BENGALURU CITY UNIVERSITY

CHOICE BASED CREDIT SYSTEM
(As per SEP)

Syllabus for Botany

2025-26

Proceedings of the Meeting of the Board of Studies in Botany (UG), Bengaluru City University (BCU) held on 29. 05. 2025 at 11.00 AM at BCU, Bengaluru

Ref: No. BCU/Syn/BOS/Botany-UG/65/2025-26 Dated 20.05.2025

AGENDA

Preparation of syllabus for B.Sc., Botany (UG) programme (III and IV Semesters) of BCU, Bengaluru.

Minutes of the Meeting:

The chairman welcomed the members and placed the agenda for discussion and approval.

1) The Botany (UG) board has discussed and prepared the new syllabus for B.Sc., Botany (III and IV Semesters) programme of Bengaluru City University, Bengaluru for its introduction from the current academic year (2025-26). The board has unanimously approved the syllabus for B.Sc., Botany programme for its introduction and is given below as under. Finally, the chairman thanked the members of the board for their co-operation.

III Sem	DSCB* –1.3	Theory	Gymnosperms And Embryology of Angiosperms	4 Hrs.	3 Credits	80+20
		Practical	Gymnosperms And Embryology of Angiosperms	4 Hrs.	2 Credits	40+10
	DSEB -1.1	Elective	Mushroom Cultivation Technology	3 Hrs.	2 Credits	40+10
	DSEB-1.2	Elective	Plant Propagation	3 Hrs.	2 Credits	40+10
IV Sem	DSCB* –1.4	Theory	Cytology Genetics and Molecular Biology	4 Hrs.	3 Credits	80+20
		Practical	Cytology, Genetics and Molecular Biology	4 Hrs.	2 Credits	40+10
	DCB**-1.1	Compulsory Practical	Nursery, Gardening & Landscaping	4 Hrs.	2 Credits	40+10
	DSEB - 1.1	Elective	Medicinal Plants and Herbal Technology	3 Hrs.	2 Credits	40+10
	DSEB - 1.2	Elective	Medicinal Plants	3 Hrs	2 Credits	40+10

2) **The board has unanimously approved the panel of examiners for the academic year 2025-26.**
3) **The board also recommended to constitute the Board of Examiners (BOE) for the academic year 2025-26.**

MEMBERS PRESENT	SIGNATURE
1) Prof. G. R. Janardhana (Chairman) Dept. of Studies in Botany University of Mysore, Mysore, Mysore-06	29/5/25
2) Prof. L. Rajanna (Member) Senior Professor, Dept. of Botany Bangalore University, Bangalore-56	29/5/25
3) Mrs. Shobharani (Member) Associate Professor, Govt. First Grade College Yelahanka, Bengaluru-64	29/05/2025
4) Mrs. Esther Watson (Member) Dept. of Botany, Bishop Cotton College for Women Bengaluru-27	29/05/2025
5) Mrs. Roopashree (Member) Dept. of Botany, KLEs Nijalingappa College Bengaluru-10.	29/5/2025
6) Dr. P.B. Mallikarjuna (Member) Professor, Govt. First Grade College, Yelahanka, Bengaluru-64.	29/5/25
7) Dr. C. Suresh Kumar (Member) Professor, Dept. of Botany, Maharans Cluster University, Bengaluru-01.	29/05/2025
8) Dr. C. R. Rekha (Member) Professor, Dept. of Botany, Govt. Science College, Nrupathunga University, Bengaluru-01.	29/5/25
9) Dr. Thoyajaksha (Member) Professor, Dept. of Botany Maharan's Science College, Mysore-05.	ABSENT
10) Dr. N.S. Suresha (Member) Dept of Botany, Govt. Science College, Hassan. --	29/5/2025

(Prof. G.R. JANARDHANA)
CHAIRMAN, BOS IN BOTANY, BCU

29/5/25

Dr. G. R. JANARDHANA
Professor
Dept. of Studies in Botany
University of Mysore
Manasagangotri
Mysore - 570 006

Sem	CourseCode	Practical/ Theory	TITLE OFTHE COURSES	Hrs./ Week L:T:P	Credits	Max Marks
I	**DSCB*-1.1**	Theory	**Microbial Diversity, Mycology and Phycology**	4 Hrs.	3	80+20
		Practical	**Microbial Diversity, Mycology and Phycology**	3 Hrs.	2	40+10
II	**DSCB*-1.2**	Theory	**Bryophytes, Pteridophytes, Paleobotany and Plant Anatomy**	4 Hrs.	3	80+20
		Practical	**Bryophytes, Pteridophytes, Paleobotany and Plant Anatomy**	3 Hrs.	2	40+10
III	**DSCB*–1.3**	Theory	**Gymnosperms And Embryology of Angiosperms**	4 Hrs.	3	80+20
		Practical	**Gymnosperms And Embryology of Angiosperms**	3 Hrs.	2	40+10
	DSEB-1.1	Elective	**Mushroom Cultivation Technology**	2 Hrs.	2	40+10
	DSEB-1.2	Elective	**Plant Propagation**	2 Hrs.	2	40+10
IV	**DSCB*–1.4**	Theory	**CytologyGeneticsand Molecular Biology**	4 Hrs.	3	80+20
		Practical	**Cytology,Geneticsand Molecular Biology**	3 Hrs.	2	40+10
	DCB-1.1**	Compulsory Practical	**Nursery, Gardening & Landscaping**	4 Hrs.	2	40+10
	DSEB-1.1	Elective	**Medicinal Plants and Herbal Technology**	2 Hrs.	2	40+10
	DSEB-1.2	Elective	**Medicinal Plants**	2 Hrs	2	
V	**DSCB-1.5**	Theory		4 Hrs.	3	80+20
	DCB-1.2**	Practical		3 Hrs.	2	40+10
	DSEB-1.4	Theory		3 Hrs.	2	40+10
VI	**DSCB-1.6**	Theory		4 Hrs.	3	80+20
	DCB-1.3**	Practical		3 Hrs.	2	40+10
	DSEB-1.5	Theory		3 Hrs.	2	40+10

DSCB* Discipline Core Course Botany**; DSEB*** Discipline Elective Botany;
DCB* Discipline Compulsory Course Botany; EC-Open Elective Course.

III SEMESTER

DSCB-1.3:GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

PROGRAMME	B.Sc., BOTANY	SEMESTER	III
Course Title	DSCB-1.1: GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS		
Course Code		No. of Credits	03
Contact Hours	56 Hours	Duration of Exam	03 Hours
Formative Assessment	20 Marks	Summative Assessment	80 Marks

Course Objectives: The **c**ourse intends to train the students to give better understanding the diversity, morphology and distribution and classification of Gymnosperms. Further it also provides the students the life cycles and their economic importance. The course also trains the students on the developmental biology of aspects of angiosperms. And also, the applications of these phenomenon in understanding the all aspects of plant development.

Course Outcome: After the completion of the course, the students are able to explain the diversity, distribution and classification system used study Gymnosperms, morphology, anatomy, reproduction and lifecycles ofGymnosperms. Further, the students will beableto explain thekey concepts and mechanisms involved in the reproductive biology of angiosperms, including flower development, pollination, fertilization, and seed formation. Overall, the course will provide the learners with the knowledge required to analyse and apply concepts in plant development, breeding, and biotechnology.

UNIT I	**INTRODUCTION TO GYMNOSPERMS** General characteristics, distribution and classification of Gymnosperms.Morphology and anatomy of root, stem (primary and secondary growth) and leaf, Reproductive structures (Developmental Stages not required) and life cycles of *Cycas, Pinus* and *Gnetum*. Angiosperm characteristics and evolutionary significance of *Gnetum*. Phylogeny of Gymnosperms. Fossil Gymnosperms. Economic importance of Gymnosperms.	**16 Hrs.**

UNIT II	**EMBRYOLOGYOFANGIOSPERMS** Contribution of Indian botanists to Plant Embryology – P. Maheshwari, B. M. Johri, BGL Swamy. Structure of typical Angiosperm flower. Structure of stamen. Microsporangium- Early stages of development of anther (Primordial stage to differentiation of wall layers and sporogenous tissue), Structure of young and mature anther. Tapetum-Origin, types, structure & functions. **Microsporogenesis**- Microspore mother cell stage, meiocyte stage, cytokinesis, microspore tetrads. Abnormalities-Compound pollen grains. Pollinia. **Microgametogenesis** –Formation of vegetative and generative cells, structure of male gametophyte. Abnormalities – Nemecphenomenon.	**16 Hrs**
UNIT III	**EMBRYOLOGY OF ANGIOSPERMS (Contd.) Structure of Pistil-** Placentation-definition and types. **Megasporangium –**Structure of ovule – Integuments (endothelium), Micropyle (Obturator), Nucellus (Crassinucellate and Tenuinucellate conditions). Types of ovules -Anatropous, Orthotropous, Amphitropous, Circinotropous. **Megasporogenesis & Megagametogenesis –**Development of Female gametophyte. Embryosac- monosporic- *Polygonum*type, bisporic- *Allium*type, tetrasporic- *Fritillaria*type. Structure of mature embryosac. **Double Fertilization** – pollen germination, growth of pollen tube through style (solid and hollowstyles), entry of pollen tube into ovule (porogamy, mesogamy, chalazogamy), entry of pollen tube into the embryosac, pollen tube discharge, syngamy, triple fusion. Significance of double fertilization, post fertilization changes.	**16 Hrs**
UNIT IV	**PALYNOLOGY AND EXPERIMENTAL EMBRYOLOGY** Dicotembryo development**.** Structure of Dicot and Monocotembryo (grass). Parthenocarpy - definition. Polyembryony – definition and types. **Seed–** Structure of Dicot and Monocot seed. **PALYNOLOGY**- Pollen morphology –shape, size and apertures, NPC system, pollen wall stratification., pollen Kit. Applied Palynology – Aeropalynology, Mellissopalynology. **EXPERIMENTAL EMBRYOLOGY**–A brief account on Experimental embryology. Totipotency, Basic steps in plant tissue culture technique. MS Media and its basic components. Tissue culture techniques and their practical applications-Antherculture, Embryo culture, Protoplast culture.	**16Hrs**

Theory Formative Assessment (Internal Assessment)	Marks
Attendance	05 Marks
Assignment	05 Marks
Test	10 Marks
TOTAL	**20 Marks**

THEORY QUESTION PAPER PATTERN FOR EXAMINATION

Credits:03 **80 Marks**

Marks for each question	No. of Questions		Total Marks
	To be answered	Out of	
A.2Very short answers	10	12	20
B. 5 Short notes	6	8	30
C.10 Essay types	3	5	30
TOTAL			**80 Marks**

III SEMESTER

DSCB-1.3:GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

No of Credits:2 **PRACTICAL** **42 Hrs**

Sl. No.	CONTENTS	15Units
1	Study of materials and permanent slides of Gymnosperms included in theory	6 Units
2	Study of permanent slides of microsporogenesis and male gametophyte	1Units
3	Mounting of Pollengrains–*Hibiscus*, Grass, *Mimosa.* Mounting Pollinia of *Calotropis*	1Units
4	Pollengermination (hanging drop method).	1Units
5	Permanent slides of types of ovules, Megasporogenesis & embryo sac development	1Unit
6	Permanent slides of types of placentation—Axile, Marginal, Parietal, basal types. Sectioning of ovary, for any two types of placentation.	1Unit
7	Mounting of embryo-*Tridax* and *Cyamopsis.*	1Unit
8	Mounting of endosperm-*Cucumis.*	1Unit
9	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, pores etc. b) Pollen germination of different pollen grains and calculation of 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. e) Any other relevant study related to Gymnosperms/Embryology. Mini project work may be carried out in groups of 3-5 students, supervised by the batch in-charge teacher. The mini project report of 5-6 pages (hand written/ typed), to be submitted in the practical examination.	2Unit

Practical Formative Assessment (Internal Assessment)	**Marks**
Continuous assessment/Attendance	05 Marks
Practical Test	05 Marks
TOTAL	**10 Marks**

PRACTICAL QUESTION PAPER PATTERN FOR EXAMINATION

Time-03Hrs **Marks– 40**

1	Identify and classify specimens **A, B** and **C** giving reasons.	**3X3=09**
2	Identify the slides **D, E, F and G** with reasons and labeled diagrams.	**3X4=12**
3	Mounttheembryo/ Endosperm of specimen **G** & comment.	**1X5=05**
4	Mountthepollinia/ perform pollen germination of specimen **H** & comment.	**1X4=04**
5	Record & Project submission	**5+5=10**

Suggested Readings

1) Bhatnagar, S. P. and Moitra, A.1971.Gymnosperms,New Age Publications, New Delhi
2) Bhojwani,S.S. and Bhatnagar, S. P 1974. The Embryology of Angiosperms, Vikas Pub, New Delhi.
3) Chopra, G. L. and Verma, V. 1988.Gymnosperms. Pradeep Publications, Jalandar, India.
4) Coulter and Chamberline, 1964. Morphology of Gymnosperms, Central Book Depot. New Delhi.
5) Davis, G.L.1966. Systemic Embryology of Angiosperms. John Wiley & Sons Inc, New York.
6) Johansen, D.A.1950. Plant Embryogeny. Chronica Botanica Co., Waitham, Mass.
7) Johri, B. M 1984. Embryology of Angiosperms. Springer–Verlag, Berlin.
8) Maheshwari, P. 1950. An Introduction to Embryology of Angiosperms. Tata Mc Graw Hill, New York.
9) Maheshwari, P. 1963. Recent Advances in Embryology, Intl. Soc. Pl. Morphol. NewYork.
10) Pullaiah, T., Lakshminarayana, K., & Rao, B. H. (2019). *Plant Reproduction 2nd Ed*. Scientific Publishers.

11) Raghavan, V. 1979. Experimental Embryogenesis of Vascular Plants, Cambridge University Press, Cambridge, U.K.

12) Sporne, K. R 1974. The Morphology of Gymnosperms. Hutchins on & Co., London

13) Swamy B. G. L. and Krishnamurthy K. V, 1980. From flower to fruit: embryology of flowering plants. Tata Mc Grew- Hill Pub Co. New York.

14) Vashista, B. R. 1990. Gymnosperms. S C hand & Co., Pvt. Ltd., New Delhi.

15) Vasishta, D. P., Sinha, D. A., & Kumar, D. A. (2017). Botany for degree students Gymnosperms. S.Chand Publishing.

III SEMESTER
DSEB-1.1: MUSHROOM CULTIVATION TECHNOLOGY

PROGRAMME	B.Sc.,BOTANY	SEMESTER	III
Course Title	DSEB: MUSHROOM CULTIVATION TECHNOLOGY		
Course Code		No. of Credits	02
Contact Hours	28	Duration of Exam	1.5 Hours
Formative Assessment	10	Summative Assessment	40 Marks

Learning Objectives: The course intends to train students on edible mushrooms. The course teaches students on science of edible mushrooms, types, life cycles and economic importance of mushrooms. Course will also teach health and economic benefits of mushrooms. The course will also help them understand the medicinal and nutritive value of mushrooms.

Learning Outcomes: After successful completion of the course, the students will be able to practice the techniques of cultivation of edible mushrooms. They will be able to setup entrepreneurial small- scale units for mushroom cultivation for self-employment. Students will be able to use the practical skills for large-scale industrial multiplication of edible mushrooms.

UNIT-I	**Mushrooms Biology** Introduction to Fungi. Basidiomycetes -forming mushrooms. Distinguishing characteristics of mushrooms and their Life cycles. Variations in Morphology and classification of mushrooms. History of mushroom cultivation. Mushroom industry in India, Food values of Mushrooms, Uses of mushrooms. Edible and poisonous mushrooms. Medicinal mushrooms. Economic importance of mushrooms.	**16Hrs.**
UNIT-II	**Mushroom Cultivation Methods** Types of edible mushrooms. Button, Straw and Oyster mushroom – General morphology. Substrates for cultivation. Composting, bed preparation, sterilization of substrates. Spawn production: Preparation of spawn substrate, obtaining pure culture. Media used in raising pure culture. Maintenance of mother culture. Inoculation and Incubation.	**16Hrs**

UNIT-III	Cultivation of Button mushroom (*Agaricusbisporous*), Oyster mushroom (*Pleurotussajor-caju*), Paddy straw mushroom (*Volvariellavolvaceae*). Precautions of mushroom cultivation. **Post- Harvest Technology of Mushrooms** Harvesting and Processing of mushrooms. Storage of mushrooms. Marketing of Mushrooms. Diseases and pest management during mushroom cultivation. Recipes of Mushroom. Value added mushroom products. A brief account on cultivation of medicinal mushrooms.	**16 Hrs**

Theory Formative Assessment (Internal Assessment)	**Marks**
Attendance	05 Marks
Visit to mushroom cultivation unit	05 Marks
TOTAL	**10 Marks**

THEORY QUESTION PAPER PATTERN FOR EXAMINATION

Time -1.5 Hrs **40 Marks**

Marks for each question	**No. of questions to be**		**Total Marks**
	Answered	**Out of**	
PART-A(2 Marks)	5	7	10
PART -B (5 Marks)	6	8	30
TOTAL			**40**

Suggested Readings

1) Nita, B. (2000). Handbook of Mushrooms. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2) Pandey, R. K. and Ghosh, S. K.(1996). A hand book of Mushroom Cultivation. Emkey Publication.
3) Pathak,V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
4) Tewari, P. and Kapoor S. C. (1998). Mushroom Cultivation, Mittal Publication, New Delhi.
5) Dubey, R. C., 2005 A Text book of Biotechnology S. Chand & Co, New Delhi.

III SEMESTER
DSEB-1.2: PLANT PROPAGATION

PROGRAMME	B.Sc., BOTANY	SEMESTER	III
Subject	BOTANY		
Course Title	DSEB-1.2: PLANT PROPAGATION		
Course Code		No. of Credits	2
Contact hours	28 Hours	Duration of Examination	1.5 Hours
Formative assessment	10 Marks	Summative Assessment	40 Marks

Learning Objectives: The course intends to teach the students to understand the various methods used to reproduce plants both sexually and asexually. Students will learn how to select appropriate propagation techniques to produce healthy and true-to-type plants. They will also gain skills in managing environmental factors to optimize propagation success. Additionally, learners will appreciate the importance of propagation in agriculture, horticulture, and conservation.

Course Outcome: After completion of the course the students will be provided with the ability to apply different propagation techniques to multiply plants efficiently. Learners will develop practical skills in both sexual and asexual methods, ensuring the production of healthy and genetically stable plants. They will also understand how to manage propagation environments to maximize success rates. Ultimately, students will be prepared to contribute effectively to agriculture, horticulture, and plant Conservation through improved propagation practices.

UNITI	**Introduction to Plant Propagation** Need and potentialities for plant multiplication. Choice of propagation methods. Sexual and asexual methods of propagation, apomixes – mono-embryony, polyembryony, chimera & bud sport. Propagating structures, equipment, and media. Supplementary Fertilizers. Care and Handling of Nursery Plants.	**16hrs**
UNITII	**Propagationmethods** Seed propagation. Vegetative propagation, methods. Techniques of cutting, layering, grafting and budding physiological & biochemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Micro grafting. Propagation by Specialized structures.	**16hrs**

UNIT-III	**Micro propagation** Requirements, Factors affecting tissue culture, culture room, hardening, hardening of plants in nurseries, approaches in micro propagation of banana, strawberry, papaya. Propagation methods of some commercially important medicinal plants (Neem, Sarpgandha, Harar, Bahera, Amla, Asparagus), Ornamental plants. House Plants, Shrubs and Trees, Succulents and cacti. Floriculture and its importance.	**16 Hrs**

Theory Formative Assessment (Internal Assessment)	**Marks**
Attendance	05 Marks
Assignment	05 Marks
TOTAL	**10 Marks**

THEORY QUESTION PAPER PATTERN FOR EXAMINATION

Time-1.5 Hrs **40 Marks**

Marks for each question	**No. of questions to be**		**Total Marks**
	Answered	**Out of**	
PART-A(2 Marks)	5	7	10
PART -B (5 Marks)	6	8	30
TOTAL			**40**

SuggestedReadings

1) Hartmann, H. T & Kester, D. E (2017). 9th Edition. Plant Propagation–Principles and Practices. Prentice Hall of India.
2) Bose,T. K, Mitra, S. K & Sadhu, M. K. (1991). Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash.
3) Peter, K. V.(2008). Basics of Horticulture. New India Publ. Agency.
4) Singh, S, P(1989) Mist Propagation. Metropolitan Book Co.
5) Rajan, S & Baby, L. M(2007). Propagation of Horticultural Crops. New India Publ. Agency.
6) Radha, T & Mathew, L (2007). Fruit Crops. New India Publ. Agency.

7) Dey, Kalyan Kumar (1992). An Introduction to Plant Tissue Culture, New Central Book Agency, Das Lane, Calcutta.
8) M. K. Sadhu. 2017 (Reprint) Fundamentals of Horticulture and Plant Propagation. Emphasizes propagation under Indian conditions.
9) De.P.C.2015 (Revised Edition) Plant Propagation and Nursery Management. Useful for understanding both propagation techniques and nursery practices.

IV SEMESTER

DSCB-1.4: CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY

PROGRAMME	B.Sc.,BOTANY	SEMESTER	IV
Course Title	DSCB-1.4:CYTOLOGY GENETICS AND MOLECULAR BIOLOGY		
Course Code		No.of Credits	03
Contact Hours	56 Hours	Duration of Exam	03 Hours
Formative Assessment	20 Marks	Summative Assessment	80 Marks

Learning Objectives: The course would help the students understand the principles of genetics, the mechanisms of heredity, variation, and the molecular basis of gene function. The course fosters skills in interpreting genetic data analysis. The molecular biology course aims to provide students with a comprehensive understanding of structure and functions of nucleic acids. Gene expressions, cellular structures and the molecular mechanisms that govern key processes such as DNA replication, transcription, translation, and cell signaling. Overall, it lays a strong foundation for further studies or Careers in biomedical research, biotechnology, and health sciences.

Course Outcome: Upon completing the course, the students will be able to explain the structure and function of cellular organelles and understand the molecular basis of key cellular processes such as structure and functions of DNA and RNA, gene expression, cell signalling, and cell division etc. They will be able to demonstrate the ability to apply fundamental laboratory techniques and analyze data from molecular and cellular experiments.

UNITI	Plant cell – Ultrastructure, cell organelles – Structure and function (Nucleus, Endoplasmic reticulum, Golgi complex, Vacuole, Mitochondria and Chloroplast), Cytoskeleton. Structure of Eukaryotic Chromosome, - centromere, Kinetochore and telomere. Structural organization - nucleosome model. Types of Chromosomes – based on centromere position and number. B-chromosomes and their significance. Cell cycle– Phasesof eukaryoticcellcycle. Cell division–Mitosis and meiosis and Its significance. Karyotype– Types and significance. Programmed Cell Death(PCD).	**16Hrs**
UNIT II	Mendelian Genetics – Introduction, history, Terminologies – Factors /Alleles, phenotype, genotype, homozygous, heterozygous, true breeding, test cross, back cross. Mendelian pattern of inheritance- Monohybrid and dihybrid crosses.Laws based on monohybrid and dihybrid cross. Non-Mendelian genetics – Incomplete Dominance. Interaction of genes - complementary, supplementary factors/ recessive epistasis, dominant epistasis. Polygenic inheritance or multiple factor inheritance. Genetic problems.	**16Hrs**

UNIT III	Linkage and its types. Crossing over – meaning, mechanism and types. Sex Determination in *Melandrium*. Variation in chromosome number (Euploidy. Polyploids – Autopolyploids and Allopolyploids. Aneuploidy – Hypoploidy and hyperploidy). Variation in chromosome structure (deletions / deficiency, duplications, inversions and translocation). Gene mutations–Types, Molecular basis of Mutations; Mutagens–physical and chemical (Baseanalogs, deaminating, alkylatingandintercalatingagents). Finestructureofgene	**16Hrs**
UNIT IV	Molecular Biology – Historical perspectives, discovery of DNA as the genetic material (Griffith's, Harshey and Chase experiments). Nucleic acids – DNA structure, composition, types and the mechanism of replication. A brief account of DNA repair mechanism. RNA – Structure, composition and types. Central dogmaofMolecularbiology,geneticcode–Salientfeatures.Proteinsynthesis (Transcriptionandtranslation).Gene regulationinprokaryotes(Lac Operon).	**16 Hrs**

Practical Formative Assessment (Internal Assessment)	**Marks**
Continuous assessment/Attendance	05 Marks
Test	05 Marks
TOTAL	**10 Marks**

THEORY QUESTION PAPER PATTERN FOR EXAMINATION

Marks for each question	No. of Questions		**Total Marks**
	To be answered	Out of	
A.2Veryshort answers	10	12	**20**
B. 5 Short notes	6	8	**30**
C.10 Essay types	3	5	**30**
TOTAL			**80 Marks**

SEMESTER IV

DSCB:CYTOLOGY GENETICS AND MOLECULAR BIOLOGY

PRACTICALS

Credits:2 **42 Hrs**

Sl. No.	CONTENTS	15Units
1	Study of cell and its organelles with help of electron micrographs	1 Unit
2	Preparation of cytological stains – Acetocarmine and Acetoorcein	1 Unit
3	Study of permanent slides of Mitosis and Meiosis	2 Units
4	Mitotic squash preparation and study of stages from – Onion roots	2 Units
5	Meiotic stage preparation and study of stages from –Onion flower buds	2 Units
6	Karyo typing in *Aliumcepa.*	1 Unit
7	Solving Genetic problems related Mendelian and Non-Mendelian Genetics	4 Units
8	Cytology- permanent slides preparation and observations	2 Units
9	Isolation of genomic DNA from plant samples	Unit 4
10	Isolation of plasmids from *E. coli.*	Unit 4
11	Estimation of DNA	Unit 4
12	Estimation of RNA	Unit 4
13	Demonstration of Restriction digestion	Unit 4
14	Demonstration of DNA ligation	Unit 4
15	Separation of nucleic acids by Agarosegel electrophoresis.	Unit 4
16	Study of Photographs, charts of Cytologists and Molecular Biologists	Unit 4

PRACTICAL QUESTION PAPERPATTERN FOR EXAMINATION

Time-03Hrs **Marks-40**

1	Prepare of Mitotic squash of material 'A'. Identify the stage, sketch and give reason.	**1X6=6**
2	Prepare of Meiotic smear of material 'B'. Identify the stage sketch and give reason.	**1X6=6**
3	Identify the slides C and D, sketch and comment	**2X3=6**
4	Identify and comment on E and F	**2X3=6**
5	Solve the genetic problem/s **G**	**1X6=6**
6	Record & Permanent Slides Submission	**5+5=10**

Suggested Readings

1) Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington DC: ASM Press & Sunderland, Sinauer Associates, MA.
2) Karp. G. (2010). Cell Biology, 6th edition. New Jersey, U. S. A. John Wiley & Sons.

3) De Robertis, E. D. P. and De Robertis R.E. 2009. Cell and Molecular Biology, 8th edition.

4) Lippincott Williams and Wilkins, Philadelphia.

5) Becker W. M., Klein smith L J, and Bertni G. P .2009. The World of the Cell. 7th edition. Pearson, Benjamin Cummings Publishing, San Francesco.

6) Reven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company.

7) Alberts, B., Bray, D., Hopkin, K., Johnson, A. D., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2013). Essential cell biology (4th ed.). Garland Publishing.

8) Verma, P. S. (2004). Cell Biology, Genetics, Molecular Biology: Evoloution and Ecology, India: S. C hand Limited.

9) Gardner, E.J., Simmons, M. J., Snustad, D. P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi, John Wiley & sons.

10) Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th edn. New York, NY: W.H. Freeman and Co.

IV SEMESTER
CPC-1.1:NURSERY, GARDENING AND LAND SCAPING
(Compulsory Practical)

PROGRAMME	B.Sc.,BOTANY	SEMESTER	IV
Course Title	CPC-1.1:NURSERY GARDENING AND LANDSCAPING		
Course Code		Number of Credits	2
Contact Hours	42	Duration of Exam	3Hrs
Formative Assessment Mark	10	Summative Assessment Marks	40

Learning Objectives: The course is aimed to teach students the basic knowledge required to develop entrepreneurship skills for the development of Nursery, Gardening and Landscaping. This course would train students to initiate remunerative enterprise owing to a high demand of skilled Professionals in this field.

Course Outcome: After the completion of the course, the learners will be able to understand the importance of nursery in gardening. Students will also be able to describe and differentiate between the types of gardens in the city areas. They will be able to execute several nursery and gardening operations in clouding media and equipment's needed for the establishment of gardens. They will also be a position to conduct and learn different methods for plant adopted from different plants. Learners will also assess the growing conditions of different horticultural plants, their general rrequirements and understand their role in landscaping.

COMPULSORY PRACTICALS

1. Media for propagation of plants in Nursery Beds, Pots and Mist chamber.
2. Methods of preparation of nursery beds and sowing of seeds.
3. Study of different propagation methods viz., cutting, layering, division, grafting and budding in different ornamental plants.
4. Introduction and practicing Bonsai training, pruning and wiring.
5. Study of different types of gardens (indoor and outdoor) and key features of gardens (Paths & Avenues, Hedges & Edges, Lawn, Flowerbeds, Arches & Pergolas, Fencing, Water bodies, Rock Garden).
6. Study of Vertical Gardening and Roof top gardening
7. Methods for selection and enlisting of suitable plants for different locations and in different types of gardens.

8. Identification of key horticultural plants, Herbs including different types of grasses – foliage and flowering, Shrubs including hedge plants – foliage and flowering, Avenue trees – foliage and flowering, Climbers, Lianas, Epiphytes, Creepers, Trailers, Aquatic plants, Succulents, Weeds.
9. Study of important gardens of India (any five).
10. Methods of Landscape designing of Residential areas and Public Gardens, Aquatic Garden, Rock Garden, Industrial gardens.
11. Concept and Application of Computer aided Designing (CAD)for landscape designing/
12. Preparation of land scape designs for school and college using CAD technology.
13. Study of Interior designing with plants - Terrarium, miniature landscape
14. Preparation and application of her balpesticides
15. Demonstration of different composting methods.

Theory Formative Assessment (Internal Assessment)	**Marks**
Attendance	05 Marks
Assignment	05 Marks
TOTAL	**10 Marks**

SCHEME OF PRACTICAL QUESTION PAPER

Time-03 Hrs **40 Marks**

Q.No.	**Question Paper Pattern**	**Marks**
1	Perform the experiment **A**	**10 Marks**
2	Perform the experiment **B** and **C (2x4)**	**08 Marks**
3	Comment on C, D and E (4x3)	**12 Marks**
4	Prepare a temporary Terrarium/Miniature Landscape F	**05 Marks**
5	Class Record	**05 Marks**

Suggested Readings:

1) Ah and book of Landscape: CPWD
2) Gopalaswamiengar, K. S., Parthasarathy, G., Mukundan, P. (1991). Complete Gardening in India. India: Gopalaswamy Parthasarathy, 'Srinivasa'.
3) Hartmann, H. T., Kester, D.E.,Hartmann, H.T., Kester, D. E. (1975). Plant Propagation: Principles and Practices. India: Prentice-Hall.
4) Hodge, G., Hodge, G. (2014). Practical Botany for Gardeners: Over 3,000 Botanical Terms Explained and Explored. United Kingdom: University of Chicago Press
5) Littlepage, R., Little page, R. (2017). Fundamentals of Garden Design: An Introduction to Landscape Design. (n.p.): Create Space Independent Publishing Platform.
6) Roy, R. K., Roy, R. K.(2013). Fundamentals of Garden Designing: A Colour Encyclopedia. India: New India Publishing Agency.
7) The Royal Horticultural Society Gardening Manual.(2000).United Kingdom: Dorling Kindersley.

IV SEMESTER

DSEB 1.1- MEDICINAL PLANTS AND HERBAL TECHNOLOGY

PROGRAMME	B.Sc.,BOTANY	SEMESTER	IV
Course Title	DSEB1.3-MEDICINAL PLANTS AND HERBAL TECHNOLOGY		
Course Code		No. of Credits	02
Contact Hours	28 Hours	Duration of Exam	1.5 Hours
Formative Assessment	10 Marks	Summative Assessment	40 Marks

Course Objectives: The course would impart the use of medicinal plants in disease treatments with minimal side effects. The course teaches the learners on Traditional Medicines in Ayurveda, Siddha, Unani. Course will also impart pertinent knowledge in the area of Medicinal plants as an important entrepreneurship development. Course would provide an insight into R & D areas in medicinal plant research. Course also expose the students to various laboratories checking adulteration of medicinal formulations.

Learning Outcome: After completion of the course, the **s**tudents are able understanding the medicinal plants world and their importance in day-to-day life. They will able to understand the ethnobotanical value of medicinal use in India for the treatment of human and animal diseases. Able to learn the methods used to extract the active principles for drug development and their validation. Able to understand the role of secondary metabolites and their exploitation, through characterization.

UNIT-I	**Medicinal Plants & Importance** General aspects and prospects. History and Scope of medicinal Botany. Role of medicinal plants in Ayurveda, Siddha and Unani systems of medicine. Important medicinal plants and their identification. The rapeutic potential of Phytochemicals. Cultivation, harvesting, processing, storage, marketing and utilization of Medicinal plants. Medicinal plant gardens and conservation of medicinal plants.	**16Hrs**
UNIT-II	**Herbal Drug Technology** Herbal medicines and foods. Active principles of medicinal plants. Methods used for isolation, testing, identification active ingredients. Examples- *Catharanthusroseus* (cardio tonic), *Withaniasomnifera* (drugs acting on nervous system), *Clerodendronphlomoides* (anti-rheumatic) and *Centellaasiatica* (memory booster). CIMAP and its role. Important firms producing herbal medicines.	**16 Hrs**

UNIT-III	**Evaluation &Validation of Herbal Medicines** Methods of drug evaluation, biological testing of herbal drugs. Phytochemical screening for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds). Drug adulteration-types, methods of drug evaluation, biological testing of herbal drugs.	**16Hrs**

Theory Formative Assessment (Internal Assessment)	**Marks**
Attendance	05 Marks
Assignment	05 Marks
Test	10 Marks
TOTAL	**10 Marks**

THEORY QUESTION PAPER PATTERN FOR EXAMINATION

Time-1.5 Hrs **40 Marks**

Marks for each question	**No. of questions to be**		**Total Marks**
	Answered	**Out of**	
PART-A (2 Marks)	5	7	10
PART -B (5 Marks)	6	8	30
TOTAL	**40**	**TOTAL**	**40**

Suggested Readings

1) Chopra, R. N., Nayar, S. L. and Chopra, I. C. 1956. Glossary of Indian medicinal plants, C.S.I.R, New Delhi.

2) Kanny, Lall, Dey and Bahadur, R. 1984.The indigenous drugs of India, International Book Distributors.

3) Arber, A.1999. Herbal Plants and Drugs. Mangal Deep Publications.

4) Sivarajan, V. V. and Indra, B. 1994. Ayurvedic Drugs and their Plant Source. Oxford IBH publishing Co.

5) Miller, L. and Miller, B. 1998. Ayurved and Aromatherapy. Motilal Banarsidass Publications, Delhi.

6) Green, G. 2000. Principles of Ayurveda. Thomsons, London.

7) Kokate, C. K., Purohit, A. P. and Gokhale, S. B. 1999. Pharmacognosy. Nirali Prakashan.

IV SEMESTER

DSEB:1.2: MEDICINAL PLANTS

PROGRAMME	**B.Sc.,BOTANY**	**SEMESTER**	**IV**
Course Title	DSEB-1.2: MEDICINAL PLANTS		
Course Code		Number of Credits	02
Contact Hours	28	Duration of Exam	1.5 Hrs
Formative Assessment Mark	10	Summative Assessment Marks	40

Learning objectives: The course intends teach learners about medicinal plants, their identification and classification along with their therapeutic values. It enables them to study the chemical compounds responsible for medicinal effects and their modes of action. Students gain knowledge of traditional and modern uses of medicinal plants in healthcare. This foundation supports research and sustain able use of plant-based medicines for health problems confronting the society.		
Learning Outcome: Students are able understanding the medicinal plants world and their importance in day-to-day life. They will able to understand the ethno botanical value of medicinal use in India for the treatment of human and animal diseases. Able to learn the methods used to extract the active principles for drug development and their validation. Able to understand the role of secondary metabolites and their exploitation, through characterization. They realize the importance of the medicinal plants in drug discovery and their application in modern medicine.		
UNIT-I	**Medicinal Plants& Importance** Definition, concept and scope. History and scope of Medicinal Botany. Ethno- medicinal practices; Local (Village, tribal) and traditional (Ayurveda, Siddha, Homeopathy and Unani) systems. Study, survey, documentation and conservation of medicinal plants of Indian sub-continent. Pharmacognosy: Types of formulations (Lehya, Churna, Bhasma, Kashayam,) and their analysis for efficacy, shelf life and adulterations. Quality Control: Ensuring the quality and safety of her bal products through various quality control measures.	**16 Hrs**

UNIT-II	**Medicinal Chemistry**: Types of secondary metabolites of medicinal importance (Alkaloids, Glycosides, Phenols, Sterols, Terpenes – its extraction (crude and pure form) and its preliminary screening. A brief account of methods of separation of compounds (Chromatographic and Spectrophotometric) and the techniques involved in elucidation of structure of therapeutic compounds.	**16 Hrs**
UNIT- III	**Pharmacology and Drug Discovery:** Invitro and invivotoxicity and efficacy studies; Animal models, cell cultures, enzyme inhibition assays and toxicological evaluation - Mutagenicity, teratogenicity, and carcinogenicity. Reverse pharmacology. Recent trends in Medicinal Botany: Drug Discovery pathways.	**16 Hrs**

Theory Formative Assessment(Internal Assessment)	**Marks**
Attendance	05 Marks
Assignment	05 Marks
TOTAL	**10 Marks**

THEORY QUESTION PAPER PATTERN FOR FINAL EXAMINATION

Time-1.5 Hrs **40 Marks**

Marks for each question	**No. of questions to be**		**Total Marks**
	Answered	**Out of**	
PART-A (2Marks)	5	7	10
PART -B (5 Marks)	6	8	30
TOTAL			**40 Marks**

Suggested Readings

1) J B Harborne: (1984): Phytochemical methods; A guide to modern techniques of Plant Analysis. Chapman and Hall Publishers. 2nd Edition.
2) Dey PM and Harborne J B, (1987) Methods in Plant Biochemistry: Academic Press; London,
3) Yash P Kalra: (1998) Hand Book of Reference Methods for Plant Analysis; CRC Press; London.
4) V. V. Sivarajan & I. Balachandran (1994) Ayurvedic Drugs and their Plant Sources by V. V. Sivarajan & I. Balachandran, Oxford & IBH.
5) H. Panda (2002). Medicinal Plants Cultivation & Their Uses. Asia Pacific Business Press.

Sd/-
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