **Taxonomic literatures:** Floras, Monograph. Revisions, Journals. **Herbaria and Botanical gardens:** Important herbaria and botanical gardens of the world and India. Technique of Herbarium Preparation and roles of botanical gardens. **Virtual herbarium;** E-flora; Documentation.	15 hrs
Unit II	**Plant identification:** Taxonomic dichotomous keys; intended (yolked) and bracketed keys. (Brief account only). **Plant descriptions:** Common Terminologies used for description of vegetative and reproductive parts of the following families **Study of the diagnostic features of Angiosperm families and their economic importance:** Annonaceae, Brassicaceae, Malvaceae, Rutaceae, Anacardiaceae, Fabaceae (with sub Families), Myrtaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Amaranthaceae, Euphorbiaceae, Orchidaceae, Liliaceae, Arecaceae and Poaceae.	15 hrs

Unit III	**Taxonomic Hierarchy:** Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concepts (biological, morphological, evolutionary).Modes of speciation. Problems with species concepts. Rankless system of phylogenetic systematics. **Botanical Nomenclature:** Principles and rules (ICN); Latest code –brief account, Brief account of Ranks of taxa, Type concept (Typification), Rule of priority, Author citation., valid publication,rejection of names, principle of priority and its limitations; Names of hybrids/cultivated species.	15 hrs
Unit IV	.**Biometrics, Numerical Taxonomy; Phenetics and Cladistics:** Characters; Variations; OTUs, character weighting and coding; Cluster analysis; Phenograms and cladograms (definitions and differences). **Origin and evolution of angiosperms:** Methods of illustrating evolutionary relationship phylogenetic tree, cladogram). **Plant Taxonomic Evidences:** from palynology embryology, cytology, phytochemistry and molecular data. Field inventory.	15hrs

Recommended books:

References

1 Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company.
2 Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons –Chichester
3 Cotton, C.M. 1996. Ethnobotany – Principles and Applications. Wiley and Sons
4 Datta S C, *Systematic Botany*, 4th Ed, Wiley Estern Ltd., New Delhi, 1988.
5 Eames A. J. - *Morphology of Angiosperms* - Mc Graw Hill, New York.
6 Hall, B.G.(2011).*Phylogenetic Trees Made Easy: A How-ToManual*. Sinauer Associates,Inc. USA
7 Heywood - *Plant taxonomy* - Edward Arnold London.
8 Jeffrey C .J. and A. Churchil - *An introduction to taxonomy* – London.
9 Jeffrey, C. (1982). An Introduction to *Plant Taxonomy.* Cambridge University Press, Cambridge
10 Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., Donogue, M.J., 2002. *Plant Systematics: A Phylogenetic approach,* 2nd edition. Sinauer Associates, Inc., USA.
11 Lawrence - *Taxonomy of Vascular Plants* - Oxford & I B H, New Delhi.
12 Manilal, K.S. and M.S. Muktesh Kumar 1998. *A Handbook on Taxonomy Training*. DST, New Delhi.
13 Manilal, K.S. and A.K. Pandey, 1996. *Taxonomy and Plant Conservation*. C.B.S. Publishers & Distributors, New Delhi.
14 Manilal, K.S. 2003. *Van Rheede'sHortusMalabaricus. English Edition*, with Annotations andModern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum.
15 Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi.
16 Pandey, S. N, and S.P. Misra (2008)-*Taxonomy of Angiosperms*- Ane Books India, New Delhi.
17 Radford A B, W C Dickison, J M Massey & C R Bell, *Vascular Plant Systematics*, 1974,Harper& Row Publishers, New York.
18 Singh G.2012. *Plant systematics: Theory and Practice*. Oxford and IBH, Pvt. Ltd., New Delhi.
19 Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut.
20 Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford &I B H New Delhi.
21 Any local/state/regional flora published by BSI or any other agency.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – V

Discipline Specific Course (DSC)

Course Title: Plant Morphology and Plant Systematics
Course Code: C 5 BOT 2 P 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-10A	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Understanding the basics of Plant morphology and Systematic Botany
CO2: Ability to identify, Classify and describe the plants up to species level.
CO3: Interpret the results by using biometrics.
CO4: Know the terminologies of plant morphology.
CO5: Understand the phylogeny of the family they studied.
CO6: Know how to construct the taxonomic key with different methods.
CO7: Know the economic importance of the family they studied.
CO8: Field visit to help the student to learn the nature and understand the methods of herbarium preparations.

List of the Experiments, each will have 4rs / Week (Minimum 12 experiments)

1. Study of root, stem and leaf structure and modifications. 04 hrs
2. Study of inflorescence types. 04 hrs
3. Study of flower and its parts, Study of fruits. 04 hrs
4. Floral diagram and floral formula. 04 hrs

5-11. Study of families mentioned in theory with at least two examples for each family and make suitable diagrams, describes them in technical terms (Description, V.S. Flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification) 28 hrs

12. Identify up to species using the flora. 08 hrs
13. Identify plants/plant products of economic importance belonging to the families mentioned in the syllabus; with binomial, family and morphology of useful parts. Cotton, Mango, Red gram, Green gram, Horse gram, Black gram, Bengal gram, Indigo, Brinjal, Tomato, Chilli, Tamarind, Bitter gourd, Luffa, Asfoetida, Cumin, Coriander, Coffee, Rubber, Tapioca, Ricinus, Ginger, Turmeric, Coir, Arecanut, Rice, Wheat, Ragi, Sugarcane *Annona muricata, Catharanthus roseus, Rauvolfia serpentina, Justicia adhatoda, Vitex nigundo* and *Leucas aspera* 04hrs

Field visit: Local or outside area/ Botanical Garden/ tribal settlements minimum 3 to 5 days.

Submission: Record book, Tour report and 10 Herbarium (Preparation of 10 properly identified herbarium specimens; mounting of a properly dried and pressed specimen of any common plants from your locality with herbarium label) and 10 Economic products.

Books recommended:

1 Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company.
2 Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons –Chichester
3 Cotton, C.M. 1996. Ethnobotany – Principles and Applications. Wiley and Sons
4 Datta S C, *Systematic Botany*, 4th Ed, Wiley Estern Ltd., New Delhi, 1988.
5 Eames A. J. - *Morphology of Angiosperms* - Mc Graw Hill, New York.
6 Hall, B.G.(2011).*Phylogenetic Trees Made Easy: A How-ToManual*. Sinauer Associates,Inc. USA
7 Heywood - *Plant taxonomy* - Edward Arnold London.
8 Jeffrey C .J. and A. Churchil - *An introduction to taxonomy* – London.
9 Jeffrey, C. (1982). An Introduction to *Plant Taxonomy.* Cambridge University Press, Cambridge
10 Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F., Donogue, M.J., 2002. *Plant Systematics: A Phylogenetic approach,* 2nd edition. Sinauer Associates, Inc., USA.
11 Lawrence - *Taxonomy of Vascular Plants* - Oxford & I B H, New Delhi.
12 Manilal, K.S. and M.S. Muktesh Kumar 1998. *A Handbook on Taxonomy Training*. DST, New Delhi.
13 Manilal, K.S. and A.K. Pandey, 1996. *Taxonomy and Plant Conservation*. C.B.S. Publishers & Distributors, New Delhi.
14 Manilal, K.S. 2003. *Van Rheede'sHortusMalabaricus. English Edition*, with Annotations andModern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum.
15 Naik V.N., *Taxonomy of Angiosperms*, 1991. Tata Mcgraw-Hill Pub. Co. Ltd., New Delhi.
16 Pandey, S. N, and S.P. Misra (2008)-*Taxonomy of Angiosperms*- Ane Books India, New Delhi.
17 Radford A B, W C Dickison, J M Massey & C R Bell, *Vascular Plant Systematics*, 1974,Harper& Row Publishers, New York.
18 Singh G.2012. *Plant systematics: Theory and Practice*. Oxford and IBH, Pvt. Ltd., New Delhi.
19 Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut.
20 Sivarajan V. V - *Introduction to Principles of taxonomy* - Oxford &I B H New Delhi.
21 Any local/state/regional flora published by BSI or any other agency.

PATTERN OF BOTANY PRACTICAL EXAMINATION SEMESTER V
COURSE CODE: C 5 BOT 2 P 1
PLANT MORPHOLOGY AND PLANT SYSTEMATICS

SCHEME OF PRACTICAL EXAMINATION
(Distribution of marks): 40 marks for the Semester end examination

1. Identify, classify and describe the specimen **A** & **B** taxonomically	08 Marks
2. Identify the given specimen **C** with the help of Key using Flora	05 Marks
3. Write the floral diagram and floral formal of the given specimen **D**	03 Marks
4. Identification of Specimen/slides **E, F** and **G**	09 Marks
5. Viva Voce	05 Marks
6. Submission (Practical Record/Record +Study Tour Report /Herbarium/Economic products)	10 Marks
	Total 40 marks

General instructions to examiners:

Q1. Give specimen from Dicotyledons (A) and Monocotyledons (B)
Q2. Give specimen from family they studied (C)
Q3. Give specimen from family they studied (D)
Q4. Specimen /Slides/ materials from Root/Stem/ Leaf/ Inflorescence (E), Flower/Fruit (F) and Economic importance (G)
Q5. Viva Voce
Q6. Submission (Practical Record/Record + Study Tour Report + 10 Herbarium + 10 Economic products)

Note: Same Scheme may be used for IA (Formative Assessment) examination

B.Sc. Semester – V

Discipline Specific Course (DSC)-

Student shall select DSC 9B & 10 B or DSC 9A & 10 A for 06 credits only

Course Title:- Plant Physiology and Phytochemistry

Course Code:- C5 BOT 2 T 2

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-9B	**Theory**	**04**	**04**	**60hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO1: Importance of water and the mechanism of transport.
CO2: To understand biosynthesis and breakdown of biomolecules.
CO3: Role of plant hormones in plant development and about secondary metabolites.
CO4: Preliminary understanding of the basic functions and applications of Phytochemistry.
CO5: To understand the importance of phytochemistry in Botany.

Unit	Title:	60 hrs/ sem
Unit I	**Plant water relations**: Importance of Water as a solvent, Diffusion, osmosis, imbibition, osmotic pressure, osmotic potential, turgor pressure, wall pressure, water potential and its components. Mechanism of water absorption, Factors affecting water absorption. **Transpiration.** Types and process. Root pressure, opening and closing mechanism of stomata **Mechanism of ascent of sap:** Vital and physical force theories. **Phloem Transport:** Translocation of organic solutes. Path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis. **Mineral nutrition:** A brief account on Micro and macronutrients**.**	15 hrs
Unit II	**Photosynthesis**: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport system and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbonfixation; Photorespiration. **Respiration**: aerobic and anaerobic respiration, Glyoxylate, Oxidative Pentose Phosphate Pathway. **Nitrogen metabolism:** Biological nitrogen fixation; Nitrate and ammonia assimilation.	15 hrs
Unit III	Definition and classification of plant growth regulators- plant growth regulator. Site of synthesis and metabolism and influence on plant growth development of individual group of hormone- Auxins, Gibberlins, Cytokinins, ABA and ethylene. Synthetic growth regulators- classification, their effect on plant growth and development. Practical utility in agriculture and horticulture**.** **Sensory Photobiology**: Biological clocks, photoperiodism, function & structure of phytochromes, phototropin & cryptochromes. Senescence, Ageing & Programmed cell death (PCD and Autophagosis). Plant movements.	15 hrs

Unit IV	**Enzymes**-classification, kinetics and mechanism of action. **Proteins and amino acids**: classification, structure - primary, secondary, tertiary and quaternary**.** **Vitamins**-classification, distribution, structure, production and function. **Phytochemistry** **General account**: Plants as source of medicine. Phytochemistry and its importance in modern medicine. Classification of plant drugs. Chemical and pharmacological drug evaluation – microscopic, physical, chemical and biological. **Secondary Metabolites**: Definition of secondary metabolites and difference with primary metabolites. Major types – Terpenoids, phenolics, alkaloids and nitrogen containing compounds and their protective action againstpathogenic microbes and herbivores.	15hrs

Recommended books:

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5^{t}
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
4. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds). 1997. Plant Metabolism(2nd edition). Longman, Essex, England.
5. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York.
6. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc.New York.
7. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. JohnWiley Sons, Chichester, England.
8. Mohr, H. and Schopfer, P. 1995. Plant Physiology. Springer-Verlag, Berlin.
9. Salisbury, F.B.and Ross, C.W. 1992. Plant Physiology (4th edition). WadsworthPublishin Co., California.
10. Taiz, L. and Zeiger, E. 2002 . Plant Physiology (3rd edition). Sinauer Associates, Inc.,Publishers, Massachusetts, USA.
11. Devi P 2000. Principles and Methods of Plant Molecular Biology, Biochemistry andGenetics. Agrobios, Jodhpur, India.
12. Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory Manual.Springer-Verlag, Berlin.
13. Ninfa, A.J. and Ballou, D.P. 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology., Fitzgerald Science Press, Ind., Maryland, USA.
14. Roberts, J. and Tucker, G.A. (Eds.) 2000 Plant Hormone Protocols. Humana Press,New Jersey, USA.
15. Scott, R.P.W. 1995. Techniques and Practice of Chromatography. Marcel Dekker, Inc.,New York.
16. Wilson, K. and Goulding, K.H. (eds.) 1986. A Biologists Guide to principles andTechniques of Practical Biochemistry. Edward Arnold, London.
17. V. Verma. Plant Physiology
18. S.N.Pandey and B.K.Sinha. Plant Physiology. IV Edition. Vikas Publication.
19. S.K.Verma. Plant Physiology. S. Chand Publications, Meerut.
20. Broen, T.A. (1994) Gene Clonning, Chapman and Hall Publication. London.
21. Satagura Prasad, M.G. (2000). A textbook of Molecular biology and Biotechnology

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester– V

Discipline Specific Course (DSC)

Course Title: Plant Physiology and Phytochemistry

Course Code: C5 BOT 2P2

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-10B	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO1: Importance of water and the mechanism of transport they will not waste water.
CO2: Importance of secondary metabolites in human welfare.
CO3: Role of plant hormones in plant development as applications to agriculture.
CO4: Preliminary understanding of the basic functions of metabolism in plants.
CO5: To understand the importance of phytochemistry in daily life.

List of the Experiments, each will have 4rs / Week (Minimum 12 experiments)

1. Experiment to demonstrate the phenomenon of osmosis by physical and physiological method.
2. To determine the osmotic pressure of the cell sap by plasmolytic method.
3. To demonstrate root pressure/transpiration pull in plants.
4. To compare the rate of transpiration from the two surfaces of leaf by using Garrreau's photometer and four leaf method
5. Conduct Hill reaction
6. To demonstrate that oxygen is liberated in the process of photosynthesis.
7. Separation of photosynthetic pigments by paper chromatography and measure their Rf values.
8. Experiment to demonstrate the fermentation.
9. To isolate and identify the amino acids from a mixture using paper chromatography.
10. Study of plant movements.
11. Estimation of total phenols by Lowry's method.
12. Conduct on the experiment on separation of chloroplast/estimation of chloroplast.
13. Estimation of TAN (Titra bale acid Number) from *Bryophyllum* leaves/*Aloevera*.
14. Preliminary phytochemical test for primary and secondary metabolites.

Recommended books:

1. Taiz, L., Zeiger, E., (2010). Plant Physiology. Sinauer Associates Inc., U.S.A. 5^{t}
2. Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition.
3. Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
4. Dennis, D.T., Turpin, D.H., Lefebvre, D.D. and Layzell (eds). 1997. Plant Metabolism(2nd edition). Longman, Essex, England.

5. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag, New York.
6. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc.New York.
7. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry and Molecular Biology. JohnWiley Sons, Chichester, England.
8. Mohr, H. and Schopfer, P. 1995. Plant Physiology. Springer-Verlag, Berlin.
9. Salisbury, F.B.and Ross, C.W. 1992. Plant Physiology (4th edition). WadsworthPublishin Co., California.
10. Taiz, L. and Zeiger, E. 2002 . Plant Physiology (3rd edition). Sinauer Associates, Inc.,Publishers, Massachusetts, USA.
11. Devi P 2000. Principles and Methods of Plant Molecular Biology, Biochemistry andGenetics. Agrobios, Jodhpur, India.
12. Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory Manual.Springer-Verlag, Berlin.
13. Ninfa, A.J. and Ballou, D.P. 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology., Fitzgerald Science Press, Ind., Maryland, USA.
14. Roberts, J. and Tucker, G.A. (Eds.) 2000 Plant Hormone Protocols. Humana Press,New Jersey, USA.
15. Scott, R.P.W. 1995. Techniques and Practice of Chromatography. Marcel Dekker, Inc.,New York.
16. Wilson, K. and Goulding, K.H. (eds.) 1986. A Biologists Guide to principles andTechniques of Practical Biochemistry. Edward Arnold, London.
17. V. Verma. Plant Physiology
18. S.N.Pandey and B.K.Sinha. Plant Physiology. IV Edition. Vikas Publication.
19. S.K.Verma. Plant Physiology. S. Chand Publications, Meerut.
20. Broen, T.A. (1994) Gene Clonning, Chapman and Hall Publication. London.
21. Satagura Prasad, M.G. (2000). A textbook of Molecular biology and Biotechnology

PATTERN OF BOTANY PRACTICAL
EXAMINATION SEMESTER V
COURSE CODE: C5 BOT 2 P 2
PLANT PHYSIOLOGY AND PHYTOCHEMISTRY PRACTICAL

Time: 03 Hours Max. Marks: 40

Q. 1. Set up an experiment as per slip **A**. Principle involved, procedure and conduction (Show the set up of the experiment to the examiner)	08 Marks
Q. 2. Perform the experiment as per the slip **B** (separation/estimation of chloroplast).	06 Marks
Q. 3. Identify and comment on the physiological phenomenon involved in the experiments **C, D** and **E**.	12 Marks
Q. 4. Perform the phyto-chemical test for the given sample **F.**	04 Marks
Viva voce	05 Marks
Practical Record	05 Marks

Instruction to the examiner:

Q. No.1. Major experiment as per the slip **A.**

Q. No.2. One experiment as per the slip **B** (Give any leaf sample for separation/estimation of chloroplast).

Q. No.3. Any three minor physiology experiments as per the practical syllabus **C, D** and **E.**

Q. No.4. Procedure (terpenoids, phenols, alkaloids, carbohydrates, proteins and fats).

B.Sc. Semester –VI

Discipline Specific Course (DSC)-

Student shall select DSC 11B & 12 B or DSC 11A & 12A for 06 credits only

Course Title: Ecology and Conservation Biology
Course Code: C 6 BOT 2 T 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-11A	**Theory**	**04**	**04**	**60 hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs):

At the end of the course students will be able to:

CO1. Know the principles and concept of ecosystems- Components, productions**,** Energy and limiting factors.
CO2. Know the concepts of productivity, measurements of productivity, food chain, food webs and trophic levels
CO3. Understand the diversity and characters of major ecosystems – Aquatic (Marine and Freshwater), Terrestrial and Agricultural ecosystems
CO4. Know the Concept of biotic community with their Size and structure of biotic community- Physiognomy, Life-forms, stratification, ecotones and concept of edge-effect.
CO5. Understand the causes and patterns of ecological succession, concept of climax.
CO6. Know the Concept of ecological niches, species coexistence, overlapping and niche segregation.
CO7. Know the concept of Eutrophication, Heavy metal pollution, Ozone depletion, greenhouse effect, Global warming and its effect, Acid rains. Pesticide, particulate and nuclear radiation.
CO8. Understand the Solid wastes. Noise Pollution. Pest population and its biological control, invasive species and their effects on native species in aquatic and terrestrial ecosystems.
CO9. Know the Patterns of diversity in a community, Diversity measurement and indices.
CO10. Understand the Global distribution of organisms, concept of islands, biodiversity hotspots. Methods of conservation of biodiversity. Centers for origin of cultivator plants.
CO11. Know the population density, Natality and mortality. Life table, population growth curves, carrying capacity.
CO12. Know the positive and negative interactions among the organisms.

Unit	Title:	60 hrs/ sem
Unit I	**Introduction to Ecology and Conservation Biology:** Definitions, Principles of Ecology, Brief History, Major Indian Contributions, Scope and importance. Ecological levels of organization. Odum, Mishra and Puri. **Ecological factors:** Climatic factors: light, temperature, precipitation and humidity. **Edaphic factors**: Soil and its types, soil texture, soil profile, soil formation; physicochemical properties of soil - mineral particle, soil pH, soil aeration, organic matter, soil humus and soil microorganisms. Topographic Factors: Altitude **Ecological groups of plants and their adaptations:** Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes and halophytes.	15 hrs
Unit II	**Ecosystem Ecology:** Introduction, types of ecosystems with examples -terrestrial and aquatic, natural and artificial. Structure of ecosystem: Biotic and Abiotic components, detailed structure of a pond ecosystem. Ecosystem functions and processes: Food chain-grazing and detritus; Food web. Ecological pyramids -Pyramids of energy, biomass and number. Principles of Energy flow in ecosystem. Bio-geo chemical cycles: Gaseous cycles -carbon and nitrogen, Sedimentary cycle-Phosphorus cycle. Ecological succession: Definition, types- primary and secondary. General stages of succession. Hydrosere and xerosere. **Community Ecology:** Community and its characteristics – frequency, density, Abundance, cover and basal area, phenology, stratifications, life-forms. Concept of Ecotone and Ecotypes. Intra-specific and Inter-specific interactions with examples. **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. **Population Ecology:** Population and its characteristics – Population density, natality, mortality, age distribution, population growth curves and dispersal.	15 hrs
Unit III	**Phytogeography and Environmental issues:** Theory of land bridge, theory of continental drift, polar oscillations and glaciations. Centre of origin of plant – Vavilov's concept, types. Phytogeographical regions – concept, phytogeographical regions of India. Vegetation types of Karnataka – Composition and distribution of evergreen, semievergreen, deciduous, scrub, mangroves, shola forests and grasslands. An account of the vegetation of the Western Ghats. Pollution: Water pollution: Causes, effect, types; water quality indicators, water quality standards in India, control of water pollution (Waste water treatment). Water pollution disasters – National mission on clean Ganga , Minimata, Pacific gyre garbage patch, Exxon valdez oil spill. Air pollution: Causes, effect, air quality standards, acid rain, control. Soil pollution: Causes, effect, solid waste management, control measures of soil pollution.	15 hrs
Unit IV	**Biodiversity and its conservation:** Biodiversity: Definition, types of biodiversity – ecosystem diversity, species diversity and genetic diversity, Global and Indian species diversity. SDG's in biodiversity conservation. Values of Biodiversity – Economic and aesthetic value, Medicinal and timber yielding plants. NTFP. Threats to biodiversity. Concept of Biodiversity Hotspots, Biodiversity	15hrs

	hot spots 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 (2024). 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	

Recommended books:

1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.
3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
6. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.
7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
8. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel.
9. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Discipline Specific Course (DSC)

Course Title: Ecology and Conservation Biology
Course Code: C 6 BOT 2 P 1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-12A	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs):At the end of the course, students will be able to:

CO1: Know the importance of ecology and conservation biology.

CO2: Understand the ecological adaptations of hydrophytes, xerophytes, epiphytes and halophytes.

CO3: Understand the importance of ecological instruments and their operational functions.

CO4: Understand the phytoplanktons richness in water body and it water quality.

CO5: Understand the remote sensing and applications in vegetation studies.

CO6: Know the COD and BOD of the water sample.

CO7: Understand the soil and its importance in agriculture farms.

List of the Experiments, each will have 4rs / Week (Minimum 12 experiments)

1. Hydrophytes: Morphological adaptations in *Pistia, Eichhornia, Hydrilla, Nymphaea* and anatomical adaptations in *Hydrilla* (stem) and *Nymphaea* (petiole).
2. Xerophytes: Morphological adaptations in *Asparagus, Casuarina, Acacia, Aloe vera, Euphorbia tirucalli* and anatomical adaptations in phylloclade of *Casuarina.*
3. Epiphytes: Morphological adaptations in *Acampe, Vanda, Drynaria* and anatomical adaptations in epiphytic root of *Acampe/ Vanda.*
4. Halophytes: study of Vivipary in mangroves, Morphology and anatomy of Pneumatophores.
5. Demonstration of different types of vegetation sampling methods – transects and quadrats. Determination of density and frequency/abundance and dominance.
6. Application of remote sensing to vegetation analysis using satellite imageries and Determination of water holding capacity of soil samples.
7. Phytoplankton studies using nearby pond water.
8. Estimation of carbonates.
9. Estimation of bicarbonates.
10. Determination of soil texture of different soil samples.
11. Determination of Biological oxygen demand (BOD).
12. Determination of Chemical oxygen demand (COD).
13. Study of Ecological instruments – Wet and Dry thermometer, Altimeter, Hygrometer, Soil thermometer, Rain Gauge, Barometer etc.
14. Field visits to study different types of local vegetations. Pond ecosystem to recording the different biotic and abiotic components and the report to be written in practical record book.

Recommended books:

1. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
2. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.
3. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
4. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
5. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
6. Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.
7. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
8. Chapman, J.L&M.J. Reiss (1992): Ecology (Principles & Applications). Cambridge University Press, U.K.
9. Malcolm L. Hunter Jr., James P. Gibbs, Viorel D. Popescu, 2020. Fundamentals of Conservation Biology, 4th Edition. Wiley-Blackwel.
10. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers.

PATTERN OF BOTANY PRACTICAL EXAMINATION SEMESTER VI COURSE CODE: C 6 BOT 2 P 1 ECOLOGY AND CONSERVATION BIOLOGY PRACTICAL

Ecology and Conservation Biology Course Code: C 6 BOT 2 P 1

Time: 03 Hours Max. Marks: 40

Q. 1. Conduct the experiment as per the slip A.	08 Marks
Q. 2. Morphological and anatomical adaptations in given material B and C.	10 Marks
Q. 3. Identify and comment on given specimen/slide/material D, E, F and G.	12 Marks
Viva voce	04 Marks
Practical Record	03 Marks
Field Visit or Tour report	03 Marks

Instruction to the examiner:

Q. No.1. Give the material to conduct the experiment on to determine the carbonate, bicarbonate, COD and BOD as per the slip **A.**

Q. No.2. Provide the any two materials from hydrophytes and xerophytes **(B)** and epiphytes and halophytes **(C).**

Q. No.3. Ecological instruments (**D and E**), remote sensing (**F**) and vegetation type (**G**)

Viva voce

Practical Record

Field Visit or Tour report

B.Sc. Semester – VI

Discipline Specific Course (DSC)-

Student shall select DSC 11B & 12 B or DSC 11A & 12A for 06 credits only

Course Title:- Molecular Biology and Biotechnology

Course Code:- C6 BOT 2T2

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-11B	**Theory**	**04**	**04**	**60hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs): At the end of the course students will be able to:

CO1: Prelimanary understanding to DNA and Genes.

CO2: Students will understand the importance of Heredity.

CO3: Beneficial impacts of molecular markers.

CO4: Importance of replication.

CO5: To understand the role of plant tissue culture in plant propagation.

Unit	Title:	60 hrs/ sem
Unit I	**Genetic material** DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material. DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi– conservative, mode of replication, replication of linear, replicating the 5' end (telomere replication) replication including replication enzymes. Genome and its organization (idea of gene, coding sequence, regulatory sequence, introns, exons, nucleosome structure and packing of DNA into higher order structure, brief idea of chloroplast DNA and mitochondrial DNA). Molecular basis of mutation, types of mutation (miss sense mutation, non sense mutation, silent mutation, point mutation, frame shift mutation).	15 hrs
Unit II	**Transcription and Translation (Prokaryotes and Eukaryotes)** **Gene expression** Types and structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; mechanism of protein synthesis in prokaryotes. Genetic code. **Regulation of gene expression** Regulation of phages, Prokaryotes: Lac operon and Tryptophan operon; and in Eukaryotes. Role of Chromatin in regulating gene expression and gene silencing.	15 hrs

	Genome sequencing technique and application – sequencing strategies and shotgun method.	
Unit III	**Plant tissue culture** Introduction, laboratory organization, nutrient media and sterilizing techniques. Micropropagation: haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications. Role of tissue culture technology in crop improvements. **Blotting techniques:** Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing and synthetic seeds.	15 hrs
Unit IV	**Biotechnology for human welfare** Health – biopharmaceuticals, development of nontoxic therapeutic agents, recombinant vaccines, insulin, gene therapy, molecular diagnostics using ELISA, PCR, monoclonal antibodies and their use in diagnostic and therapy, human genome project.	15 hrs

Recommended books:

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. JohnWiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8thedition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5thedition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of theCell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
5. Bruce Albert, *et al*, (2002) Molecular Biology of the Cell. 4th Edition Garland Science Publishers, New York.
6. Benjamin Lewin, (2004) Genes VIII, Pearson Prentice Hall, New Jersey.
7. Dornell, J. (2000). Cell and Molecular Biology, W.H. Freeman and Co., New York
8. Bhojwani, S.S. and Razdan, M.K. 1996. Plant tissue culture- theory and practice. Elsevier publications, Amsterdam.
9. Torpe, T.A. 1981. Plant tissue culture. Academic press. New York.
10. Kumar, H.C. 1992. Text book of Biotechnology. East west press, New York.
11. Keshar, T. 1990. Biotechnology. Willey. Estern Ltd. New Delhi.

Formative Assessment for Theory	
Assessment Occasion/type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester–VI

Discipline Specific Course (DSC)

Course Title:- Molecular Biology and Biotechnology -Practical

Course Code: C6 BOT 2P2

Type of Course	Theory /Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours /Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
DSC-12B	**Practical**	**02**	**04**	**56hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs): At the end of the course, students will be able to:

CO1. Students become aware of SOPs of molecular biology
CO2. Hands on training of Molecular Biology experiments in Isolation and Extraction of DNA , RNA, Protein
CO3. Practicals are platform for increasing the knowledge in molecular biology
CO4. Students can opt for Molecular Biology research
CO5.To understand the importance of biotechnology in industry and agricultural

List of the Experiments, each will have 4rs / Week (Minimum 12 experiments)

1. Laboratory Safety measurements
2. Study of molecular techniques: PCR, AGE and PAGE.
3. To study Blotting techniques (Northern, Southern and Western)
4. Isolation and Estimation of RNA
5. Isolation and Estimation of DNA
6. Isolation and Estimation of Proteins
7. Study of Gel electrophoresis
8. Study of Principle and working mechanism of biotechnology instruments.
9. Preparation of MS media for tissue culture and sterilization techniques.
10. Inoculation of explants on nutrient media.
11. Study through photographs: somatic embryogenesis, anther and embryo culture; micropropagation.
12. Preparation of synthetic seeds.
13. Preparation of wines from fruits.

Recommended books:

1. Guard, R.S., Gupta, G.D. and Ghukade, S.B. 2000. Practical biotechnology . Nirali publications. Pune.
2. Tejovathi, G., Vimala, Y., Rekha, B. 1996. A practical manual for plant biotechnology. CBS publications and distributors, New Delhi.
3. Colin, R. and Bjorn, K. 2004. Basic biotechnology. Cambridge University, Press London.
4. Asenjo, J.A. 1990. Separation process in biotechnology manual, Dakker, New Delhi

PATTERN OF BOTANY PRACTICAL
SEMESTER VI
MOLECULAR BIOLOGY AND BIOTECHNOLOGY -PRACTICAL
COURSE CODE: C6 BOT 2P2

Molecular Biology and Biotechnology
Course Code: C 6 BOT 2 P 2

Time: 03 Hours | Max. Marks: 40

Q. 1. Isolation and estimation of DNA/RNA/Protein from the given sample **A.**	15 Marks
Q. 2. Prepare synthetic seeds and show to the examiner - **B**.	05 Marks
Q. 3. Identify and comment on **C, D, E** and **F**.	10 Marks
Viva voce	05 Marks
Practical Record	05 Marks

Instruction to the examiner:

Q. No.1. Isolation and estimation of DNA/RNA/Protein from the sample studied in practical.
Q. No.2. Synthetic seed preparation.
Q. No.3. Can be given from experiment 2, 3, 7, 8 and 11
Viva voce
Practical Record

B.Sc. Semester – V

Elective Course (EC)-
It is for other combination students

Course Title: - Mushroom Culture Technology
Course Code: - C5 BOT 5T1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
EC-1	**Theory**	**03**	**04**	**45 hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs):

At the end of the course students will be able to:

CO1 : Non subject (Botany) students are introduce to the subject that all plants do not flower
CO2: Students are introduced to know types of mushrooms and economic importance of Mushrooms
CO3: Students have a deep knowledge to the cultivation of Mushrooms
CO4: Different beds and nutrients involved in mushroom cultivation
CO5: Packaging, Marketing and utilization as food
CO6: To make the students familiar with mushroom cultivation for commercial exploitation.
CO7: To make the students known about the *Agaricus* (mushroom) used as-food, medicine and economic value for sustainable development.
CO8**:** To generate interest amongst the students to know the importance of mushroom in day today life.

Unit	Title:	45 hrs/ sem
Unit I	Introduction to Fungi; scope, structure, classification with special reference to Basidiomycetes. Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus*.	15 hrs
Unit II	Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production	15 hrs

Unit III	Storage and nutrition: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins. Food Preparation_: Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.	15 hrs

Recommended books:

1. Harandar Singh 1991. Mushrooms: the art of Cultivation. Sterling Publishers.
2. Kaul, T.N.2001. Biology and conservation of Mushrooms. Oxford and IBH Publishing Company. New Delhi.
3. Tripathi, M. Mushroom Cultivation. Oxford and IBH Publishing Company. New Delhi.
4. Suman B.C. and Sharma V P.2007. Mushroom Cultivation in India. Eastern Book Corporation. New Delhi.
5. Singh R. and U.C.Singh 2005. Modern Mushroom Cultivation. Agrobios. New Delhi.
6. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
7. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
8. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
9. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester – VI

Elective Course (EC)

Course Title: Medicinal and Aromatic Plants
Course Code: C 6 BOT 5T1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
EC-2	**Theory**	**03**	**04**	**45 hrs.**	**3hrs.**	**20**	**80**	**100**

Course Outcomes (COs):

At the end of the course students will be able to:

CO1: Recognize the basic medicinal plants

CO2: Apply techniques of conservation and propagation of medicinal plants.

CO3: Setup process of harvesting, drying and storage of medicinal herbs

CO4: Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India

Unit	Title:	45 hrs/ sem
Unit I	**History and Traditional System of Medicine** History, Scope and Importance of Medicinal Plants; Traditional systems of medicine. **Ayurveda:** History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments, **Siddha:** Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine. **Unani:** History, concept: Umoor-e-tabiya, tumors treatments / therapy, polyherbal formulations.	15 hrs
Unit II	**Conservation, Augmentation and Ethnobotany and Folk Medicine** Conservation of Endemic and endangered medicinal plants, Red list criteria; *In situ* conservation: Biosphere reserves, sacred groves, National Parks; *Ex situ* conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important	15 hrs
Unit III	**Medicinal Plants** Brief description of selected plants and derived drugs, namely Guggul (*Commiphora*) for hypercholesterolemia, *Boswellia* for inflammatory disorders, Arjuna (*Terminalia arjuna*) for cardioprotection, turmeric (*Curcuma longa*) or wound healing, antioxidant and anticancer properties, Kutaki (*Picrorhiza kurroa*) for hepatoprotection, Opium Poppy for analgesic and antitussive, *Salix* for analgesic, *Cincona* and *Artemisia* for Malaria, *Rauwolfia* as tranquilizer, *Atropa belladona* as anticholinergic, *Digitalis* as cardiotonic, *Podophyllum* as antitumor.	15 hrs

Recommended books:

1. Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press.
2. AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yogaand Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
3. CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). *Aush Gyanya*: Handbook of Medicinal and Aromatic Plant Cultivation.
4. Dev, S. (1997). Ethno-therapeutics and modern drug development: The potential of Ayurveda. *Current Science* 73:909–928.
5. Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16thedn. Philadelphia, PA:Elsevier Saunders Ltd.
6. Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi
7. Kapoor, L.D. (2001). Handbook of Ayurvedic medicinal plants. Boca Raton, FL: CRC Press.
8. Saroya, A.S. (2017). Ethnobotany. ICAR publication.
9. Sharma, R.(2003). Medicinal Plants of India- An Encyclopaedia. Delhi: Daya Publishing House.
10. Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi.
11. Thakur, R.S., H.S. Puri, and Husain, A.(1989). Major medicinal plants of India. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.

Formative Assessment for Theory	
Assessment Occasion/ type	**Marks**
Internal Assessment Test 1	05
Internal Assessment Test 2	05
Assignment	10
Total	**20 Marks**
Formative Assessment as per guidelines.	

B.Sc. Semester –IV/ V/VI

Skill Enhancement Course (SEC)

Student shall study SEC in any one of the Semesters either in IV or V or VI semester

College shall decide to allot the students

Practical

Course Title: NURSERY MANAGEMENT AND GARDENING
Course Code: C0BOT 6T1

Type of Course	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative assessment Marks	Total Marks
SEC	**Practical**	**02**	**04**	**56 hrs.**	**3hrs.**	**10**	**40**	**50**

Course Outcomes (COs):

At the end of the course, students will be able to:

CO1: To gain knowledge of gardening, cultivation, multiplication, raising of seedlings of garden plants.
CO2: To get knowledge of new and modern techniques of plant propagation.
CO3: To develop interest in nature and plant life.
CO4: Apply the basic principles and components of gardening
CO5: Conceptualize flower arrangement and bio-aesthetic planning
CO6: Design various types of gardens according to the culture and art of bonsai
CO7: Establish and maintain special types of gardens for outdoor and indoor landscaping

List of the Experiments, each will have 4rs / Week (Minimum 12 experiments)

1. Tools, implements, and containers used for propagation and nursery techniques.
2. Propagation by natural methods Rhizome, Bulb, Tubers, Suckers, Stolons, Corm, Runner.
3. Methods used to break seed dormancy
4. Propagation by Artificial methods cutting, layering, budding and grafting.
5. Seed propagation-preparation of portable trays, seed treatments, sowing, and seedling production.
6. Identification and description of annuals, herbaceous perennials, climbers, creepers, foliage, and flowering shrubs, trees, palms, ferns, ornamental grasses; cacti, and succulents.
7. Planning and designing of gardens, functional uses of plants in the landscape.
8. Preparation of land for lawn and planting.
9. Identification of commercially important flower crops and their varieties.
10. Propagation practices in flower crops, sowing of seeds, and raising of seedlings of annuals.
11. Use of chemicals and other compounds for prolonging the vase life of cut flowers.
12. Grading, packing, and marketing of cut flowers.
13. Visit commercial nurseries and commercial tissue culture laboratories.
14. Undergo project in related to garden and nursery.

B.Sc. Semester –IV/ V/VI

Skill Enhancement Course (SEC)
Course Title: NURSERY MANAGEMENT AND GARDENING
Course Code: C0BOT 6T1

General introduction to examiners:

1. **A –** Methods – grafting, layering, cutting and budding.
2. **B –** Breaking seed dormancy as conducted in the practicals.
3. **C, D, E and F** - Tools, chemicals, charts, photographs materials.
4. Project on nursery techniques/gardening/landscaping/cut flower arrangements/ commercial flowers/floral arrangement/growing kitchen garden/cactus garden/rock garden.

   Viva voce

   Record and field visit report

NURSERY MANAGEMENT AND GARDENING
C0BOT 6P1

Time: 03 Hours Max. Marks: 40

Q. 1. Perform the vegetative propagation method in specimen **A.**	05 Marks
Q. 2. Demonstrate seed dormancy of the given material **B.**	05 Marks
Q. 3. Identify and comment on slides/material/photographs of **C, D, E** and **F**.	10 Marks
Q. 4. Project report	10 Marks
Viva voce	05 Marks
Record and field visit	05 Marks

GENERAL PATTERN OF THEORY QUESTION PAPER FOR COURSE DSC/ EC/AECC

(80 marks for semester end Examination with 3 hrs duration)

Part-A

1. Question number 1-10 carries 2 marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 11- 20 carries 05Marks each. Answer any 08 questions : 40 marks

Part-C

3. Question number 21-24 carries 10 Marks each. Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 80 Marks

Note: Proportionate weight age shall be given to each unit based on number of hours Prescribed