



RANI CHANNAMMA UNIVERSITY

BELAGAVI

**REVISED CURRICULUM FRAMEWORK FOR
UNDER GRADUATE COURSE**

STRUCTURE & SYLLABUS OF BACHELOR OF SCIENCE

BOTANY


1ST TO 2ND Semesters

w.e.f.

Academic Year 2024-25 and Onwards

Submitted by

Chairman,
Board of Studies (UG),
Bachelor of Science,
Rani Channamma University, Belagavi.


RANI CHANNAMMA UNIVERSITY, BELGAVI
VIDYASANAGAMA
Accredited with B+ Grade by NAAC

FACULTY OF SCIENCE : DEPARTMENT OF BOTANY

Board of Studies in Botany

Sl. No.	Name and Address	Designation
01	Prof. Basavaraj Padmashali Department of Chemistry Rani Channamma University Belagavi-591156	Chairman
02	Dr T.C. Gopal Department of Botany J.S.S Arts , Science and Commerce College ,Gokak	Member
03	Shri. Raveendra. B. Hujaratti Department of Botany D.M.S. Mandal's B.K. Arts , Science and Commerce College , Belgavi	Member
04	Shri. R.R. Naik Department of Botany K.L.E. Society's B.K. Arts , Science and Commerce College , Chikkodi	Co-opt member
05	Dr L.B. Kadam, Department of Botany KRCES's, GGD Arts, BMP Commerce & SVS Science College, Bailhongal-591 102.	Co-opt member

First Semester B.Sc. Botany Theory

Paper Title: Botany-1T	Marks: Th-80+IA-20
Paper Code : SEP BSCBOT T-1	Total hours: 60
Teaching Hours: 4 Hours/Week	Credits : 03

UNIT-I: Microbial Diversity	15 Hours
<p>Chapter No. 1: - Introduction to microbial diversity; Hierarchical organization. Whittaker's five-kingdom system Distribution of microbes in soil, air, and water. Significance of microbial diversity in nature. 5 Hours</p> <p>Chapter No. 2: History and developments of microbiology Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister). Culture media for Microbes- Natural and synthetic media, basal media, enriched media , Sterilization methods -Principle of disinfection, antiseptic, tyndallisation and Pasteurization, Sterilization-Sterilization by dry heat, moist heat, UV light,. Chemical methods of sterilization-phenolic compounds, anionic and cationic detergents. 5 Hours</p> <p>Chapter No. 3: Microbial Growth- Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs. 5 Hours</p>	
UNIT-II Viruses-	15 Hours
<p>Chapter No. 1: Viruses- General characteristics, structure and classification of Viruses; Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Vaccines and types. Viroid's- general characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases. Economic importance of viruses. 5 Hours</p> <p>Chapter No. 2: Viral Plant Diseases: TMV. Vein clearing, Dwarfing, Yellowing and BBTV disease. Bacteria- General characteristics and classification. Archaeobacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of Rhizobium and its applications. A brief account of Actinomycetes and Cyanobacteria. Mycoplasmas and Phytoplasmas General characteristics and diseases. 5 Hours</p> <p>Chapter No. 3: Plant Pathology Plant Disease: Bacterial Citrus canker, Bacterial blight, Bacterial wilt in Banana, blight in Rice and BBTV , Yellow mosaic Crown gall disease. Economic importance of Bacteria. 5 Hours</p>	
UNIT-III: Algae	15 Hours
<p>Chapter No. 1 Algae –Introduction and historical development in algology. General characteristics and classification of algae, Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. 5 Hours</p> <p>Chapter No. 2 Morphology and reproduction and life-cycles of Nostoc, Volvox Oedogonium, Chara , Ectocarpus and Batrachospermum. Diatoms and their importance. Blue-green algae-A general account. Algal blooms and toxins. 5 Hours</p> <p>Chapter No. 3 Algal cultivation- Cultivation of microalgae-Spirulina; Algal cultivation methods in India. - Economic importance of algae as Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses. 5 Hours</p>	
UNIT-IV: Fungi	15 Hours
<p>Chapter No. 1. Fungi-General characteristics and Aloxopholous classification. Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and Para sexuality. 5 Hours</p> <p>Chapter No. 2 Types study and Life cycles of the Rhizopus Albugo , Penicillium Puccinia, Agaricus and Cercospora Economic 5 Hours</p> <p>Chapter No. 3. Lichens – Structure and reproduction. VAM Fungi and their significance. Fungal diseases-. Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, White rust of</p>	

References

1. Ananthnarayan R and Panikar JCK. 1986. Text book of Microbiology. Orient Longman Ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, NewDelhi.
3. William CG. 1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, NewDelhi.
5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Text book of Microbiology. Mittal Publications. New Delhi. 305pp.
7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
8. Vasanthkumari R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi
- 9) Chopra,G.L.AtextbookofAlgae.Rastogi&Co.,Meerut,Co.,NewDelhi,Depot. Allahabad.
- 10) Johri, LataanfTyagi, 2012, A Text Book of, Vedam e Books, NewDelhi.
- 11) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
- 12) Sharma, O.P., 2017, AlgaeSingh-Pande-Jain2004-05. A Text Book ofBotany. Rastogi Publication, Meerut

Suggested Readings

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. 10thedition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, Mac Millan Publishers Pvt. Ltd.,Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4thedition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi,
6. Dr.T.C.Gopal Practical Handbook 2023.

First Semester B.Sc. Botany Practicals

Paper Title: Botany-1P	Marks: Th-40+IA-10
Paper Code : SEPBSCBOT P01	hours: 04/WEEK
Teaching Hours: 4 Hours/Week	Credits : 02

Practical 1: Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, Laminar flow hood, Colony counter, Haemocytomer, Micrometer etc.).

Practical 2. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.

Practical 3: Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.

Practical 4: Study of vegetative and reproductive structures of Volvox, Nostoc, Oedogonium,

Practical 5: Study of vegetative and reproductive structures of Chara, Ectocarpus and Batrachospermum through temporary preparations and permanent slides.

Practical 6: Study of vegetative structures and reproductive structures - Albugo, Rhizopus Penicillium.

Practical 7: Study of vegetative structures and reproductive structures Puccinia, Agaricus and Cercospora

Practical 8 : Study of lichens and fungal disease -. Black stem rust of wheat; White rust of Albugo Cercospora .

Practical 9: Study of well-known microbiologists and their contributions through charts and photographs as mentioned in theory.

Practical-10: Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand role of microbes in day today life.

(Note: submission of study tour report is compulsory)

Second Semester B.Sc. Botany Theory

Paper Title: Botany-2T	Marks: Th-80+IA-20
Paper Code : SEPBSCBOT T-2	Total hours: 60
Teaching Hours: 4 Hours/Week	Credits : 03

UNIT-I: Bryophytes	15 Hours
<p>Chapter 1: Bryophytes: General characteristics and classification of Bryophytes, Diversity-habitat, thallus structure, Gametophytes and sporophytes of Bryophytes. 5 Hour:</p> <p>Chapter 2 : Distribution, morphology, anatomy, reproduction and life-cycles Riccia, Marchantia and Anthoceros, 5 Hours</p> <p>Chapter 3: Morphology, anatomy, reproduction and life-cycles Porella and Funaria. Ecology and economic importance of bryophytes, fossil bryophytes. 5 Hours</p>	
UNIT-II: Pteridophytes	15 Hours
<p>Chapter 1: General characteristics and classification; Structure of sporophytes and life-cycles. Distribution, morphology, anatomy, reproduction and life-cycles in Psilotum, Lycopodium . 5 Hours</p> <p>Chapter 2:. Distribution, morphology, anatomy, reproduction and life-cycles in Selaginella Equisetum, Marselia Nephrolepis . 5 Hours</p> <p>Chapter 3:. A brief account of heterospory and seed habit. Stelar evolution in Pteridophytes. Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance. 5Hours</p>	
UNIT-III: Gymnosperms	15 Hours
<p>Chapter 1: Gymnosperms- General characteristics. Distribution and classification of Gymnosperms. Study of the habitat, distribution, habit, anatomy, reproduction and life-cycles in Cycas, 5 Hours</p> <p>Chapter 2: Habit and habitat anatomy, reproduction and life-cycles in Pinus and Gnetum , abnamlous secondary growth in Gnetum 5 Hours</p> <p>Chapter 3: Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses and medicines. 5 Hours</p>	
UNIT-IV: Paleobotany	15 Hours
<p>Chapter 1: Paleobotany- Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating. 5Hours</p> <p>Chapter 2: Origin and evolution of Plants: Origin and evolution of plants through Geological Time scale. Fossil taxa- Rhynia, Exploration of fossil fuels BirbalSahni Institute of Paleo sciences. 5 Hours</p> <p>Chapter 3: General characteristics, classification, Early land plants (lepidodendron, Lepidocarpon, Calamites). 5 Hours.</p>	

References

1. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
2. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
3. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahaba
- 4) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. NewDelhi.
- 5) Johri, LataanfTyagi, 2012, A Text Book of, Vedam e Books, NewDelhi.
- 6) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. NewDelhi.

Suggested reading

1. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment and Allied plants. Hutchinson & Co., Ltd., London.
2. Publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.
3. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew- Hill Publishing Co. New Delhi, Freeman & Co., New York.
4. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge University Press, Cambridge.Gymnosperms.
- 5 Kakkar, R.K. and B.R.Kakkar(1995) The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.
6. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allhabad.
7. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allhabad.
8. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot.,Allahabad.Press, Cambridge.
- 9.. Rashid, A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New Delhi.
10. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes &Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
11. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
12. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants, Cambridge UniversityCambridge
13. Dr.TC. Gopal practical Hand book of Botany .

Second Semester B.Sc. Botany Practicals

Paper Title: Botany2P	Marks: Th-40+IA-10
Paper Code : SEPBSBOT P-2	Total hours: 40
Teaching Hours: 4 Hours/Week	Credits : 02

Paper Title: Diversity of Non Flowering plants

Teaching Hours: 4 Hrs / Week

Marks: Th-40+IA-10

Credits: 2

Practical-1: Study of morphology, classification, anatomy and reproduction in Riccia Marchantia-morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, L.S. sporophyte (all permanent slides).

Practical -2: Study of morphology, classification, anatomy and reproduction in Anthoceros

Practical -3: Funaria- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, L. S. capsule and protonema

Practical -4: Study of morphology, classification, anatomy and reproduction Psilotum , Lycopodium Selaginella- morphology, w.m. leaf with ligule, T.S. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), L.S. strobilus (permanent slide)

Practical -5: Equisetum- morphology, T.S. internode, L.S. strobilus, T.S. strobilus, w.m. sporangiophore, w.m. spores (wet and dry) (temporary slides); T.s rhizome (permanent slide).

Practical -6: Study of morphology, classification, anatomy and reproduction in Marsilia in details

Practical-7: Nephrolepis morphology, T.S. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), T.S. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).


Practical-8: Cycas-morphology (coralloid roots, bulbil, leaf), T.S. coralloid root, T.S. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), L.S. ovule, T.S. root (permanent slide). . **Practical-9 : Pinus-** morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, T.S. needle, T.S. stem, L.S./T.S. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), L S female cone, T. L.S. & R. L.S. stem (permanent slide).

Practical-10 ;Study of morphology, classification & anatomy, reproduction in Gnetum.

Practical-11 :study plant fossils.

Visit to algal cultivation units/lakes with algal blooms/Fern house/ Nurseries/Geology museum/lab to study plant fossils

(Note: Botanical study tour to a floristic rich area for 1-2 days and submission of study report is compulsory)


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FACULTY OF SCIENCE : DEPARTMENT OF BOTANY

QUESTION PAPER PATTERN

PAPER CODE: – 24 BSC BOT T1

Title of the paper: MICROBIAL DIVERSITY (Microbes, Algae, Fungi and Plant Pathology)

Time: 3 Hours

Max. Marks: 80

Q. I Answer any TEN of the following

10X2=20

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

Q.II Answer any SIX of the following

5X6=30

- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20

Q.III Answer any THREE of the following

3X10=30

- 21
- 22
- 23
- 24
- 25

Instructions to the Question paper setting

Q. I Three questions from each Unit


Q.II Two questions from each Unit

Q.III Q. 21 and 22 from Unit I

Q. 23 from Unit II

Q. 24 from Unit III

Q. 25 from Unit IV


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FACULTY OF SCIENCE : DEPARTMENT OF BOTANY

QUESTION PAPER PATTERN

PAPER CODE: – 24 BSC BOT I P

Title of the paper: MICROBIAL DIVERSITY (Microbes, Algae, Fungi and Plant Pathology)


Time: 4 Hours

Max. Marks: 40

Q. I Identify and classify the following specimen A,B and C	12
Q. II Make a Temporary slide of the specimen D (Gram staining Technique)	06
Q.III Identify and Comment on the specimen / slides /Photographs E,F,G and H	12
Q.IV Journal	05
Q. V Tour Report	05

Instructions to the Examiners

- Q. I A-Algae
 B- Fungi or Lichen
 C-Plant pathology
- Q. II D (Gram staining Technique in Curd)
- Q.III E- Virus Photograph
 F-Bacteria Photograph
 G- Algae Slide or photograph
 H- Fungi Slide or photograph
- Q.IV Journal
- Q. V Submission of Tour Report


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FACULTY OF SCIENCE : DEPARTMENT OF BOTANY

QUESTION PAPER PATTERN

PAPER CODE: – 24 BSC BOT T2

Title of the paper: Diversity of Non-flowering plants (Bryophytes, Pteridophytes, Gymnosperms and Paleobotany)

Time: 3 Hours

Max. Marks: 80

Q. I Answer any TEN of the following

10X2=20

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

Q.II Answer any SIX of the following

5X6=30

- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20

Q.III Answer any THREE of the following

3X10=30

- 21
- 22
- 23
- 24
- 25

Instructions to the Question paper setting

Q. I Three questions from each Unit


Q.II Two questions from each Unit

Q.III Q. 21 and 22 from Unit I

Q. 23 from Unit II

Q. 24 from Unit III

Q. 25 from Unit IV


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FACULTY OF SCIENCE : DEPARTMENT OF BOTANY

QUESTION PAPER PATTERN

PAPER CODE: – 24 BSC BOT P-2

Title of the paper: Diversity of Non-flowering plants (Bryophytes, Pteridophytes, Gymnosperms and Paleobotany)


Time: 4 Hours

Max. Marks: 40

Q. I Identify and classify the following specimen A,B and C	09
Q. II Make a Temporary micropreparation of the given specimen D	05
Q.III Identify and Comment on the specimen / slides /Photographs E,F,G and H	12
Q. IV Identify and Comment on the specimen / slides /Photographs I and J	04
Q.IV Journal	05
Q. V Tour Report	05

Instructions to the Examiners

- Q. I A-Algae
 B- Fungi or Lichen
 C-Plant pathology
- Q. II D (Gram staining Technique in Curd)
- Q.III E- Virus Photograph
 F-Bacteria Photograph
 G- Algae Slide or photograph
 H- Fungi Slide or photograph
- Q.IV Journal
- Q. V Submission of Tour Report


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FACULTY OF SCIENCE : DEPARTMENT OF BOTANY

CERTIFICATE COURSE

Title: Mushroom Culture Technology

Lectures: 15 Hrs Theory (2 Hours per week)

Practicals: Two (4X2=8 Hours)

Objectives:

- 1. To increase scientific attitude among the students**
- 2. To acquire knowledge about the cultivation efficiency, sustainable production and marketing**
- 3. To gain the knowledge about the nutritional value of edible mushrooms**

Unit 1:

Introduction, History. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India -Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus. **02 hours**

Unit 2:

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. **06 hours**

Unit 3:

Storage and nutrition: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins. Calorific value **04 hours**

Unit 4:

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. **03 hours**

Practicals: Two (4X2=8 Hours)

1. Basic instrumentation, materials and chemicals required for mushroom Cultivation
2. Cultivation practice in laboratory by using oyster mushrooms spawns.
3. Visit to nearby mushroom cultivation Unit.

References

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.
5. T. C. Gopal, (2023) Edible Fungi, Mushroom cultivation and handling, Research article, ISBN-9783346958334, "Natural Science"



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REVISED CURRICULUM FRAMEWORK FOR UNDER GRADUATE COURSE

STRUCTURE & SYLLABUS OF BACHELOR OF SCIENCE BOTANY

III and IV Semesters

w.e.f.

Academic Year 2025-26 onwards

Submitted by

**Chairman, Board of Studies (UG),
Bachelor of Science,
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VIDYA SANGAMA

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FACULTY OF SCIENCE: DEPARTMENT OF BOTANY

Appendix 2: B.Sc. and B.A. with practical Programmes

COURSE PATTERNS, SCHEMES OF EXAMINATIONS AND CREDITS

(L: Lectures, P: Practical, T: Tutorial, L: Languages, C: Compulsory, E: Elective, O: Optional)

Third Semester B.Sc. Botany DSC Theory

Paper Title: Plant Anatomy and Embryology	Marks:Th- 80 + IA-20
Paper Code:SEPBSCBOTT-3	Total hours:60
Teaching Hours:4 Hours/Week	Credits:03

Course Outcomes:

On completion of this course, the students will be able to:

1. Understand internal structure of various parts of a plant in support of the evolutionary aspect.
2. Develop skills for the proper description of internal structure using botanical terms and their identification.
3. Inculcate enthusiasm on internal structure of locally available plants.
4. Understand various levels of organization in a plant body with an outlook in the relationship between the structure and function through comparative studies.
5. Understand the various reproductive methods sub-stages in the life cycle of plants
6. Understand classification of the embryological variations in angiosperms.

PLANT ANATOMY

UNIT: I

15 Hours

Tissues- Meristems, types, characters, histological organisation of root & shoot apices.

Theories- Histogen and Tunica carpus. Permanent tissues- simple & complex. Types of vascular bundles.

Tissue systems –dermal-stomata and its types, mechanical, secretary- nectary, laticiferous & oil glands.

UNIT-II:

15 Hours

Internal structure of primary plant body- root, stem & leaf (dicot & monocot).

Secondary growth – Stem.

Abnormal secondary growth – general account with the examples -Bignonia, Boerhaavia and Dracaena.

Wood anatomy- General account, ring porous, diffuse porous, distribution & types of wood parenchyma, Tracheary elements, fibre types.

EMBRYOLOGY

UNIT-III:

15 Hours

Contribution of Indian embryologists- : P. Maheshwari, B.G.L. Swamy, M.S. Swaminathan and K.C.Mehta

Anther –Structure (Young and Mature) microsporogenesis & male gametophyte. Tapetum and its types, Pollen embryo sac. Palynology and its applications.

Ovule – Placentation and its types. Structure and types of ovules, megasporogenesis and Megagametogenesis.

Development of female gametophyte-monosporic (Polygonum), bisporic (Allium) & tetrasporic (Peperomia, Drusa, Fritillaria & Adoxa.)

UNIT-IV:

15 Hours

Pollination- Types of Pollination and pollinating agents.

Fertilization – Pollen –pistil interaction, entry of pollen tube into the stigma, style & embryo sac.

Double fertilization and triple fusion. Endosperm – Development (Free nuclear, Cellular and Helobial), Special types of endosperm (Ruminant, starchy).

Embryogeny – Dicots (Crucifer) & monocot (grass). A brief account of polyembryony, apomixes and their significance.

Seed Structure: Dicot and Monocot.

References

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
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13. Nair P .K .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 Publication.
21. S.B.Patil and S. D.Payamalle. 2019. Plant anatomy and Embryology, Akash Publications

Third Semester B.Sc. Botany Practicals

Paper Title: Botany-3P	Marks: Th-40+IA-10
Paper Code: SEP BSC BOT P03	hours: 04/WEEK
Teaching Hours: 4 Hours/Week	Credits: 02

1. Demonstration of double-staining technique (sectioning, staining & mounting).
2. Meristems and Simple tissues: different types of parenchyma, collenchyma & sclerenchyma (sclereids & fibres). Complex tissues – xylem & phloem (in T.S & L.S) & maceration technique.
3. Primary internal structures of root, stem and leaf (Sunflower/Tridax/Eupatorium and Maize/Grass/Sorghum)
4. Normal secondary growth – dicot stem (stelar and extra stelar)
5. Abnormal secondary growth in stem – Bignonia, Boerhaavia and Dracaena.
6. Study of microsporogenesis, T.S. of Young and Mature anther.
7. Structure of pollen grain using whole mounts (Hibiscus and Maize). Mounting of Pollinea.
8. Ovule types and megasporogenesis by using permanent slides.
9. Mounting of embryo and endosperm: Cucumber, Maize and Cyamopsis.
10. 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.
 - e) Any other relevant study related to Anatomy / Embryology.

RANI CHANNAMMA UNIVERSITY, BELAGAVI
B.Sc. III Semester (SEP) Botany Practical Examination
Subject: Plant anatomy and Embryology

Time: 4 Hours

Max Marks: 40

1. Make a double stained micro preparation of T.S of material. 'A' Draw a labelled diagram & mention the features of anatomical interest (show the preparation to the examiner). **08 M**
2. Make a temporary micro preparation of specimen 'B' so as to expose _____ and draw the diagram. (Show the preparation to the examiner). **05M**
3. Mount endosperm/embryo in the specimen 'C' and draw the diagram (show the preparation to the examiner). **05 M.**
4. Identify & mention the important features observed in the slide / material D, E, F & G. **12 M**
5. Mini Project **05 M**
6. Journal **05 M**

RANI CHANNAMMA UNIVERSITY, BELAGAVI
B.Sc. III Semester (SEP) Botany Practical Examination
Subject: Plant anatomy and Embryology
INSTRUCTIONS TO EXAMINERS.

- Q.1. Material A- Bignonia, Boerhaavia, Dracaena stem. **8 Marks**
(Preparation -4 marks, Diagram- 2 marks, Explanation- 2 marks).
- Q.2. Specimen B- Lenticel/Stomata/Pollinea/Pollen grain. **5 Marks**
(Preparation -3 marks, Diagram- 1mark, oral- 1mark).
- Q.3. Specimen C- Mounting of Embryo /Endosperm. **5 Marks**
(Cucumis seeds/Maize grain/Cyamopsis).
(Preparation -3 marks, Diagram- 2 marks).
- Q.4. D and E Slides from anatomy and. F and G - Slides from Embryology. **12 Marks**
- Q.5. Mini Project **5 Marks**
- Q.6. Journal **5 Marks**

Course Title & Code	Elective 1: Food processing technology		
Semester III	Teaching Hours:3/Week	Credits:2	Total Hours: 30
Learning Objective	<p>The open elective course ‘Food Processing Technology’ in Semester-III includes the theory based units on</p> <ul style="list-style-type: none"> • Post-harvest processing and preservation technology as well as beverage processing and preservation technology. • It would introduce the learners to the world of post-harvest handling, processing and preservation techniques and the governmental schemes available for the same. • It would develop interest among learners by highlighting the processing and health benefits of alcoholic, non-alcoholic and probiotic beverages. 		
Course Outcomes	<p>Upon completion of this course the students will be able to</p> <p>Course Outcomes:</p> <p>After completion of the course, learners would be able to:</p> <p>CO1: Understand the objective, scope and importance of post-harvest and beverage processing and preservation technologies.</p> <p>CO2: Learn the various post-harvest handling and processing techniques for fruits, vegetables, and flowers for their better shelf-life.</p> <p>CO3: Understand Indian Government Schemes available for effective Post harvest management of horticultural crops.</p> <p>CO4: Develop required skills to have their own start-ups by processing fruits and vegetables into jam, jelly, squash, syrup, pickles, mix-herb powders.</p> <p>CO5: Classify and differentiate amongst the alcoholic and non-alcoholic beverages along with special reference to their botanical sources, processing techniques and health benefits.</p>		
Unit I	<p>Introduction to post-harvest technology: Scope and importance of post-harvest technology in horticultural industry.</p> <p>Post-harvest handling operations: Overview of post-harvest handling, Post-harvest handling of fruits, vegetables, grains, cut flowers, herbs; Pre-treatment before transport (chlorination, trimming, dressing, waxing, chemical treatment); Packaging and transport of produce; types of storage.</p> <p>Processing and preservation of fruits using sugar concentrates: Definition, Principle and preparation of Jam, jelly, fruit candies, and fruit leather. Canning of fruits and vegetables.</p> <p>Processing and preservation of vegetables using salt concentrates: Definition, Principle of Pickling, Types and preparation of Pickles (Brine, Vinegar, Indian pickles). Preparation of mix herb powder, vegetable powder, vegetable chips.</p> <p style="text-align: right;">15Hrs</p>		

Unit II	<p>Beverage Processing and Preservation Technology</p> <p>Beverages: Definition, classification/types, nutritional values, and health benefits. Role of Fermentation technology in the Indian Beverage Industry.</p> <p>Non-alcoholic beverages: Botanical sources, processing and health benefits of Tea, coffee, cocoa, neera, coconut water, kokum juice.</p> <p>Alcoholic beverages: Botanical sources, and health benefits of Fermented beverage (Wines, Cider, Perry), Brewed and fermented beverages (Beer and Sake), Distilled beverages (Spirits and Liquors).</p> <p>Preservation of Beverages: Objectives and principles of beverage preservation, Chemical preservatives and their role, Antioxidants, and their role.</p> <p>Industrial preparation of non-fermented beverages: Fruit squash, syrups, and fruit juices.</p> <p>Industrial preparation of fermented beverages: Fruit wines, Floral wines, apple cider, fermented red beet juice.</p> <p>15Hrs</p>
Text Books	<p>References :</p> <ol style="list-style-type: none"> 1. Fellows, P.J. 2022, "Food Processing Technology: Principles and Practice", 5th Edition. 2. Sivasankar, B. 2002, "Food Processing & Preservation", Prentice Hall of India. 3. Pelczar, et al. 2001, Microbiology. 4. Prescott & Dunns, 2004, Industrial Microbiology, 4th edition. 5. P. Prave, W. Sitting, D.A. Sukatsch, 2004, Fundamentals of biotechnology. 6. Roger Arnold, Gordon Beech, John Taggart, 1989, Food Biotechnology, Cambridge Univ.Press 7. Owen P. Ward, 1990, Fermentation Biotechnology Open Univ. Press 8. V.K. Joshi and Ashok Pandey, 2009, Biotechnology - Food Fermentation (Vol. I & II), Educational Publishers & Distributors 9. Martin Adams, M.J.R. Nout, 2001, Fermentation and Food Safety, Springer.

**Third Semester B.Sc. Degree Examination
Botany**

Elective 1

Time: 2 hours

Max. Marks: 40

Q. I. Answer any FIVE of the following.

5X2=10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

Q. II. Answer any THREE of the following.

3X5=15

- 9.
- 10.
- 11.
- 12.
- 13.

Q. III. Answer any THREE of the following.

3X5=15

- 14.
- 15.
- 16.
- 17.
- 18.

Instruction to Question Paper Setting.

1. Question number I has 1-8 sub questions consisting of 4 questions from each unit. Each question carries two marks. Student has to answer any five questions.
2. Question number II has 9-13 sub questions from Unit - I.
3. Question number III has 14-18 sub questions from Unit - II.

Fourth Semester B.Sc. Botany Theory

Paper Title:Ecology, Environmental Biology & Phytogeography	Marks:Th-80 + IA-20
PaperCode:SEPBSCBOT T-4	Total hours:60
Teaching Hours:4Hours/Week	Credits:03

Course Outcomes:

On completion of this course, the students will be able to:

1. Understand ecosystem structure and function.
2. Analyse biodiversity, species interactions and population dynamics.
3. Understand biological response to environmental changes.
4. Explore bioremediation and ecological restoration methods.
5. Assess climate change effects on living organisms and ecosystem.
6. Understand the plant distribution patterns and their ecological significance.
7. Understand how Climate, soil and geography influence plant growth.
8. Explore biogeographical regions and vegetation types.

RANI CHANNAMMA UNIVERSITY, BELAGAVI

B.SC. IV (SEP) SEMESTER BOTANY

PLANT ECOLOGY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY

60 Hours

UNIT 1:

15 Hours

Plant and Environment: Atmosphere (gaseous composition), water, light temperature, soil (development, soil profiles, physico-chemical properties), and biota. Morphological, anatomical and physiological responses of plants to water (hydrophytes, xerophytes and epiphytes), temperature (thermoperiodicity and vernalization), light (photoperiodism, heliophytes and sciophytes) and salinity.

UNIT 2:

15 Hours.

Population Ecology and Ecosystems: Growth curves; ecotypes; ecads, Ecological succession- hydrach and xerarch. Structure of Ecosystems (Pond and Forest): abiotic and biotic components; food chain, food web, ecological pyramids, energy flow. Biogeochemical Cycle (Nitrogen and Carbon)

UNIT 3:

15 Hours.

Phytogeography: Botanical regions of world, Vegetation types of Karnataka and India.

Conservation of Natural Resources: Different types of natural resources and their conservation, Forest and Forest Management: Forest and its ecological significance, deforestation, forest management and social forestry. Natural depletion of vegetation- Endangered and threatened. Economic plants of India and red data book, Ex-situ and In-situ conservation. National parks and sanctuaries.

Energy resources: conventional and non-conventional sources of energy.

Biodiversity: Significance, types, depletion, conservation of biodiversity.

UNIT 4:

15 Hours.

Pollution: Introduction, causes, effects and control measures of Water pollution, Air pollution, Soil pollution, Acid rain, Global warming, and Ozone depletion. Sewage and waste water treatment. Methods of effluent treatment of industrial waste water, sludge disposal and its care related to environment.

Reference:

1. Sharma P.D. (1993)-Ecology and Environment – Rastogi Publication, New Delhi.
2. Mishra R. - Ecology Work Book- Oxford and IBH, New Delhi.
3. Agarwal K.C. (1993)- Environmental Biology- Agro Botanical Publishers, Jodhapur.
4. Mishra K.C. (1992)- Manual of Plant Ecology – Oxford & IBH Publication, New Delhi.
5. Kochar P.L. (1980) – Plant Ecology – S. Nagin & Co., Jalandhar.
6. Kormandi E.J. (1984)- concept of Ecology- Printice Hall Ind., New Delhi.
7. Asthana R.K. (1998) – Environmental Problems and Solution- S.Chand & Co. Pvt, Ltd., New Delhi.
8. Verma P.S., V.K. Agarwal (1983) – Environmental Biology - S.Chand & Co. Pvt, Ltd., New Delhi.
9. Subramanyam N.S. A.V.S.S. Samburthy (2000)- Ecology- Narosa Publishing House, New Delhi.
10. Sharma O.P. (1993) – Ecology & Environmental Biology- Rastogi Publication, Meerut.
11. Nebel B.J. (1990) – Environmental Science – Printice Hall Indu. Pvt. Ltd. New Delhi.
12. Trivedi R.K. Etal (1987) – Practical Ecology – Anmol Publication, Jodhapur.
13. Rao K.S. (1971) - Fundamentals of Ecology – W.B. Saunders co. Philadelphia.
14. Shukla R.S. & Chandel P.S. (2000) – Plant Ecology – S.Chand & Co. Pvt. Ltd., New Delhi.
15. Odum, E.P 1983. Basic Ecology, Saunders, Philadelphia.
16. Mackenzie, A et al. 1999. Instant Notes in Ecology. Viva Books Pvt.Ltd Delhi.
17. For laboratory exercises
 - a. Krebs, C.J. 1989. Ecological Methodology. Harper and Row, New York.
 - b. Ludwig, J.A. and Reynolds, J.F. 1988. Statistical Ecology. Wiley. New York.
 - c. Moore, P.W. and Chapman, S.B. 1986. Methods in plant Ecology. Blackwell scientific publications.

Fourth Semester B.Sc.Botany Practicals

Paper Title: Ecology, Environmental Biology & Phytogeography	Marks:Th-40+IA-10
Paper Code:SEPBSCBOTP-4	Total hours:40
Teaching Hours:4Hours/Week	Credits:02

PRACTICAL

1. Study of frequency and density of herbaceous plants by quadrat method.
2. To determine moisture content and water holding capacity of different types of soils.
3. To determine the pH of water samples (Tap, Pond and River).
4. Study of Ecological instruments.
5. Morphology and anatomical adaptations in hydrophytes.
6. Morphology and anatomical adaptations in xerophytes: One succulent and one non-succulent, one epiphyte.
7. Physico-chemical analysis of waste water (pH, turbidity, TDS).
8. Visit to near by effluent treatment plant to study recycling of waste water/ Forest Ecosystem /Pond Ecosystem.
9. Assignment of Project related to practical number eight.
10. Study Tour of minimum two days to study forest types and ecological groups.

RANI CHANNAMMA UNIVERSITY, BELAGAVI
B.Sc. IV Semester (SEP) Botany Practical Examination
Subject: Ecology, Environmental Biology and Phytogeography

TIME: 4 HOURS

MAX MARKS: 40

- Q.1. Give the external and internal features of ecological adaptations with neat labelled diagrams of specimen- A. 08 Marks
- Q.2. Determine the moisture content /water holding capacity of sample 'B'. 05 Marks
- Q.3. Determine pH/ turbidity/ TDS of water sample- C 06 Marks
- Q.4. a. Identify and describe the features of ecological interest in slide D. 03 Marks
- b. Describe the use and working mechanism of ecological instrument E. 03 Marks
- Q. 5. Submission of Project report. 05 Marks
- Q. 6. Submission of Study tour report 05 Marks
- Q. 7. Journal 05 Marks

RANI CHANNAMMA UNIVERSITY, BELAGAVI
B.Sc. IV Semester (SEP) Botany Practical Examination
Subject: Ecology, Environmental Biology And Phytogeography

Instructions To Examiners.

- Q.1. Ecology specimen -A (Hydrophyte/Xerophyte/Epiphyte) 08 marks
(External and internal ecological adaptations- 5 marks, diagram-2 marks, mentioning habitat- 1mark)
- Q.2. Moisture content /water holding capacity of sample -B (Red/Black/Sandy Soil). 05 marks
(Performing experiment and procedure-3 marks, calculation and result-2marks).
- Q.3. Analysis of sewage and waste water sample –C
(Industrial/Domestic). 06 marks
(PH/ turbidity/TDS Procedure-3marks Result-3 marks).
- Q.4. a-Ecological slide- D (Velamen/sunken stomata/multilayered epidermis) 03 marks
(Identification -1mark, description -2 marks)
- b- Ecological instrument-E 03marks
(Identification-1mark, working mechanism and use -2marks)
- Submission of project 05 marks.
- Study tour report 05 marks.
- Journal 05 marks.



RANI CHANNAMMA UNIVERSITY, BELAGAVI

VIDYASANAGAMA

Accredited with B+ Grade by NAAC

FACULTY OF SCIENCE: DEPARTMENT OF BOTANY
QUESTION PAPER PATTERN

PAPER CODE:--SEPBSCBOTT3

Title of the paper: Plant Anatomy and Embryology

Time: 3 Hours

Max.Marks:80

I. Answer any TEN of the following

10X2=20

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

II. Answer any SIX of the following

5X6=30

- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20

III. Answer any THREE of the following

3X10=30

- 21
- 22
- 23
- 24
- 25

Instructions to the Question paper setting

Q.No. 1-12 Three questions from each Unit

Q.No. 13-20 Two questions from each Unit

Q.21 and 22 from Unit- I

Q.23 from Unit -II

Q.24 from Unit – III

Q.25 from Unit -IV



RANICHANNAMMA UNIVERSITY, BELAGAVI

VIDYASANAGAMA

Accredited with B+ Grade by NAAC

FACULTY OF SCIENCE: DEPARTMENT OF BOTANY

QUESTION PAPER PATTERN

PAPER CODE:--SEPBSCBOTT4

Title of the paper: Ecology, Environmental Biology and Phytogeography

Time: 3 Hours

Max.Marks:80

I. Answer any TEN of the following

10X2=20

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

II. Answer any SIX of the following

5X6=30

- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20

III. Answer any THREE of the following

3X10=30

- 21
- 22
- 23
- 24
- 25

Instructions to the Question paper setting

Q.No. 1-12 Three questions from each Unit

Q.No. 13-20 Two questions from each Unit

Q.21 and 22 from Unit- I

Q.23 from Unit –II

Q.24 from Unit – III

Q.25 from Unit –IV

Course Title & Code	Elective 2: WASTE MANAGEMENT		
Semester IV	Teaching Hours:3/Week	Credits:2	Total Hours: 30
Learning Objective	<ul style="list-style-type: none"> • To acquire deep knowledge in solid waste management • To learn the treatment techniques for the scientific disposal of solid waste 		
Course Outcomes	<p>After completion of this course the students will be able to</p> <p>CO1 - Obtain a deep knowledge in waste collection and transport. CO2 - Know about resource recovery from waste. CO3 - Learn the landfill techniques to apply in the field. CO4 - Apply the knowledge to identify the hazardous waste. CO5 - Learn the techniques for biomedical waste disposal.</p>		
Unit I	<p>Waste Management : Introduction, classification and source generation of waste. Handling and Management of wastes. Land disposal of solid waste; Sanitary landfills – site selection, design and operation of sanitary landfills, landfill gas and Landfill bioreactor– Dumpsite Rehabilitation. Processing & Recovery: storage and processing including segregation, transfer and transport, handling equipment, Processing techniques: purpose of processing, volume reduction by incineration, mechanical volume reduction (compaction), mechanical size reduction (shredding), component separation (manual and mechanical methods). Recovery and recycling of useful solid wastes, Recovery of biological conversion products: Compost (Vermicompost) and Biogas. Municipal solid waste rules. 15Hrs</p>		
Unit II	<p>Hazardous Waste Management: Introduction, definitions, identification. Sources, Impacts, transportation modes, regulations, control, handling, storage and recycling. Biomedical and chemical wastes- Biomedical wastes types, handling, control of biomedical wastes and disposal methods. Chemical wastes: Sources, industrial inorganic pollutants, effects, need for control. Treatment and disposal techniques. Physical, chemical and biological methods to treat chemical wastes. Health and Environmental effects of chemical wastes. 15Hrs</p>		
Text Books	<p>References:-</p> <ol style="list-style-type: none"> 1. Henry J. Pepler, 1979, Microbial Technology: Fermentation technology, Academic Press. 2. Gupta.D.K, Sonarkar, Nimbalkar, 2010, Solid waste Management. 3. Bhide and Sundaresan, 2000, Solid Waste management in Developing countries – Indian National Scientific documentation center-, New Delhi. 4. Gupta.D.K, Sonarkar, Nimbalkar, 2010, Solid waste Management. 5. Bhide and Sundaresan, 2000, Solid Waste management in Developing countries – Indian National Scientific documentation center-, New Delhi. 		

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|--|---|
| | <ol style="list-style-type: none">6. John Pichtel, 2005, Waste Management Practices, CRC Press, Taylor and Francis Group.7. LaGrega, M.D., Buckingham, P.L. and Evans, J.C., 2010, Hazardous Waste Management, McGraw Hill International Editions, New York.8. Richard J. Watts, 2008, Hazardous Wastes - Sources, Pathways, Receptors John Wiley and Sons, New York.9. Lie, D.H.F. and Liptak, B.G., 2000, Hazardous Wastes and Solid Wastes- Lewis publishers, New York.10. La Grega, M.D., Buckingham, P.L. and Evans J.C., 2001, Hazardous Waste Management, II Ed, Mc Graw Hill Inc.,. |
|--|---|

Question paper pattern for Elective

Third Semester B.Sc. Degree Examination Botany

Elective 2

Time: 2 hours

Max. Marks: 40

Q. I. Answer any FIVE of the following.

5X2=10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

Q. II. Answer any THREE of the following.

3X5=15

- 9.
- 10.
- 11.
- 12.
- 13.

Q. III. Answer any THREE of the following.

3X5=15

- 14.
- 15.
- 16.
- 17.
- 18.

Instruction to Question Paper Setting.

4. Question number I has 1-8 sub questions consisting of 4 questions from each unit. Each question carries two marks. Student has to answer any five questions.
5. Question number II has 9-13 sub questions from Unit - I.
6. Question number III has 14-18 sub questions from Unit - II.

Elective I and II Internal Assessment Pattern		
Component	Internal Test	Reduced to
C1	20	5
C2	20	5
	Total	10

Course Title & Code	SKILL 1 : Skill Based Learning Biological Instrumentation and Methodology		
Semester IV	Semester- IV	Credits:2	Hours/weeks: 30
Learning Objective	<ul style="list-style-type: none"> To acquire deep knowledge in Instruments To learn the method of operation and its use. 		
Course Outcomes	Upon completion of this course the students will be able to		
	CO1	1. Understand the Principles of microscopy	
	CO2	2. Understand the structure and functioning of various biological instruments	
	CO3	3. Handling and use of instrument.	
Practical 1	Study and handling of compound and dissecting microscopes. Technique of handling micropipettes . Knowledge about common toxic chemicals and safety measures in their handling.		
Practical 2	Centrifugation: Handling of centrifuge PH meter: Principle, working application and handling.		
Practical 3	Spectrophotometry: Principle , working application and handling Colorimeter: Principle , working application and handling		
Practical 4	Autoclave: Principle, working application and handling. Laminar airflow : Principle , working application and handling		
Practical 5	Incubator and Oven: Principle, working, uses and handling. Haemocytometer: Principle, working, uses and handling.		
Practical 6	Microtome: principle, working, uses and handling.		
Practical 7	Camera Lucida : Principle, uses and handling		
Practical 8	Visit to research lab		
Text Books	References:- <ol style="list-style-type: none"> 1. Bajpai, P.K. 2006. Biological Instrumentation and methodology. S. Chand & Co. Ltd. 2. K. Wilson and J. Walker Eds. 2005. Biochemistry and Molecular Biology. Cambridge University Press. 3. K. Wilson andKHGoulding. 1986. Principles and techniques of Practical Biochemistry. (3 edn) Edward Arnold, London. 4. Dawson, C. (2002). Practical research methods.UBS Publishers, New Delhi. 5. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong. 6. Ruzin, S.E. (1999). Plant micro technique and microscopy. Oxford University Press, New York, U.S.A. 		

RANI CHANNAMMA UNIVERSITY, BELAGAVI
B.Sc. IV Semester (SEP) Botany Practical Examination
Skill I: Skill Based Learning
Course title: Biological Instrumentation and Methodology

TIME: 4 HOURS

MAX MARKS: 40

- | | |
|--|----------|
| Q.1. Determine the cell count by Haemocytometric method of sample 'A'. | 08 Marks |
| Q.2. Determine the pH of given sample 'B'. | 05 Marks |
| Q.3. Demonstrate the working mechanism of the instruments 'C' and 'D' | 06 Marks |
| Q.4. Identify and comment on E, F, G and H. | 12 Marks |
| Q. 5. Journal | 05 Marks |

RANI CHANNAMMA UNIVERSITY, BELAGAVI
Skill I: Skill Based Learning
Course title: Biological Instrumentation and Methodol
Instructions To Examiners.

- | | |
|--|-----------|
| Q.1. Algal sample/pollen grains/ fungal spores.
(Procedure- 5 marks, calculation-3 marks) | 08 marks |
| Q.2. Tap/ pond/river water samples
(Performing experiment and procedure-3 marks, tabulation and result-2marks). | 05 marks |
| Q.3. Centrifuge/Autoclave/camera lucida/ laminar airflow/microtome.
(Procedure and working mechanism of any two C and D). | 10 marks |
| Q.4. Identify and comment on E, F, G and H
(other than instruments given in C and D) | 12 marks. |
| Q. 5. Journal | 05marks |

Fifth Semester B.Sc. (Botany) Paper-1
SEP Syllabus- 2026-27

Paper Title: Plant Taxonomy, Economic and Medicinal Botany	Marks:Th- 80 + IA-20
Paper Code:SEPBSCBOTT-5	Total hours:60
Teaching Hours:4 Hours/Week	Credits:03

Course Outcomes (COs): After the successful completion of the course, the student will be able to:

CO1.Understanding the main features in Angiosperm evolution
 CO2.Ability to identify, classify and describe a plant in scientific terms, 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 Botanical gardens(Indian and world),
 CO5.Recognition of locally available angiosperm families and plants and economically important plants.
 CO6.Recognition of locally available economic and medicinal important plants .

Unit I: 15 Hours

Morphology: Study of roots, stems and its modifications, Leaf- types, stipules, Phyllotaxy and their modifications. Study of Inflorescences, flowers (Floral formula and Floral diagram to be included) and fruits.

Angiosperm Systematics: Botanical nomenclature- ICN, principles and rules, taxonomic ranks, type concept and principle of priority.

Classification of Angiosperms: Systems proposed by Bentham and Hooker, Engler Prantl. Their salient features, merits and demerits.

Unit II: 15 Hours

Plant descriptions: Detailed study of Common terminologies used for description of vegetative and reproductive parts.

Study of Classification, Key character, salient features, floral formula and floral diagram with economic importance of Angiosperm families: Annonaceae, Brassicaceae, Malvaceae, Fabaceae (with sub Families), Apiaceae, Cucurbitaceae, Rutaceae, Rubiaceae, Asteraceae, Verbenaceae, Apocynaceae, Amaranthaceae, Solanaceae, Lamiaceae, Euphorbiaceae, Orchidaceae , Liliaceae, Arecaeae and Poaceae.

Herbarium: Techniques and its importance, Botanical survey of India.

Unit III: 15 Hours

Family, Botanical name and parts used and economic importance of following plants-

Fruits: Mango, Cashew, Grapes, Coconut, Areca Nut.

Cereals: Rice, Wheat, Jowar, Bajra, Maize.

Pulses : Red gram, Green gram, Horse gram, Black gram, Bengal gram, Pigeon pea .

Vegetables: Brinjal, Tomato, Chilly, Tamarind, Bitter gourd, Luffa.

Fibres: Cotton, Jute.

Oil yielding plants: Ground nut, Sunflower, Palm oil, Castor oil.

Paper & pulp: Bamboo & Eucalyptus

Spices: Ginger, Clove, Cinnamom, Hing and Cardamom.

Beverages: Tea, Coffee.

Rubber: *Hevea brasiliensis* (Rubber tree). *Ficus elastica* (Indian Rubber Tree)

Unit IV:**15 Hours**

Medicinal Botany: Common medicinal plants in primary health care: Family, Vernacular names, parts used & medicinal importance - *Tinospora cordifolia*, *Oscimum sanctum*, *Aloe-vera*, *Curcuma longa*, *Withania somnifera* and *Rauwolfia serpentina*, *Catharanthus roseus*, *Vitex nigundo*, *Leucas aspera*, *Embllica officinalis*, *Azadirachta indica*, *Cinchona officinalis*, *Abutilon indicum*, *Andrographis paniculata*, *Gloriosa superb*, *Aegle marmelos*, *Phyllanthus emblica*, *Gymnema sylvestre*, *Achyranthus aspera*, *Calotropis gigantia*, *Centella asiatica*, *Bcopa monnieri*.

SUGGESTED REFERENCE BOOKS:

1. Davis, P.H. and Heywood, V.H. 1963. Principles of angiosperm taxonomy. Oliver and boyd, London.
2. Heywood, V.H. and moore, D.M. (EDS) 1984. Current concepts in plant taxonomy academic press, London
3. Jeffery, C. 1982. An introduction to plant taxonomy. Cambridge university press, cambridge, London.
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5. Radford, A.E. 1986. Fundamentals of plant systematics. Harper and Row, newyork.
6. Singh, G. 1999. Plant systematics; theory and practice. Oxford and IBH, newdelhi.
7. Atace, C.A. 1989. Plant taxonomy and bio systematics (2nd edition). Edward Arnold, London.
8. Dutta, S.C. 1988. systematic botany. walleyeastern, newdelhi.
9. Jaques, H.E. 1999, Plant families- how to know them. IBS, newdelhi.
10. Lawrence, G.H.M. 1951. Taxonomy of vascular plants. Macmillan, newdelhi.
11. Stewart, W.M. 1983. Paleobotony and the evolution of plants, cambridge university press, cambridge.
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16. College botany vol 1 by Gangulee, Das and Datta. New central book agency, Calcutta.
17. Systematic botany by R.N Sutaria.
18. Taxonomy of Angiosperms by B.P. Pandey.
19. Kocchar, S.L. 1998. Economic Botany in Tropics. 2nd edition, Macmillian Ltd, New Delhi .
20. Sambamurthy, A.V.S.S and subramanyam, N.S. 1989. A Text Book of Economic Botany, Wiley Eastern Ltd. New Delhi .
21. Sharma, O.P. 1996. Hill's Economic Botany. Tata McGraw Hill Co., Ltd., New Delhi.
22. Simpson, B.B. and Conner-Ogorzaly, M. 1986. Economic Botany-plants in our world. McGraw Hill, New York.
23. Hill. A.F. 1989. Economic Botany. Tata McGraw-Hill, New York.
24. Herbs Cultivation and Medicinal Uses- H. Panda – NIIR Publication, New Delhi.
25. Chopra R.N., Badhuvar R.L. & Ghosh G. (1965) - Poisons Plant of India.
26. Jain S.K. – Medicinal Plants.
27. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.

**Fifth Semester B.Sc. (Botany) Practical
SEP Syllabus- 2026-27**

Paper Title: Botany – 5P	Marks:Th- 40 + IA-10
Paper Code:SEPBSCBOT P-05	Total hours: 4/Week
Teaching Hours: 4 Hours/Week	Credits:02

Practicals

1. Study of the morphology of root, stem, and leaf, and their modifications.
2. Study of inflorescence and its different types.
3. Study of Flower – I: Descriptive terms, thalamus, calyx, corolla, and aestivation.
4. Study of Flower – II: Androecium and gynoecium; floral formula and floral diagram.
5. Study of different types of fruits.
6. Study of any 18 families representing Polypetalae, Gamopetalae, and Apetalae groups. (as per syllabus)
7. Study of monocot plants available in the locality.
8. Study of economic botany and medicinal plants (as per syllabus) available in the locality.
9. Study tour for a minimum of two to four days to study the flora (taxonomy).

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 40 marks for the Semester end examination

BOTANY PRACTICAL - 5

Time: 04 hrs

Max. Marks: 40

1. Assign the specimens **A, B & C** to the respective families giving diagnostic features and their classifications. **15 Marks**
2. Draw the floral diagram and write the floral formula of specimen “**D**” **03 Marks**
3. Identify & Explain morphological peculiarities observed in the specimens **E, F & G.** **06 Marks**
4. Identify giving botanical name and family of specimens **H, I & J.** Mention the parts used & their uses. **06 Marks**
5. Certified Practical record. **05 Marks**
6. Study Tour report & Submission of 5 Herbarium **05 Marks**

General instructions:

1. Assign the specimens **A, B & C** (Polypetalae or Gamopetale or Monochlamydeae or Monocot families)
(Identification & Classification-2 mark & distinguishing characters-3 marks.) **15 Marks**
2. Specimen “**D**”
(Floral formula 1 Marks and floral diagram 2 Marks.) **03 Marks**
3. Specimens **E-root, F-stem/ leaf & G-inflorescence/ fruit.**
(Identification- 1 Mark, Explanation-1 Mark) **06 Marks**
4. Specimens **H, I & J** (Economic crops & Medicinal plants)
(Identification- 1 Mark, Explanation-1 Mark) **06 Marks**
5. Certified Practical record. **05 Marks.**
6. Study tour report & 5 Herbarium Submission **05 Marks**

Fifth Semester B.Sc. (Botany) Paper-2
SEP Syllabus- 2026-27

Paper Title: Plant Breeding, Tissue Culture and Biotechnology	Marks:Th- 80 + IA-20
Paper Code:SEPBSCBOTT-6	Total hours:60
Teaching Hours:4 Hours/Week	Credits:03

Course Outcome:

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

- Understand the principles, objectives and significance of plant breeding in crop improvement.
- Identify the centres of origin of crop plants and methods of plant introduction and acclimatization.
- Apply methods of selection, hybridization and heterosis in the improvement of crop plants.
- Understand the concepts and techniques of plant tissue culture and their applications.
- Explain the tools, steps and techniques of plant genetic engineering and gene transfer methods.
- Evaluate the applications and biosafety aspects of transgenic crops such as Golden Rice and Bt cotton.

Unit-I

15Hours

Plant Breeding: Introduction and objectives. Important achievements and undesirable consequences of plant breeding. Methods of crop improvement. Plant Introduction: Centers of origin and domestication of crop plants, plant genetic resources, Acclimatization. Selection methods: Self-pollinating and cross-pollinating plants and types of vegetative propagation in plants.

Unit-II

15Hours

Hybridization: self, cross and vegetative propagation in plants – Procedure, advantages and limitations.

Inbreeding depression and heterosis: History, genetic basis of inbreeding depression and heterosis; Applications. Role of mutations in crop improvement; Polyploidy; Distant hybridization and role of biotechnology in crop improvement.

Unit-III

15Hours

Plant Tissue Culture: History and Scope, concept of cellular totipotency. Basic aspects of plant tissue culture- Sterilization, Culture media (MS Media) and its preparation. Role of growth hormones in plant tissue culture. Types of cultures-Callus culture and Organogenesis. Pollen culture and haploid plant production. Embryo culture. Somatic embryogenesis and synthetic seeds. Protoplast culture and somatic hybridization techniques. Application of plant tissue culture in Agriculture, Forestry and Industries.

Unit-IV

15Hours

Plant Biotechnology: Introduction to Plant Genetic Engineering. Tools used in genetic engineering: Enzymes- Restriction endonucleases, DNA ligase, Vectors - pBR 322, Ti plasmid. General steps of recombinant DNA technology using plasmid vectors and bacterial host cell. PCR and its application. Gene transfer methods to plant cells: Agrobacterium based gene transfer technique, Direct gene transfer – microinjection, electroporation, microprojectile techniques. Plant regeneration from transformed cells. Transgenic plants: Definition and examples, Steps involved in the production of golden rice and Bt cotton. Applications and threats from transgenic plants.

SUGGESTED REFERENCE BOOKS:

1. Allard R.W (1999): The Principles of Plant Breeding, John & Wiley and Sons.
2. Poelman J.M: Breeding Field Crops, Springer.
3. George Acquaaah (2012): Principles of Plant Genetics & Breeding: Wiley-Blackwell.
4. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
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8. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
9. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
10. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
11. Gupta P.K. (2010), Plant Biotechnology, Rastogi Publications, Meerut.
12. Monica Jain (2014), Environmental Biotechnology, Narosa Publishing House, New Delhi.
13. Mohapatra, P. K. (2007), Textbook of Environmental Biotechnology, IK International, New Delhi.

Paper I and II Internal Assessment Pattern			
Evaluation Component	Assessment Type	Marks	Reduce to
C1	1 st IA Test	20	5
C1	Assignment	5	5
C2	2 nd IA Test	20	5
C2	Attendance	5	5
Total IA Marks			20

RANICHANNAMMA UNIVERSITY, BELAGAVI
VIDYASANAGAMA
FACULTY OF SCIENCE: DEPARTMENT OF BOTANY
QUESTION PAPER PATTERN
PAPER CODE:–SEPBSCBOTT 5 & 6
Paper 1 & Paper 2

Time: 3 Hours

Max.Marks:80

I. Answer any TEN of the following

10X2=20

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

II. Answer any SIX of the following

5X6=30

- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20

III. Answer any THREE of the following

3X10=30

- 21
- 22
- 23
- 24
- 25

Instructions to the Question paper setting

Q.No. 1-12 Three questions from each Unit

Q.No. 13-20 Two questions from each Unit

Q.21 and 22 from Unit- I

Q.23 from Unit –II

Q.24 from Unit – III

Q.25 from Unit –IV

Course Title & Code	SKILL II : Skill Based Learning Nursery and Garden Management		
Semester V	Semester- V	Credits:2	Hours/weeks: 4hours/Week

Course Outcome:

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

- Plan, design and establish a functional nursery with appropriate layout and infrastructure.
- Apply practical skills in seed sowing, vegetative propagation, transplanting and plant hardening.
- Prepare and use potting media, organic manures and eco-friendly plant protection measures.
- Develop and maintain lawns, herbal/ornamental gardens and small garden units for sustainable use and self-employment.

PRACTICALS

- 1. Layout and Planning of a Nursery** ▪ Preparation of a simple nursery layout plan showing mother beds, seed beds, potting area, compost pit, and irrigation channels.
Skill gained: Nursery planning and space management
- 2. Soil Preparation and Potting Mixture Preparation** ▪ Preparation of potting mixture (soil : sand : compost in suitable proportion) and filling of pots/polybags.
Skill gained: Media preparation and soil handling
- 3. Seed Sowing Techniques** ▪ Sowing of seeds in nursery beds, trays, and polybags; labeling and watering methods.
Skill gained: Nursery sowing and record maintenance
- 4. Vegetative Propagation by Cuttings** ▪ Preparation and planting of stem cuttings of ornamental/medicinal plants.
Skill gained: Clonal propagation techniques
- 5. Propagation by Layering or Grafting** ▪ Demonstration and practice of layering or grafting in suitable plants.
Skill gained: Advanced vegetative propagation
- 6. Preparation and Application of Organic Manures and Biofertilizers** ▪ Preparation of compost/vermicompost and application to nursery plants.
Skill gained: Organic nutrient management
- 7. Transplanting and Hardening of Seedlings** ▪ Transplanting nursery seedlings to pots or garden beds and demonstrating hardening techniques.
Skill gained: Seedling management and acclimatization
- 8. Identification and Management of Common Nursery Pests and Diseases** ▪ Identification of common pests/diseases and preparation of simple botanical pesticides (e.g., neem extract).
Skill gained: Plant protection and eco-friendly management
- 9. Lawn Preparation and Maintenance** ▪ Preparation of lawn bed, sowing of grass seeds or turfing, watering, trimming.
Skill gained: Lawn establishment and maintenance
- 10. Preparation of a Mini Garden / Terrace Garden / Herbal Garden** ▪ Designing and developing a small garden unit with ornamental, medicinal, and seasonal plants.
Skill gained: Garden design and maintenance skills

RANI CHANNAMMA UNIVERSITY, BELAGAVI
B.Sc. V Semester (SEP) Botany Practical Examination
Skill II: Skill Based Learning
Course title: Nursery and Garden Management

TIME: 4 HOURS

MAX MARKS: 40

- | | |
|---|-----------------|
| Q.1. Prepare potting mixture and fill pots/polybags with suitable medium. | 08 Marks |
| Q.2. Perform seed sowing in nursery bed/tray and label the plants. | 05 Marks |
| Q.3. Demonstrate vegetative propagation method using the plant material 'C' and 'D'. | 10 Marks |
| Q.4. Identify and comment on E, F, G and H. | 12 Marks |
| Q.5. Certified Practical record. | 05 Marks |
-

RANI CHANNAMMA UNIVERSITY, BELAGAVI
Skill II: Skill Based Learning
Course title: Nursery and Garden Management
Instructions to Examiners

- | | |
|---|-----------------|
| Q.1. Preparation of potting mixture (soil : sand : compost) and filling of pots/polybags.
(<i>Procedure – 5 marks, proportion & method – 3 marks</i>) | 08 Marks |
| Q.2. Seed sowing using any seasonal/ornamental/vegetable crop.
(<i>Sowing technique – 3 marks, labeling & watering – 2 marks</i>) | 05 Marks |
| Q.3. Vegetative propagation by any two methods: cutting/layering/grafting using plant material 'C' and 'D'.
(<i>Procedure – 6 marks, explanation – 4 marks</i>) | 10 Marks |
| Q.4. Identify and comment on E, F, G and H (any four):
Nursery tools / compost / vermicompost / seed tray / polybag / biofertilizer / pest or disease symptom / lawn grass sample.
(<i>Identification – 4 marks, comments – 8 marks</i>) | 12 Marks |
| Q.5. Certified Practical record. | 05 Marks |

SUGGESTED REFERENCE BOOKS:

1. Plant Propagation and Nursery Management - B. S. Chundawat
 2. Principles and Practices of Plant Propagation and Nursery Management -C.
 3. Rajamanickam, A. Subbiah, J. Rajangam, et al.
 4. Essentials of Plant Nursery Management -P. K. Ray
 5. Nursery Management and Horticulture Crops - D. C. Meena, Abu Nayyer & Deepa Lal
 6. Nursery Management of Fruit Crops in India -Prashant Joshi
 7. Plant Propagation: Principles and Practices -H. T. Hartmann & D. E. Kester
 8. Propagation of Horticultural Crops -T. K. Bose, Mitra & Sandhu
 9. Vegetative Propagation of Plants - K. K. Nanda & V. K. Kochhar
 10. Basic Horticulture -J. Singh
 11. A Handbook for Skill Development: Nursery Management of Horticultural Crops — Deepa H. Dwivedi & Navaldey Bharti
-

Sixth Semester B.Sc. (Botany) Paper-1
SEP Syllabus- 2026-27

Paper Title: Cell and Molecular Biology (Theory)	Marks:Th- 80 + IA-20
Paper Code:SEPBSCBOTT-7	Total hours:60
Teaching Hours:4 Hours/Week	Credits:03

Course objectives:

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

Course outcome:

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

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

Unit – 1

15 Hours

Cytology: Structure of plant cell, Ultra-structure and functions of cell wall, plasma membrane- fluid-mosaic model, endoplasmic reticulum, chloroplast, ribosomes, golgi complex, mitochondria, peroxisome, plastids and vacuole. Ultra structure of nucleus - nuclear membrane, nuclear pore complex and nucleolus. Ergastic substances in plant cells.

Unit-2

15 Hours

Cell Division and Chromosomes: History, types and functions of chromosomes. Giant chromosomes, Polytene chromosome and Lampbrush chromosome. Types of chromosomes based on centromere position, Autosomes and Allosomes, structure of metaphase chromosome, Ultra structure of Chromosomes- Nucleosome model. Cell cycle, Mitosis in plant cells– karyokinesis and cytokinesis, Meiosis in plant cells, significance of mitosis and meiosis.

Unit-3

15 Hours

Structure, Chemistry of Nucleic acids: Experiments to prove DNA as genetic material – Griffith experiment, Avery. Hershey - Chase experiment. DNA: Chemical composition, types -A, B and Z-DNA, structure-Watson & Crick model, RNA Polymerase, Semiconservative replication of DNA. RNA: Structure and functions of m RNA, t RNA and r RNA.

Unit-4

15 Hours

Structure, Regulation and Expression of Gene: Cistron, recon and muton concept. Prokaryotic and eukaryotic genes. Genetic code and its properties. Regulation of gene expression in prokaryotes- Lac operon model. Tryptophan operon model. Gene regulation in eukaryotes- Transcription (Prokaryotes and Eukaryotes) and Translation (Protien synthesis in Prokaryotes and eukaryotes), process of Gene splicing, post transcriptional changes.

SUGGESTED REFERENCE BOOKS:

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

**Sixth Semester B.Sc. (Botany) Practical
SEP Syllabus- 2026-27**

Paper Title: Botany – 6P	Marks:Th- 40 + IA-10
Paper Code:SEPBSCBOT P-06	Total hours: 4/Week
Teaching Hours: 4 Hours/Week	Credits:02

Cell and Molecular Biology

1. Study of ergastic substances - starch (potato), aleurone (wheat grain), calcium oxalate (Pistia), calcium carbonate (Ficus leaf), oil globules (castor seed) and Raphides (Colocasia petiole)
2. Study of different stages of mitosis by squash technique using Onion root tip
3. Study of different stages of meiosis using permanent slides.
4. Measurement of length and breadth of cells by micrometry technique (Using Onion or Rhoeo leaf cells)

Plant Physiology and Plant Biochemistry

5. Experiment to demonstrate the phenomenon of exosmosis and endosmosis.
6. To determine the plasmolysis using hypertonic solution in *Rhoeo discolor* leaves . (Major)
7. To demonstrate transpiration pull in plants.
8. To demonstrate that oxygen is liberated in the process of photosynthesis.
9. Separation of photosynthetic pigments by paper chromatography and measure their Rf values (Major)
10. To Study of Phototropism.
11. Qualitative test for Starch, Protein, Reducing Sugars and Lipids.

SCHEME OF PRACTICAL EXAMINATION

(Distribution of marks): 40 marks for the Semester end examination

BOTANY PRACTICAL 6P

Time: 04 hrs

Max. Marks: 40

- | | |
|--|----------|
| 1. Preparation of squash of material A , identify, Sketch and label the any two stages with reasons | 08 marks |
| 2. Conduct Major Experiment B | 08 marks |
| 3. Find out cell length and breadth of the given material C using micrometry | 05marks |
| 4. Comment on minor Experiments D & E | 06 marks |
| 5. Identify the slides F & G | 04 marks |
| 6. Micro Chemical test H | 04 marks |
| 7. Certified Practical record. | 05 marks |

General instructions:

1. Give specimen for Mitosis from Onion (**A**)
2. Plasmolysis/paper chromatographic separation of pigments (**B**)
3. Give specimen from Onion/ *Rhoeo* leaf (**C**)
4. O₂ evolution/ transpiration pull experiments/ Phototropism. (**D & E**)
5. Give slide from meiosis (**F & G**)
6. Qualitative tests for Starch/ Protein/ Reducing Sugars/ Lipids (**H**)
7. Certified Practical record.

Sixth Semester B.Sc. (Botany) Paper-2
SEP Syllabus- 2026-27

Paper Title: Plant Physiology and Plant Biochemistry (Theory)	Marks:Th- 80 + IA-20
Paper Code:SEPBSCBOTT-8	Total hours:60
Teaching Hours:4 Hours/Week	Credits:03

Course objectives:

- To understand the various physiological life processes in plants
- To study the importance of the physiological processes and their mechanism
- To study the role of various metabolites and their importance

Course Outcomes (COs):

After the successful completion of the course, the student 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 metabolism in a plant body.
- CO5.To understand the importance of nutrients in plant metabolism and crop yield.

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, Mechanism of guard cell movement, K⁺ ion mechanism, Antitranspirants.

Mechanism of ascent of sap: Vital and physical force theories.

Phloem Transport: Transport of organic solutes. Path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis.

Mineral nutrition: Micro and macro nutrients - their importance and deficiency symptoms.

Unit- II

Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C₃, C₄ and CAM pathways of carbon fixation; Photorespiration.

Respiration: Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, Oxidative Pentose Phosphate Pathway.

Nitrogen metabolism: Biological nitrogen fixation: Nitrate and ammonia assimilation.

UNIT- III

Plant growth regulators: Definition and classification, Site of synthesis, biosynthesis pathway and metabolism and influence on plant growth development - Auxins, Gibberellins, 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, Aging & Cell Death (PCD and Autophagosis). Plant Movements

Unit- IV

Biochemistry : Introduction and scope of Biochemistry

Carbohydrates :Structure, Classification and functions of Carbohydrates

Enzymes: Classification, kinetics and mechanism of action.

Proteins and amino acids: Classification, structure - primary, secondary, tertiary and quaternary. Classification of Amino acids.

Vitamins: Classification, distribution, structure, production, function.

Lipids: Classification, structure, function and biosynthesis of fatty acids.

Secondary plant products: Structure, biosynthesis and distribution of terpenes, phenolics and nitrogen containing compounds.

SUGGESTED REFERENCE BOOKS:

1. Wilson, K. and Walker, J. 1994 Fundamentals of Biochemistry 2nd Ed, John Wiley and Sons Inc.
2. Jain V K, 2008. Fundamentals of Plant Physiology. S Chand and Co.
3. Kochhar P L, Krishnamoorthy H N. Plant Physiology. Atmaram and sons, Delhi.
4. Kumar and Purohit. Plant Physiology: Fundamentals and Applications. Agrobotanical Publishers.
5. Malik CP, 2002. Plant Physiology. Kalyani publishers.
6. Mukherjee S, Ghosh AK, 2005. Plant Physiology. New Central Book Agency, Calcutta.
7. Noggle GR, Fritz GJ, Introductory Plant Physiology. Prentice Hall of India.
8. Pandey SN, Sinha BK, 2006. Plant physiology. Vikas Publishing House, New Delhi.
9. Salisbury F B, Ross C W, 1992. Plant Physiology. CBS publishers and Distributors, New Delhi.
10. Sinha A K, 2004. Modern Plant Physiology. Narosa publishing House, New Delhi.
11. Srivastava H S, 2004. Plant physiology and Biochemistry. Rasthogi publications.
12. Verma V, 2007. Text Book of Plant Physiology. Ane Books Pvt. Ltd.

Paper I and II Internal Assessment Pattern			
Evaluation Component	Assessment Type	Marks	Reduce to
C1	1 st IA Test	20	5
C1	Assignment	5	5
C2	2 nd IA Test	20	5
C2	Attendance	5	5
Total IA Marks			20

RANICHANNAMMA UNIVERSITY, BELAGAVI
VIDYASANAGAMA
FACULTY OF SCIENCE: DEPARTMENT OF BOTANY
QUESTION PAPER PATTERN
PAPER CODE:–SEPBSCBOTT 7 & 8
Paper 1 & Paper 2

Time: 3 Hours

Max.Marks:80

I. Answer any TEN of the following

10X2=20

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

II. Answer any SIX of the following

5X6=30

- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20

III. Answer any THREE of the following

3X10=30

- 21
- 22
- 23
- 24
- 25

Instructions to the Question paper setting

Q.No. 1-12 Three questions from each Unit

Q.No. 13-20 Two questions from each Unit

Q.21 and 22 from Unit- I

Q.26 from Unit –II

Q.27 from Unit – III

Q.28 from Unit –IV

Course Title & Code	SKILL III : Skill Based Learning Herbal Powder and Cosmetic Preparations		
Semester VI	Semester- VI	Credits:2	Hours/weeks: 4hours/Week

Course Outcomes (CO)

- CO1:** Understand the principles and methods involved in the preparation of herbal powders (Churna) and herbal cosmetic formulations.
- CO2:** Identify, authenticate, and process crude plant materials used in herbal powder and cosmetic preparations.
- CO3:** Formulate and prepare various herbal powders and cosmetic products using appropriate techniques.
- CO4:** Perform evaluation tests such as organoleptic evaluation, particle size analysis, pH determination, and stability studies of prepared formulations.
- CO5:** Demonstrate knowledge of therapeutic uses, safety aspects, and quality control measures of herbal powder and cosmetic preparations.

CHURNA (HERBAL POWDER) PREPARATIONS

1. Preparation of Triphala Churna

Plant Products: Terminalia chebula – Pericarp, Terminalia bellirica – Pericarp, Phyllanthus emblica – Dried fruit

Uses: Mild laxative, antioxidant, digestive tonic, rejuvenator.

2. Preparation of Sitopaladi Churna

Plant Products: Cinnamomum verum – Bark, Elettaria cardamomum – Seeds, Piper longum – Fruit

Uses: Cough, cold, sore throat, improves respiratory health.

3. Preparation of Hingwashtak Churna

Plant Products: Ferula asafoetida – Oleogum resin, Cuminum cyminum – Seeds, Zingiber officinale – Rhizome

Uses: Carminative, relieves flatulence and indigestion.

4. Preparation of Laxative Churna

Plant Products: Senna alexandrina – Leaves, Foeniculum vulgare – Seeds

Uses: Treats constipation, mild purgative action.

5. Preparation of Antidiabetic Polyherbal Churna

Plant Products: Gymnema sylvestre – Leaves, Momordica charantia – Fruit, Trigonella foenum-graecum – Seeds

Uses: Helps in managing blood glucose levels.

6. Preparation of Tulsi Herbal Powder

Plant Product: Ocimum tenuiflorum – Dried leaves

Uses: Immunity booster, Useful in cough and cold, Antimicrobial and antioxidant, Supports respiratory health

7. Preparation of Ashwagandha Churna

Plant Product: Withania somnifera – Dried root

Uses: Adaptogen (reduces stress), Improves strength and stamina, Enhances immunity, General tonic

HERBAL COSMETIC PREPARATIONS (FACE PACKS)

8. Preparation of Neem Face Pack

Plant Product: Azadirachta indica – Leaves

Uses: Anti-acne, antibacterial, reduces skin inflammation.

9. Preparation of Turmeric Face Pack

Plant Product: Curcuma longa – Rhizome

Uses: Anti-inflammatory, improves complexion, reduces blemishes.

10. Preparation of Multani Mitti and Sandalwood Face Pack

Plant Product: Santalum album – Heartwood

Uses: Cooling effect, improves glow, reduces oiliness.

11. Preparation of Papaya Exfoliating Face Pack

Plant Product: Carica papaya – Fruit

Uses: Exfoliation, removes dead cells, brightens skin.

12. Preparation of Aloe Vera Face Pack

Plant Product: Aloe vera – Leaf gel

Uses: Moisturizing, soothing, reduces sunburn and irritation.

13. Preparation of Hibiscus Hair Pack Powder

Plant Product: Hibiscus rosa-sinensis – Flowers and leaves

Uses: Promotes hair growth, Reduces dandruff, Conditions hair naturally, Prevents premature graying.

Note: “Two cosmetic experiments with products applied on the faces of interested students.”

RANI CHANNAMMA UNIVERSITY, BELAGAVI
B.Sc. VI Semester (SEP) Botany Practical Examination
Skill III: Skill Based Learning
Course title: Herbal Powder and Cosmetic Preparations

TIME: 4 HOURS

MAX MARKS: 40

Practical Exercise	Marks
1. Preparation of Churnas “ A and B”	12
2. Preparation of Cosmetic Formulations “C and D”	12
3. Identification of given plant specimen and their uses “E, F, G and H”	12
4. Certified Practical record.	04

RANI CHANNAMMA UNIVERSITY, BELAGAVI
Skill III: Skill Based Learning
Course title: Herbal Powder and Cosmetic Preparations
Instructions to Examiners

1. Preparation of Churna **A and B** :Triphala Churna / Sitopaladi Churna/ Hingwashtak Churna/ Laxative Churna
(*Procedure-4 marks, Preparation-2 marks*) **12 marks**
2. Preparation of herbal cosmetic preparations “**C and D**”: Neem Face Pack/ Turmeric Face Pack/ Aloe Vera Face Pack/ Papaya Exfoliating Face Pack/ Hibiscus Hair Pack Powder/ Multani Mitti Face Pack
(*Procedure – 4 marks, Preparation – 2 marks*) **12 marks**
3. Plant specimen and their uses “E, F, G and H” - *Carica papaya* – Fruit, *Azadirachta indica* – Leaves,/ *Curcuma longa* – Rhizome/ *Santalum album* – Heartwood/ *Foeniculum vulgare* – Seeds/ *Phyllanthus emblica* – Dried fruit/ *Zingiber officinale* – Rhizome/ *Cinnamomum verum* – Bark, *Elettaria cardamomum* – Seeds, *Piper longum* – Fruit/ *Withania somnifera* – Dried root
(*Identification-1mark, uses-2 marks*) **12 marks**
4. Certified Practical record. **04 Marks**

SUGGESTED REFERENCE BOOKS:

Herbal Powder and Cosmetic Preparations

1. **Trease and Evans' Pharmacognosy** – William C. Evans, 16th Edition
 - Comprehensive coverage of herbal drugs, powder preparation, and standardization.
 - Good for both theory and practical insights.
2. **A Textbook of Pharmacognosy** – C.K. Kokate, Purohit, Gokhale, 56th Edition
 - Covers medicinal plant identification, extraction methods, and herbal formulations.
 - Widely used in herbal and pharmaceutical courses.
3. **Herbal Drug Technology** – Dr. M.K. Gupta
 - Practical aspects of herbal powders, extracts, and cosmetic preparations.
 - Includes preparation techniques, stability, and standardization.
4. **Cosmetic Science and Technology** – Balsam & Sagarin, Vol. 1 & 2
 - Focused on formulation of creams, lotions, and herbal cosmetics.
 - Includes testing, packaging, and stability considerations.
5. **Handbook of Cosmetic Science and Technology** – André O. Barel, Marc Paye, Howard I. Maibach
 - Practical reference for cosmetic formulations and quality control.
6. **Textbook of Cosmeceuticals and Cosmetic Formulations** – P.M. Dandekar
 - Explains herbal ingredients in cosmetics, formulation techniques, and safety.
7. **Pharmacognosy Practical Manual** – Dr. R. K. Sharma / Dr. Sunil Kumar
 - Step-by-step guidance for preparation of herbal powders and cosmetic products.
 - Includes practical exercises, observations, and lab evaluation methods.

END