

SKE Society's
Govindram Seksaria Science College (Autonomous), Belagavi

PROGRAM /COURSE STRUCTURE AND SYLLABUS

For

Bachelor of Science (Botany)

B.Sc. III & IV Semester

w.e.f.

Academic Year 2025-26 onward

GSS College (AUTONOMOUS), Belagavi

Accredited with A Grade by NAAC

DEPARTMENT OF BOTANY

Board of Studies in Botany

Sl. No	Name and Address	Designation
01	Dr. Y. B. Dalvi	Chairperson
02	Smt. B. R. Sholapurmath	Member
03	Dr. D. S. Patil	Member
04	Prof. M. S. Bagi	Subject Expert from other College During introducing special course)
05	Dr. K. N. Amruthesh	University Appointee
06	Dr. Ameresh Topalkatti	Subject Expert from non- parent University
07	Dr. K. P. Kolkar	Subject Expert from non- parent University
08	Smt. Shweta Deshpande	College Alumni
09	Shri. Shankara H. Langati	Representative from industry/ corporate sector/ allied areas

SKE Society's
Govindram Seksaria Science (Autonomous) College, Belagavi

FACULTY OF SCIENCE: DEPARTMENT OF BOTANY

Third Semester B.Sc. Botany 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, Tunica carpus and Quiescent centre. 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, microsporogenesis & microgametogenesis. Male germ unit Tapetum and its types, Pollen embryo sac. Palynology and its applications.

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

Types of embryo sac-Monosporic (Polygonum), Bisporic (Allium) & Tetrasporic (Drusa and Fritillaria.)

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 its significance. Endosperm – Development (Free nuclear, Cellular and Helobial), Special types of endosperm (Ruminant).

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
7. Evert, R.F. (2006) Esau's Plant Anatomy: Meristem, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. John Wiley and Sons, Inc
8. Fahn, A.1992. Plant Anatomy, Pergamon Press, USA
9. Johri, B.M. I., 1984.Embryology of Angiosperms, Springer-Verlag, Netherlands.
10. Karp G., 1985. Cell Biology; Mc.Graw Hill Company
11. Maheshwari,P 1950. An introduction to the embryology of angiosperms. New York: McGraw-Hill
12. Mauseth, J.D. (1988). Plant Anatomy, the Benjammin/Cummings Publisher, USA.
13. Nair P .K .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

G.S.S. College (Autonomous) Belagavi.
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

- a.
- b
- c
- d
- e
- f
- g
- h
- i
- j
- k
- l

II. Answer any SIX of the following

5X6=30

- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

III. Answer any THREE of the following

3X10=30

- 10
- 11
- 12
- 13
- 14

Instructions to the Question paper setting

Q.No. 1. a-l Three questions from each Unit

Q.No. 2-9 Two questions from each Unit

Q.10 and 11 from Unit- I

Q.12 from Unit -II

Q.13 from Unit – III

Q.14 from Unit -IV

Third Semester B.Sc. Botany Practical

PaperTitle:Botany-3P	Marks:Th-40+IA-10
PaperCode:SEPBSCBOT P03	hours: 04/WEEK
Teaching Hours:4Hours/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.
 - f) study of trichomes/stomata of different leaves found in different locality.

G.S.S. College (Autonomous) 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**

G.S.S. College (Autonomous) 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/Oil glands/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	The open elective course ‘Food Processing Technology’ in Semester-III includes the theory based units on • 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	Upon completion of this course the students will be able to Course Outcomes: After completion of the course, learners would be able to: CO1: Understand the objective, scope and importance of post-harvest and beverage processing and preservation technologies. CO2: Learn the various post-harvest handling and processing techniques for fruits, vegetables, and flowers for their better shelf-life. CO3: Understand Indian Government Schemes available for effective Post harvest management of horticultural crops. CO4: Develop required skills to have their own start-ups by processing fruits and vegetables into jam, jelly, squash, syrup, pickles, mix-herb powders. CO5: Classify and differentiate amongst the alcoholic and non-alcoholic beverages along with special reference to their botanical sources, processing techniques and health benefits.		
Unit I	Introduction to post-harvest technology: Scope and importance of post-harvest technology in horticultural industry. 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. 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. 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. 15Hrs		

Unit II	Beverages: Definition, classification/types (Non-alcoholic and Alcoholic beverages), Botanical sources, nutritional values, and health benefits. Processing and Role of Preservation Technology. Role of Fermentation technology in the Indian Beverage Industry. Non-alcoholic beverages: Tea, coffee, cocoa, neera, coconut water, kokum juice. Alcoholic beverages: Fermented beverage Fruit and floral wines: (Wines, Apple Cider, Perry), Brewed and fermented beverages Red beet juice (Beer and Sake), Distilled beverages (Spirits and Liquors). Industrial preparation of fermented and non-fermented beverages: Fruit squash, syrups, and fruit juices. Visit to distillery unit/cold storage/food processing unit. 15Hrs
Text Books	References : 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.

Question paper pattern for Elective

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.

G.S.S. College (Autonomous) 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 (photoperiodism, heliophytes and sciophytes), temperature (thermoperiodicity and vernalization), soil (development, soil profiles, physico-chemical properties), and biota. Morphological, anatomical and physiological responses of plant groups (hydrophytes, xerophytes, halophytes and epiphytes).

UNIT 2:

15 Hours.

Ecosystem: Structure, composition and types (Pond and forest); food chain, food web, ecological pyramids, energy flow. Ecological succession-hydrach and xerarch. Biogeochemical Cycle (Nitrogen, Carbon and phosphorus)

Population Ecology: Characteristics, Growth curves, ecotypes and ecads

UNIT 3:

15 Hours.

Phytogeography: Phytogeographical regions of India and Vegetation types of Karnataka.

Conservation of Natural Resources: Different types of natural resources and their conservation, Forest and its ecological significance, forest management and social forestry, Economic plants of India. Endangered and threatened plant species. 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, Hotspots of India and Sacred grooves of Karnataka.

UNIT 4:**15 Hours.**

Pollution: Introduction, causes, effects and control measures: **Water pollution** –National Clean Ganga Mission. Sewage and Industrial effluent treatment, sludge disposal and its care related to environment. Air pollution, Soil pollution and Noise pollution.

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.

G.S.S. College (Autonomous) Belagavi.

**FACULTY OF SCIENCE: DEPARTMENT OF BOTANY
QUESTION PAPER PATTERN**

PAPER CODE:--SEPBCBOTT4

Title of the paper: Ecology, Environmental Biology and Phytogeography

Time: 3 Hours

Max.Marks:80

I. Answer any TEN of the following

10X2=20

- a.
- b
- c
- d
- e
- f
- g
- h
- i
- j
- k
- l

II. Answer any SIX of the following

5X6=30

- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

III. Answer any THREE of the following

3X10=30

- 10
- 11
- 12
- 13
- 14

Instructions to the Question paper setting

Q.No. 1 a-l Three questions from each Unit

Q.No. 2-9 Two questions from each Unit

Q.10 and 11 from Unit- I

Q.12 from Unit –II

Q.13 from Unit – III

Q.14 from Unit –IV

Fourth Semester B.Sc. Botany Practical

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, turbidity, TDS 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: Succulent- Aloe vera and Non-succulent- Nerium, Epiphyte- Vanda.
7. Estimation of DO and BOD in different types of water samples.
8. Field visit to near by effluent treatment plant to study recycling of waste water/ Forest Ecosystem /Pond Ecosystem.
9. Assignment of Project.
10. Study Tour of two days to study forest types and ecological groups.

G.S.S. College (Autonomous) Belagavi.
B.Sc. IV Semester (SEP) Botany Practical Examination
Subject: Ecology, Environmental Biology and Phytogeography

TIME: 4 HOURS

MAX MARKS: 40

- Q.1. Identify and comment on 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 / viva voce 05 Marks
- Q. 7. Journal 05 Marks

G.S.S. College (Autonomous) 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 /viva voce 05 marks.
- Journal 05 marks.

Course Title & Code	Elective 2: WASTE MANAGEMENT		
Semester IV	Teaching Hours:3/Week	Credits:2	Total Hours: 30
Learning Objective	- To acquire deep knowledge in solid waste management - To learn the treatment techniques for the scientific disposal of solid waste		
Course Outcomes	After completion of this course the students will be able to 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.		
Unit I	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		
Unit II	Hazardous Waste Management: Introduction, definitions, identification. Sources, Impacts, transportation modes, regulations, control, handling, storage and recycling. E-wastes- Sources and management. Biomedical 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		
Text Books	References:- Henry J. Peppler, 1979, Microbial Technology: Fermentation technology, Academic Press. - Gupta.D.K, Sonarkar, Nimbalkar, 2010, Solid waste Management. - Bhide and Sundaresan, 2000, Solid Waste management in Developing countries – Indian National Scientific documentation center-, New Delhi. - Gupta.D.K, Sonarkar, Nimbalkar, 2010, Solid waste Management. - Bhide and Sundaresan, 2000, Solid Waste management in Developing countries – Indian National Scientific documentation center-, New Delhi. - 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 HillInc.,.
--	--

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		
C2		
	Total	

Course Title & Code	SKILL 1 : Skill Based Learning Biological Instrumentation and Methodology (Practical)		
Semester IV	Semester- IV	Credits:2	Hours/weeks: 30
Learning Objective	- 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	Laboratory safety rules. Study and handling of dissecting, compound and light microscopes, Technique of handling multipipettes . 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	Digital 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	Visit to research lab		
Text Books	References:- 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 and KH Goulding. 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.		

G.S.S. College (Autonomous) 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 |

G.S.S. College (Autonomous) Belagavi.
Skill I: Skill Based Learning
Course title: Biological Instrumentation and Methodology
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/ 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 |