

DEPARTMENT OF BOTANY

II B. Sc. BOTANY SEP SYLLABUS

FOR

III & IV SEMESTER

2025-26

BOTANY FRAMEWORK FOR III & IV SEMESTER

Sem	Course Code	Practical/ Theory	TITLE OF THE COURSES	Hrs./ Week L:T:P	Credits	Max Marks
III	BOT-S-301T	Theory	Gymnosperms and Embryology of Angiosperms	4 Hrs.	3	80+20
	BOT-S-301P	Practical	Gymnosperms and Embryology of Angiosperms	3 Hrs.	2	40+10
	DSEB-1.1	Elective	Mushroom Cultivation Technology	3 Hrs.	2	40+10
	DSEB-1.2	Elective	Plant Propagation	3 Hrs.	2	40+10
IV	BOT-S-401T	Theory	Cytology, Genetics and Molecular Biology	4 Hrs.	3	80+20
	BOT-S-401P	Practical	Cytology, Genetics and Molecular Biology	3 Hrs.	2	40+10
	DCB**-1.1	Compulsory Practical	Nursery, Gardening & Landscaping	3 Hrs.	2	40+10
	DSEB - 1.1	Elective	Medicinal Plants and Herbal Technology	3 Hrs.	2	40+10
	DSEB-1.2	Elective	Medicinal Plants	3Hrs	2	

BOT-S * Discipline Core Course Botany; **DSEB*** Discipline Elective Botany;

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

SEP 2024 ONWARDS BOTANY CURRICULUM
III SEMESTER

BOTANY PAPER– III

BOT-S-301T: GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

Programme name	B. Sc. BOTANY	SEMESTER	III
Course Title	GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS		
Course Code	BOT-S-301T	No. of Credits	03
Contact Hours	52 Hours	Duration of Exam	03 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

COURSE OBJECTIVES:

- To understand the characteristics that define gymnosperms, differentiating them from other plant groups like bryophytes and angiosperms.
- Students will delve into the structure and function of different reproductive organs (e.g., flowers, pollen, ovules, seeds).
- Students will explore the evolutionary history of gymnosperms and their phylogenetic relationships with other plant groups.
- Students will examine the economic uses of gymnosperms, such as wood, resins, and food products.
- Students will learn the mechanisms of pollination, fertilization, and embryogenesis in detail.

COURSE OUTCOMES:

- CO1.** Understand the diversity and affinities in Gymnosperms and also their ecological and evolutionary significance.
- CO2.** Knowledge on the morphology, anatomy, reproduction and life cycle and economic uses of Gymnosperms.
- CO3.** Observation and classification of the embryological variations in angiosperms.
- 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.** Skill development for the proper description of internal structure of plant parts and basic concepts in plant morphogenesis, embryology and organ development.

III SEMESTER

BOTANY PAPER– III

BOT-S-301T: GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

52 Hrs.

UNIT I	GYMNOSPERMS: General characteristics and classification. Morphology and Anatomy of vegetative structures- root, stem and leaf, reproductive structures and life cycle of <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> . Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms. Study of Fossil forms: <i>Cycadeoidea</i> , <i>Cordaites</i> .	13 Hrs.
UNIT II	MICROSPOROGENESIS: Development and structure of young and mature anther, anther wall layers, Tapetum – types and functions. Sporogenous tissue - microspore mother cells (mmc), cytokinesis, microspore tetrads. Rare features - Pollinia, compound pollen grains, Nemece phenomenon. Microgametogenesis – formation of vegetative and generative cells, male germ unit, structure of male gametophyte. PALYNOLOGY – Pollen morphology – pollen wall, aperture, shape, size and architecture, NPC system, pollen wall stratification. Applied palynology– aeropalynology and melissopalynology.	14 Hrs.
UNIT III	MEGASPOROGENESIS: Structure of ovule. Types of Angiosperm ovule. Megasporogenesis in crassinucellate type of ovule. Megagametogenesis – types of embryosac development monosporic – <i>Polygonum</i> type, bisporic – <i>Allium</i> type, tetrasporic – <i>Fritillaria</i> type. Structure of mature embryosac (<i>Polygonum</i> type). General account on fertilization - pollen germination, growth of pollen tube through style (types of styles), entry of pollen tube into ovule (porogamy, mesogamy, chalazogamy), entry of pollen tube into embryo sac, syngamy, triple fusion. Significance of double fertilization, post fertilization changes.	14 Hrs.
UNIT IV	Endosperm – types and its biological importance, free nuclear (<i>Cocos nucifera</i>), cellular (<i>Cucumis</i>), helobial types. Embryogenesis – Dicot (<i>Capsella bursa-pastoris</i>) and Monocot (<i>Poa</i>) embryo development. A general account of Seed and its development. Brief account on: Parthenocarpy, Polyembryony and Apomixis. Contributions of Indian botanists in the field of Embryology- P. Maheshwari, B.G.L. Swamy and contemporary palynologist Shivanna.	13 Hrs.

Assessment	Marks
Attendance	05 Marks
Assignment	05 Marks
Test	10 Marks
Total	20 Marks

BOTANY PRACTICAL PAPER – III

BOT-S-301P: GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

Assessment	Marks
Continuous assessment/Attendance	05 Marks
Test	05 Marks
Total	10 Marks

No of Credits: 02

45 Hrs.

BOT-S-301P: GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS		15 Units
1	Study of morphology, classification, anatomy and reproduction in <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> .	5 Units
2	Study of Young Anther and Mature Anther.	1 Unit
3	Study of Pollen grains of Grass, <i>Hibiscus</i> , <i>Vinca</i> and Pollinia of <i>Calotropis</i> .	1 Unit
4	Pollen germination by hanging drop method.	1 Unit
5	Study of the types of ovules, Megasporogenesis & embryosac development.	2 Units
6	Study of the types of placentation. Sectioning of ovary to study the types of placentation.	1 Unit
7	Mounting of embryo: <i>Tridax</i> .	1 Unit
8	Mounting of endosperm: <i>Cucumis</i> .	1 Unit
9	<p>Mini project work in groups of 3-5 students, from the following list.</p> <p>a) Study of pollen morphology of different flowers with respect to shape, colour, pores etc.</p> <p>b) Pollen germination of different pollen grains and calculation of percentage of germination.</p> <p>c) Calculating percentage of germination of one particular type of pollen grain collected from different localities/ under different conditions.</p> <p>d) Study of placentation of different flowers.</p> <p>e) Any other relevant study related to Gymnosperms / Embryology.</p> <p>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.</p>	2 Units

**PRACTICAL QUESTION PAPER
BOTANY PAPER– III**

BOT-S-301P: GYMNOSPERMS AND EMBRYOLOGY OF ANGIOSPERMS

Time 3 Hours

Max Marks - 40

1.	Identify & classify the specimens A & B with labelled diagrams and reasons.	3x 3 = 9 Marks
2.	Demonstrate the Pollen germination technique with the given specimen D and comment on the same. Leave the preparation for evaluation. or Mount the Pollinia of the given specimen D and comment on the same. Leave the preparation for evaluation.	1 x 4 = 4 Marks
3.	Mount the embryo/ endosperm of the give specimen E and comment with a labelled diagram. Leave the preparation for evaluation.	1 x 5= 5 Marks
4.	Identify the Slides F, G, H and I with labelled diagrams with reasons.	4 x 3= 12 Marks
5.	Record and Submission of Mini project report.	5 + 5= 10 Marks

SCHEME OF EVALUATION

1	Three specimens A, B and C – Specimens from Gymnosperms (Identification with classification – 1 mark, Diagram – 1 mark, reasons 1 mark).
2	D – Pollen Germination / Pollinia (Performance – 2 marks, Comment with diagram – 2 marks).
3	E – Embryo/ Endosperm Mounting (Mounting- 3 marks, identification with comment- 2 marks).
4	Permanent slides F, G, H & I : F and G - Gymnosperms, H and I - Embryology (Identification – 1 mark, diagram with reasons- 2 marks).
5	a) Record –5 marks b) Submission of Mini project report–5 marks.

REFERENCES

- Andrews H.N. 1961.**Studies in Paleobotany**. John Wiley & Sons New York.
- Annie Ragland & Kumaresan V. 2011.**Pteridophytes, Gymnosperms and Palaeobotany**. Saras Publication.
- Bhatnagar S.P.& Moitra A. 1996.**Gymnosperms**. New Age International Ltd., New Delhi.
- Bhojawani, S. S. and Bhatnagar, S. P. **The Embryology of Angiosperms**. Vikas Publication, New Delhi. 1979.
- Chamberlain C.J. 1986.**Gymnosperms – Structure and Evolution**. CBS Publishers, New Delhi.
- Chopra G.L.& Verma V. 1988.**Gymnosperms**. Pradeep Publications, Jalandar.
- Harris T.M. 1973.**Cycas and the Cycadales**. Central Book Depot, Allahabad.
- Johri, B. M. **Embryology of Angiosperms**. Spinger – verlag, Berlin. 1984.
- Lyndon, R. F. **Plant development – The cellular basis**. Unwin hyman, London. 1990.
- Maheshwari, P. **Recent advances in embryology**. International Soc. Plant Morphol, New York. 1963.
- Maheshwari, P. **An introduction to the embryology of Angiospersm**. McGraw Hill, New York. 1950.
- Pandey S.N.& Chadha A. 1997.**Plant Anatomy and Embryology**. Vikas Publication House Pvt Ltd.
- Pullaiah, T. Lakshminarayana, K. and Hanumatha Rao, K. **Text Book of Embryology of Angiosperms**, Regency Publication, New Delhi. 2001.
- Sambamurthy A.V.S.S. 2005.**A Text Book of Bryophytes, Pteridophytes, Gymnosperms & Paleobotany**.
- Shukla A.C. & Misra S.P. 1975.**Essentials of Paleobotany**. Vikas Publishing House Pvt., Ltd., New Delhi.
- Sporne N.E. 1965.**The Morphology of Gymnosperms**. Hutchinson and Company. (Publishers) Ltd., U.K.

BLUEPRINT

UNIT	NO. OF HOURS	NUMBER OF QUESTIONS				TOTAL NO. OF QUESTIONS UNDER EACH UNIT
		1 mark (Answer all)	3 marks (Any 5 questions)	5 marks (Any 5 questions)	10 marks (Any 3 questions)	
I	13	2	2	1	1	6
II	14	3	2	2	1	8
III	14	3	2	2	1	8
IV	13	2	1	2	1	6

Question Paper Format for Discipline Specific (Elective) Subjects
BOTANY THEORY EXAMINATION
MAHARANI LAKSHMI AMMANI COLLEGE FOR WOMEN, AUTONOMOUS
I/II/III/IV/V/VI SEM END EXAMINATION
SEP-2024 ONWARDS

YEAR:

PROGRAM – B.COM/B.Sc./BA/BBA/BCA/MA/MSc/ M. Com

COURSE CODE: BOT-S-301T

COURSE TITLE: GYMNOSPERMS AND REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

TIME: 3 Hrs

TOTAL MARKS:80

GENERAL INSTRUCTIONS:

1. Draw diagram where ever necessary
2. Utilize left side of the sheet as workspace
3. Write the answers in blue/black pen only
4. Question numbers should be mentioned correctly
5. Avoid over writing/ scratching

Q.No	Answer all the questions:	CO's	CL's	MARKS: 1Mx10=10M
1		CO1		
2		CO1		
3		CO1		
4		CO1		
5		CO1		
6		CO2		
7		CO2		
8		CO2		

9		C02		
10		C02		
SECTION B				
	Answer any FIVE of the following:			3MX5=15 M
11.		C01		
12.		C01		
13.		C01		
14.		C01		
15.		C02		
16.		C02		
17.		C02		
SECTION C				
	III. Answer any FIVE of the following			5Mx5=25M
18.		C02		
19.		C02		
20.		C02		
21.		C03		
22.		C03		
23.		C03		
24.		C03		
SECTION D				
	IV. Answer any THREE of the following			10Mx3=30M
25.		C03		
26.		C03		
27.		C04		
28.		C04/C05		

QUESTIONS SECTION WISE MARKS DISTRIBUTION

SEC/MAINS	Total No. of Questions	Questions to be answered	Marks/question	Marks for written questions (excluding Choice)	Total Marks (including Choice)
A	10	10	1	10	10
B	7	5	3	15	21
C	7	5	5	25	35
D	4	3	10	30	40
TOTAL	28	23		80	106

BLUE PRINT FOR QUESTION PAPER

I. DISTRIBUTION OF CO'S FOR DSC QUESTION PAPER FOR END SEMESTER EXAMINATION

Section	Total No. of CO's	Question Numbers
	ESE	
Section A	5CO1's	1 TO 5
	5CO2's	6 TO 10
Section B	4 CO1's	11 TO 14
	3 CO2's	15 TO 17
Section C	3 CO2's	18 to 20
	4 CO3's	21 TO 24
Section D	2 CO3's	25 & 26
	2 CO4's / (1 CO4 & 1 CO5)	27 & 28 Note: If CO5 is given only question no. 28 can be given

II. WEIGHTAGE FOR CO'S IN END SEMESTER EXAMINATIONS

CO'S	Total No. of CO's	Total Marks	% of LOT/HOT
CO1	09 (LOT)	17	17%
CO2	11 (LOT)	29	29%
CO3	06 (HOT)	40	40%
CO4/CO5	02 CO4/ 1 CO4 & 1 CO5 (HOT)	20/ 10 + 10	
	TOTAL MARKS	106	

LOT-Lower order thinking

HOT- Higher order thinking

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	30	Duration of Exam	02 Hours
Formative Assessment	10	Summative Assessment	40 Marks

COURSE 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.

COURSE OUTCOMES

CO1: Ability to practice the techniques of cultivation of edible mushrooms.

CO2: They will be able to setup entrepreneurial small- scale units for mushroom cultivation for self-employment.

CO3: Students will be able to use the practical skills for large-scale industrial multiplication of edible mushrooms.

UNIT-I	<p>MUSHROOMS BIOLOGY</p> <p>Brief 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.</p>	10 Hrs.
UNIT-II	<p>MUSHROOM CULTIVATION METHODS</p> <p>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.</p>	10 Hrs

UNIT-III	<p>Cultivation of Button mushroom (<i>Agaricus bisporous</i>), Oyster mushroom (<i>Pleurotus sajor-caju</i>), Paddy straw mushroom (<i>Volvariella volvaceae</i>). Precautions of mushroom cultivation.</p> <p>POST-HARVEST TECHNOLOGY OF MUSHROOMS</p> <p>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.</p>	10 Hrs
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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 -02 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

REFERENCES

- Nita, B. (2000). Handbook of Mushrooms. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- Pandey, R.K. and Ghosh, S.K. (1996). A handbook of Mushroom Cultivation. Emkey Publication.
- Pathak, V.N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
- Tewari, P. and Kapoor S.C. (1998). Mushroom Cultivation, Mittal Publication, New Delhi.
- Dubey, R.C., 2005 A Textbook 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	30 Hours	Duration of Examination	2 Hours
Formative assessment	10 Marks	Summative Assessment	40 Marks

COURSE 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 OUTCOMES

CO1: Ability to apply different propagation techniques to multiply plants efficiently.

CO2: Develop practical skills in both sexual and asexual methods, ensuring the production of healthy and genetically stable plants.

CO3: Understand how to manage propagation environments to maximize success rates.

CO4: Contribute effectively to agriculture, horticulture, and plant conservation through improved propagation practices.

UNIT I	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.	10 Hrs
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UNIT II	Propagation methods Seed propagation. Vegetative propagation, methods. Techniques of cutting, layering, grafting and budding physiological & bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Micrografting. Propagation by Specialized structures.	10 Hrs
UNIT-III	Micropropagation 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, Sarpagandha, Harar, Bahera, Amla, Asparagus), Ornamental plants. House Plants, Shrubs and Trees, Succulents and cacti. Floriculture and its importance.	10 Hrs

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

THEORY QUESTION PAPER PATTERN FOR EXAMINATION

Time-02 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

REFERENCES

- Hartmann, H.T & Kester, D.E (2017). 9th Edition. Plant Propagation – Principles and Practices. Prentice Hall of India.
- Bose, T. K, Mitra, S. K & Sadhu, M. K. (1991). Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash.
- Peter, K.V. (2008). Basics of Horticulture. New India Publ. Agency.
- Singh, S, P (1989) Mist Propagation. Metropolitan Book Co.
- Rajan, S & Baby, L.M (2007). Propagation of Horticultural Crops. New India Publ. Agency.
- Radha, T & Mathew, L (2007). Fruit Crops. New India Publ. Agency.
- Dey, Kalyan Kumar (1992). An Introduction to Plant Tissue Culture, New Central Book Agency, Das Lane, Calcutta.
- M.K. Sadhu. 2017 (Reprint) Fundamentals of Horticulture and Plant Propagation. Emphasizes propagation under Indian conditions.
- De. P.C. 2015 (Revised Edition) Plant Propagation and Nursery Management. Useful for understanding both propagation techniques and nursery practices.

MAHARANI LAKSHMI AMMANI COLLEGE FOR WOMEN, AUTONOMOUS

I/II/III/IV/V/VI SEM END EXAMINATION

2024 ONWARDS

YEAR:

PROGRAM – B.COM/B.Sc./BA/BBA/BCA/MA/MSc./M.Com

COURSE CODE

COURSE TITLE:

TIME: 2 HRS

TOTAL MARKS:40

GENERAL INSTRUCTIONS:

Draw diagram where ever necessary

6. Utilize left side of the sheet as workspace
7. Write the answers in blue/black pen only
8. Question numbers should be mentioned correctly
9. Avoid over writing/ scratching

COURSE TITLE

TIME: 90 MIN

TOTAL MARKS: 40 M

SECTION A

Q.No	Answer all the questions	CO's	CL's	MARKS: 2Mx5=10M
1		CO1		
2		CO1		
3		CO1		
4		CO2		
5		CO2		

SECTION B

	III. Answer any FOUR of the following			5Mx4=20M
6.		CO1		
7.		CO2		
8.		CO2		
9.		CO2		
10		CO3		

SECTION C

	IV. Answer any ONE of the following			10Mx1=10M
11.		CO3		
12.		CO3		

III. DISTRIBUTION OF CO,S FOR ESE QUESTION PAPER -INDIAN CONSTITUTION (SEP)

Section		Question Numbers
	I/II internals	
Section A	3CO1	1 TO 3
	2CO2	4 TO 5
Section B	1CO1	6
	3CO2	7 TO 9
	1CO3	10
Section C	2 CO3	11 12

IV. WEIGHTAGE FOR CO'S in ESE -INDIAN CONSTITUTION (SEP)

CO'S	Total No. of CO's	Total Marks
	I/II internals	I/II internals
CO1	4	11
CO2	4	19
CO3	3	25

SEP 2024 ONWARDS BOTANY CURRICULUM

SEMESTER IV

BOTANY PAPER – IV

BOT-S-401T: CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY

Programme name	B. Sc. BOTANY	SEMESTER	IV
Course Title	PAPER – II: CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY		
Course Code	BOT-S-401T	No. of Credits	03
Contact Hours	60 Hours	Duration of Exam	03 Hours
Formative Assessment Marks	20	Summative Assessment Marks	80

COURSE OBJECTIVES

- CO1:** Understand the structure and functions of chromosomes, chromosome mapping.
- CO2:** Understanding the principles of inheritance, including Mendelian genetics, extensions of Mendelian principles, and quantitative genetics.
- CO3:** Knowledge on the molecular aspects of cell structure and functions in plant cell.
- CO4:** Exploring the structure and function of DNA and RNA, including transcription and translation, and the role of proteins in cellular processes.
- CO5:** Understanding how genes are regulated and expressed, including epigenetics and gene expression analysis.

COURSE OUTCOMES

- CO1.** Understand the ultra-structure and functioning of cell in the sub-microscopic and molecular level.
- CO2.** Understand principles of heredity and the patterns of inheritance in different organisms.
- CO3.** Understand DNA as the basis of heredity and variation.
- CO4.** Understand and investigate the cause and effect of chromosome abnormalities (chromosome aberrations, trisomy, rearrangements etc.) and associated human diseases.
- CO5.** Knowledge of genetic code, gene expression and regulation.

- CO1:** Explain the structure and function of cell organelles, biological membranes, and cytoskeleton components.
- CO2:** Describe cell cycle phases, mitosis and meiosis, and analyze mechanisms of cell division and regulation.
- CO3:** Demonstrate understanding of chromosome structure, types, numerical and structural chromosomal variations.
- CO4:** Explain Mendelian principles, gene interactions, linkage, recombination, and mapping of chromosomes.
- CO5:** Interpret patterns of inheritance and solve genetic problems related to monohybrid, dihybrid, and non-Mendelian ratios.

- CO6:** Understand the structure of nucleic acids, DNA replication models, and the central dogma of molecular biology.
CO7: Describe mechanisms of transcription, translation, genetic code, operon model and regulation of gene expression.
CO8: Explain mutation types, mutagenic agents, DNA repair mechanisms, and relate them to genetic disorders.
CO9: Apply cytological and molecular techniques such as karyotyping, PCR, gel electrophoresis for genetic analysis.
CO10: Develop skills for experimental design and data interpretation in cytology, genetics and molecular biology.

IV SEMESTER

BOTANY PAPER – IV

BOT-S-401T CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY

52 Hrs.

Unit I	<p>CYTOLOGY Cell wall, distribution, chemical composition, functions and variations in prokaryotic and eukaryotic cells (primary and secondary wall). Programmed Cell Death; Biology and elementary knowledge of development and causes of cancer. Active and Passive transport, Phagocytosis, Pinocytosis, Exocytosis. Structural organization, function, marker enzymes of the organelles- biogenesis of mitochondria and chloroplasts, Structure and functions of Nucleus and Lysosomes. Endoplasmic Reticulum– Structure, types, targeting and insertion of proteins in the ER, protein folding, processing; Golgi Apparatus– organization, protein sorting and export from Golgi Apparatus.</p>	13 Hrs.
Unit II	<p>Chromosome biology – Chromosome staining and Chromosome painting (FISH), Structure of eukaryotic chromosome; centromere, kinetochore and telomere. Euchromatin and Heterochromatin. Nucleosome and its organization in eukaryotic chromosome, types of Chromosomes, special types (Polytene). Karyotype and Idiogram, Cell Division – Cell cycle and its regulation with reference to cell division, Mitosis: Phases, mitotic apparatus, Cytokinesis, mitotic inhibitors, significance of mitosis; Meiosis- phases of meiotic cycle, Significance of meiosis, cytological evidences of crossing over, synaptonemal complex. Aberrations: Numerical aberrations, changes in Chromosome number, Polyploidy: Euploidy and Aneuploidy- Trisomic and Monosomic. Role of Polyploidy in evolution- Wheat and Cotton. Structural aberrations: Deficiency, Duplication, Inversion and Translocation.</p>	14 Hrs.
Unit III	<p>GENETICS Biography of Mendel (in brief), Mendel’s experiments: Monohybrid cross – law of dominance, law of segregation, purity of gametes. Homozygous, heterozygous, phenotype, genotype, monohybrid test cross, Dihybrid cross - law of independent assortment, dihybrid test cross, incomplete dominance</p>	14 Hrs.

	<p>(<i>Mirabilis jalapa</i>, Snapdragon). Modification of Mendelian ratios (With reference to plant examples). Interaction of genes: epistasis (dominant & recessive); supplementary factors, complementary factors.</p> <p>Polygenic inheritance in Wheat and Maize, Self-Sterility in <i>Nicotiana</i>, Linkage & Crossing over in Maize.</p> <p>Sex Determination: Chromosomal mechanism of sex determination methods, XX –XY, ZZ – ZW & XX – XO, Sex determination in <i>Melandrium</i> and genetic problems related to topics.</p> <p>Extrachromosomal Inheritance. Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast.</p>	
Unit IV	<p>MOLECULAR BIOLOGY</p> <p>Historical perspectives, DNA as the genetic material (Griffith's, Harshey and Chase experiments). DNA structure, composition, types and the mechanism of replication. A brief account of DNA repair mechanism.</p> <p>RNA structure, composition and types. Genetic code. Biosynthesis of proteins. Regulation of gene action in prokaryotes (Lac operon concept). Regulation of gene action in Eukaryotes (Britten and Davidson Model).</p>	13 Hrs.

Assessment	Marks
Attendance	05 Marks
Assignment	05Marks
Test	10 Marks
Total	20 Marks

IV SEMESTER

BOTANY PRACTICAL PAPER – IV

BOT-S-401P: CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY

No. of credits: 02

45 Hrs.

BOT-S-401P: CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY		15 Units
1.	Study of plant cell structure with the help of epidermal peel mount of Onion. Measurement of length and breadth of plant cell using micrometry.	1 Units
2	Study of Mitosis and Meiosis (Permanent slides).	2 Units
3	Study of Mitosis from <i>Allium</i> root tips- Aceto-orcein (Slide preparation).	2 Units
4	Study of Meiosis from <i>Allium</i> flower buds- Acetocarmine (Slide preparation).	2 Units
5	Study of Karyotype of <i>Allium cepa</i> .	1 Unit
6	Isolation of DNA by C-TAB/SDS method.	1 Unit
7	Estimation of RNA - by Orcinol method.	1 Unit
8	Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes. Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge.	2 Units
9	Genetic Problems- <ul style="list-style-type: none">• Dihybrid Cross and Test cross• Incomplete dominance• Complementary factors• Supplementary factors• Epistasis	2 Units
10	Visit to Laboratory/ Industry relevant to the subject.	1 Unit

PRACTICAL QUESTION PAPER
BOTANY PAPER– IV
BOT-S-401P: CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY

Time 3 Hours

Max Marks - 40

1.	Prepare a temporary squash of material A , identify the stage, sketch and label with reasons.	1 x 5= 5 Marks
2.	Prepare a temporary squash of material B , identify the stage, sketch and label with reasons.	1 x 5 = 5 Marks
3.	Perform Micrometry for the given sample C .	1 x 5 = 5 Marks
4.	Identify and comment on D, E and F .	3 x 3= 9 Marks
5.	Solve the genetic problems- G and H .	2 x 3 = 6 Marks
6.	Record and Submission of 02 slides and Report.	5 + 5= 10 Marks

SCHEME OF PRACTICAL EXAMINATION

1	A Specimen from Onion Root tip Mitosis: Preparation-2 Marks, Identification of stage-1 Mark, diagram and reasons-2 Marks.
2	B Specimen from Onion flower buds Meiosis: Preparation-3 Marks, Identification of stage-1 Mark diagram and reasons-2 Marks.
	C – Micrometry- Performance-2 Marks, Procedure-1 Mark, Calculation-2 Marks.
3	D – Mitosis/ Meiosis slide (Identification- 1 mark, Comment- 1 Mark, Labelled diagram- 1 mark). E - Karyotype (Comment, formula & Labelled diagram 3 Marks). F - Photographs of Translocation Ring/ Laggards/ Inversion Bridge/ Down's/ Klinefelter's/ Turner's syndromes/ (Identification – 1 mark, Comment– 2 marks).
4	G and H – Genetic Problems- 3 + 3 = 6 Marks.
6	a) Record –5 marks b) Submission of 02 slides- 3 marks c) Report –2 marks.

REFERENCES

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- 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.
- Becker W. M., Kleinsmith L.J. and Bertni G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San francisco.
- Cooper, G.M., Hausman, R.E. (2009). The Cell: A Molecular Approach, 5th edition. Washington, D.C.: ASM Press & Sunderland, Sinauer Associates, MA.
- De Robertis, E. D. P. and De Robertis R. E. 2009. Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia.
- Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & sons.
- 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.
- Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings.
- Raven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
- Verma, P. S. (2004). Cell Biology, Genetics, Molecular Biology: Evolution and Ecology. India: S. Chand Limited.
- Welsh, J. R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.

BLUEPRINT

UNIT	NO. OF HOURS	NUMBER OF QUESTIONS				TOTAL NO. OF QUESTIONS UNDER EACH UNIT
		1 mark (Answer all)	3 marks (Any 5 questions)	5 marks (Any 5 questions)	10 marks (Any 3 questions)	
I	13	2	2	1	1	6
II	14	3	2	2	1	8
III	14	3	2	2	1	8
IV	13	2	1	2	1	6

Question Paper Format for Discipline Specific (Elective) Subjects
BOTANY THEORY EXAMINATION
MAHARANI LAKSHMI AMMANI COLLEGE FOR WOMEN, AUTONOMOUS

I/II/III/IV/V/VI SEM END EXAMINATION
SEP-2024 ONWARDS

YEAR:

PROGRAM – B.COM/B.Sc./BA/BBA/BCA/MA/MSc/M. Com

COURSE CODE: BOT-S-401T

COURSE TITLE: CYTOLOGY, GENETICS AND MOLECULAR BIOLOGY

TIME:3HRS

TOTAL MARKS:80

GENERAL INSTRUCTIONS:

10. Draw diagram where ever necessary
11. Utilize left side of the sheet as workspace
12. Write the answers in blue/black pen only
13. Question numbers should be mentioned correctly
14. Avoid over writing/ scratching

Q.No	Answer all the questions:	CO's	CL's	MARKS: 1Mx10=10M
1		CO1		
2		CO1		
3		CO1		

4		CO1		
5		CO1		
6		CO2		
7		CO2		
8		CO2		
9		CO2		
10		CO2		
SECTION B				
	Answer any FIVE of the following:			3MX5=15 M
11.		CO1		
12.		CO1		
13.		CO1		
14.		CO1		
15.		CO2		
16.		CO2		
17.		CO2		
SECTION C				
	Answer any FIVE of the following:			5Mx5=25M
18.		CO2		
19.		CO2		
20.		CO2		
21.		CO3		
22.		CO3		
23.		CO3		
24.		CO3		
SECTION D				
	Answer any THREE of the following:			10Mx3=30M
25.		CO3		
26.		CO3		
27.		CO4		

28.		CO4/CO5		
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QUESTIONS SECTION WISE MARKS DISTRIBUTION

SEC/MAINS	Total No. of Questions	Questions to be answered	Marks /question	Marks for written questions (excluding Choice)	Total Marks(including Choice)
A	10	10	1	10	10
B	7	5	3	15	21
C	7	5	5	25	35
D	4	3	10	30	40
TOTAL	28	23		80	106

BLUE PRINT FOR QUESTION PAPER

V. DISTRIBUTION OF CO'S FOR DSC QUESTION PAPER FOR END SEMESTER EXAMINATION

Section	Total No. of CO's	Question Numbers
	ESE	
Section A	5CO1's	1 TO 5
	5CO2's	6 TO 10
Section B	4 CO1's	11 TO 14
	3 CO2's	15 TO 17
Section C	3 CO2's	18 to 20

	4 CO3's	21 TO 24
Section D	2 CO3's	25 & 26
	2 CO4's / (1 CO4 & 1 CO5)	27 & 28 Note: If CO5 is given only question no. 28 can be given

VI. WEIGHTAGE FOR CO'S IN END SEMESTER EXAMINATIONS

CO'S	Total No. of CO's	Total Marks	% of LOT/HOT
CO1	09 (LOT)	17	17%
CO2	11 (LOT)	29	29%
CO3	06 (HOT)	40	40%
CO4/CO5	02 CO4/ 1 CO4 & 1 CO5 (HOT)	20/ 10 + 10	
	TOTAL MARKS	106	

LOT-Lower order thinking

HOT- Higher order thinking

IV SEMESTER

DSEB 1.1- MEDICINAL PLANTS AND HERBAL TECHNOLOGY

PROGRAMME	B.Sc., BOTANY	SEMESTER	IV
Course Title	DSEB 1.3- MEDICINAL PLANTS AND HERBAL TECHNOLOGY		
Course Code		No. of Credits	02
Contact Hours	30 Hours	Duration of Exam	02 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.

COURSE OUTCOMES

- CO1:** Ability to understand the medicinal plants world and their importance in day-to-day life.
- CO2:** Understand the ethnobotanical value of medicinal use in India for the treatment of human and animal diseases.
- CO3:** Learn the methods used to extract the active principles for drug development and their validation.
- CO14:** 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. Therapeutic potential of Phytochemicals. Cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants. Medicinal plant gardens and conservation of medicinal plants.	10Hrs
UNIT- II	Herbal Drug Technology Herbal medicines and foods. Active principles of medicinal plants. Methods used for isolation, testing, identification active ingredients. Examples- <i>Catharanthus roseus</i> (cardiotonic), <i>Withania somnifera</i> (drugs acting on nervous system), <i>Clerodendron phlomoides</i> (anti-rheumatic) and <i>Centella asiatica</i> (memory booster). CIMAP and its role. Important firms producing herbal medicines.	10 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.	10 Hrs
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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-02 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

BOT-S-401E MEDICINAL PLANTS

PROGRAMME	B.Sc. BOTANY	SEMESTER	IV
Course Title	BOT-S-401E: MEDICINAL PLANTS		
Course Code	BOT-S-401E	Number of Credits	02
Contact Hours	30	Duration of Exam	2 Hrs
Formative Assessment Mark	10	Summative Assessment Marks	40

COURSE OBJECTIVES

- The course intends to 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 sustainable use of plant-based medicines for health problems confronting the society.

COURSE OUTCOMES

CO1: Understand the medicinal plants, ethnobotanical value of medicinal use in India for the treatment of human and animal diseases and their importance in day-to-day life.

CO2: Learn the methods used to extract the active principles for drug development and their validation.

CO3: Understand the role of secondary metabolites and their exploitation, through characterization.

CO4: 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 herbal products through various quality control measures.	10 Hrs
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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.	10 Hrs
UNIT- III	Pharmacology and Drug Discovery: In vitro and in vivo toxicity 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.	10 Hrs

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

THEORY QUESTION PAPER PATTERN FOR FINAL EXAMINATION

Time-02 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 Marks

REFERENCES

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

MAHARANI LAKSHMI AMMANNI COLLEGE FOR WOMEN, AUTONOMOUS

I/II/III/IV/V/VI SEM END EXAMINATION

2024 ONWARDS

YEAR:

PROGRAM – B.COM/B.Sc./BA/BBA/BCA/MA/MSc. /M.Com

COURSE CODE

COURSE TITLE:

TIME: 2 HRS

TOTAL MARKS:40

GENERAL INSTRUCTIONS:

Draw diagram where ever necessary

15. Utilize left side of the sheet as workspace

16. Write the answers in blue/black pen only

17. Question numbers should be mentioned correctly

18. Avoid over writing/ scratching

COURSE TITLE

TIME: 90 MIN

TOTAL MARKS:

40 M

SECTION A

Q.No	Answer all the questions	CO's	CL's	MARKS: 2Mx5=10M
1		CO1		
2		CO1		
3		CO1		
4		CO2		
5		CO2		
SECTION B				
	III. Answer any FOUR of the following			5Mx4=20M
6.		CO1		
7.		CO2		
8.		CO2		
9.		CO2		

10		CO3		
SECTION C				
	IV. Answer any ONE of the following			10Mx1=10M
11.		CO3		
12.		CO3		

VII. DISTRIBUTION OF CO,S FOR ESE QUESTION PAPER -INDIAN CONSTITUTION (SEP)

Section		Question Numbers
	I/II internals	
Section A	3CO1	1 TO 3
	2CO2	4 TO 5
Section B	1CO1	6
	3CO2	7 TO 9
	1CO3	10
Section C	2 CO3	12 12

VIII. WEIGHTAGE FOR CO'S in ESE -INDIAN CONSTITUTION (SEP)

CO'S	Total No. of CO's	Total Marks
	I/II internals	I/II internals
CO1	4	11
CO2	4	19
CO3	3	25

IV SEMESTER

CPC-1.1: NURSERY, GARDENING AND LANDSCAPING

(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	30	Duration of Exam	2 Hrs
Formative Assessment Mark	10	Summative Assessment Marks	40

COURSE OBJECTIVES

- The course is aimed to teach students the basic knowledge required to develop entrepreneurship skills.
- This course will make the students to gain ability to develop Nursery, Gardening and Landscaping.
- This course would train students to initiate a remunerative enterprise owing to a high demand of skilled professionals in this field.

COURSE OUTCOMES

CO1: After the completion of the course, the learners will be able to understand the importance of nursery in gardening.

CO2: Students will also be able to describe and differentiate between the types of gardens in the city areas.

CO3: They will be able to execute several nursery and gardening operations including media and equipment's needed for the establishment of gardens.

CO4: Learners will also assess the growing conditions of different horticultural plants, their general requirements 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 landscape designs for school and college using CAD technology.
13. Study of Interior designing with plants- Terrarium, miniature landscape
14. Preparation and application of herbal pesticides
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 (4 x 3)	12 Marks
4	Prepare a temporary Terrarium/Miniature Landscape F	05 Marks
5	Class Record	05 Marks

REFERENCES

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

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