



**GULBARGA UNIVERSITY, KALABURAGI**

**Faculty of Science and Technology**

Syllabus for  
**B.Sc Course With Botany**  
Choice Based Credit System (CBCS)

**(With effect from Academic Year 2018-19)**

**Department of Post Graduate Studies and Research in Botany**  
**Gulbarga University, Kalaburagi-585106,**  
**Karnataka, India**

**2018**

**The Course structure offered for B.Sc. course with Botany at Gulbarga University, Kalaburagi effective from the academic year 2018-19.**

Se mes ter	Course	Course code	Course title	Credits L+P	Teaching hours/week L+P=Total
I	Core courses	CCBOT-1	Biodiversity (Microbes, Algae, Fungi and Archegoniate)	4+2=6	4+2=6
II		CCBOT-2	Plant Ecology and Taxonomy	4+2=6	4+2=6
III		CCBOT-3	Plant Anatomy and Embryology	4+2=6	4+2=6
IV		CCBOT-4	Plant Physiology and Metabolism	4+2=6	4+2=6
V	Skill Enhancement courses	SECBOT-1	Biofertilizers	1+1=2	1+1=2 1+1=2
		SECBOT-2	Herbal Technology	1+1=2	
	Discipline Specific Elective Course	DSEBOT-1 OR DSEBOT-2	Cytology, Genetics and Molecular Biology OR Analytical techniques in plant sciences.	4+2=6	4+2=6 <hr/> 6+4=10
VI	Skill Enhancement Courses	SECBOT-3	Nursery and Gardening	1+1=2	1+1=2 1+1=2
		SECBOT-4	Floriculture	1+1=2	
	Discipline Specific Elective Course	DSEBOT-3 OR DSEBOT-4	Plant Pathology and plant Protection. OR Economic Botany and Plant Biotechnology.	4+2=6	4+2=6 <hr/> 6+4=10
<b>Total credits for Botany Courses</b>				<b>44</b>	



## Semester- I

### CCBOT-1: Biodiversity: Microbes, Algae, Fungi and Archegoniata. 60 h

**Preamble:** The paper on Biodiversity: Microbes, Algae, Fungi and Archegoniata is a compulsory core course for the undergraduate students with Botany deals with the ecology, distribution, classifications, reproduction and economic importance of some important groups of microbes, algae, fungi and archegoniates. The paper also deals with the anatomical structures of bryophytes, Pteridophytes and gymnosperms along with two early land plants. The students exposed to this paper will have a basic understanding of virus, bacteria, algae, fungi, bryophytes, Pteridophytes and gymnosperms and capable of working in these areas on joining for advance courses.

#### Unit 1:

12h

##### Microbes

**Viruses** – Brief history, general structure, replication (Lytic & Lysogenic), Economic importance;

**Bacteria** – Ultra structure, reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance.

#### Unit 2

20h

**Algae:** General characteristics, distribution, thallus organization and reproduction, Fritsch classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Scytonema*, *Volvox*, *Oedogonium*, *Vaucheria*, *Sargassum*, *Polysiphonia*, Economic importance.

**Fungi:** General characteristics, classification, life cycle of *Rhizopus*, *Penicillium*, *Agaricus*, *Cercospora*. Symbiotic associations-Lichens (Anatomy & Economic importance).

#### Unit 3:

08h

**Archegoniates: Bryophytes :** General characteristics, classification, morphology, anatomy and reproduction of *Marchantia*, *Anthoceros* and *Funaria*.

#### Unit 4:

20h

**Pteridophytes:** General characteristics and classification, morphology, anatomy and reproduction of *Selaginella*, *Equisetum*, *Marselia* and *Nephrolepis*, Stellar evolution.

**Gymnosperms:** General characteristics, classification, morphology, anatomy and reproduction of *Cyca* and *Pinus*.

#### Practical

1. EMS/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.

2. Types of Bacteria - Temporary/permanent slides/photographs.

3. Gram staining
4. Study of vegetative and reproductive structures in algae as per theory.
5. Study of fungi: Vegetative and asexual stages from temporary mounts and sexual structures through permanent slides (As per theory).
6. Lichens: Study of lichen forms (crustose, foliose and fruticose),
7. Study of vegetative, anatomy and reproductive structures in Bryophytes (As per theory)
8. Study of vegetative, anatomy and reproductive structures in Pteridophytes (As per theory)
9. Study of vegetative, anatomy and reproductive structures in Gymnosperm (As per theory)

#### References

1. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
2. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction, Pearson Benjamin Cummings, U.S.A. 10th edition.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi & Their Allies, MacMillan Publishers Pvt. Ltd., Delhi.
4. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley and Sons (Asia), Singapore. 4th edition.
5. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi, India.
6. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi, India.
7. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
8. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
9. Ganguli and Kar: College Botany Vol-I &II
10. B P Pande: College Botany.
11. Sing, Pande and Jain: College Botany Vol-I &II. Rastogi Publication.



## Semester-II

### CCBOT-II: Plant Ecology and Taxonomy

60 h

**Preamble:** The paper on **Plant Ecology and Taxonomy** is a compulsory core course for the undergraduate students with Botany and deals with different aspects of ecology and angiosperm taxonomy. Students will learn soil formation, composition and soil profile, ecological factors, adaptation of hydrophytes, xerophytes, energy flow, ecological pyramids and productivity, biogeochemical cycles and Phytogeography in ecology. Similarly in taxonomy, students will have an exposure to several basic aspects such as, plant classification, nomenclature, herbarium, botanical gardens and Taxonomic evidences from palynology, cytology, phytochemistry and molecular data.

#### Unit 1:

15h

**Ecology: Introduction to Ecology, Ecological factors,** Soil- formation, composition & soil profile. Light and temperature: Variation Optimal and limiting factors; Shelford law of tolerance.  
**Plant communities:** Characters; Ecotone and edge effect; Succession; Processes and types.

#### Unit 2:

10h

**Ecosystem:** Structure, energy flow trophic organisation; Food chains and food webs, Ecological Pyramids, Biogeochemical cycle-Nitrogen cycle.  
**Phytogeography:** Biogeographical zones of India.

#### Unit 3

15h

**Morphology of Angiosperms:** Brief account on characters, types and modifications of Root, stem, leaf, inflorescence, flower, fruit.  
**Introduction to plant taxonomy:** Identification, Classification, Nomenclature (Binomial).  
**Taxonomical aids:** Functions of Herbarium, important herbaria and botanical gardens of the world and India(any two). **Taxonomic hierarchy:** Ranks, categories and taxonomic groups.

#### Unit 4

20 h

**Botanical nomenclature:** Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

**Classification:** Artificial (Linnaeus), Natural (Bentham and Hooker) and Phylogenetic (Engler and Prantl) upto series. Introduction to APG system. Salient features of the families-Brassicaceae, Malvaceae, Rutaceae, Fabaceae (Three sub families), Cucurbitaceae, Apiaceae, Solanaceae, Asclepidaceae, Asteraceae, Lamiaceae, Euphorbiaceae, Amarantheceae, Liliaceae, Arecaceae, Poaceae.

**Biometrics, numerical taxonomy and cladistics:** Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).



### Practical

1. Study of instruments used to measure microclimatic variables: Soil thermometer, Maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Study of morphological adaptations of hydrophytes, Xerophytes, epiphytes and halophytes (One example in each)
4. Study of vegetative and floral characters of family as per theory.

**Note:** Submission of herbarium of any five weed plants

### Reference Books

1. Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4<sup>th</sup> edition.
2. Sharma, P.D. (2010) Ecology and Environment. Rastogi Publications, Meerut, India. 8<sup>th</sup> edition.
3. Simpson, M.G. (2006). *Plant Systematics*. Elsevier Academic Press, San Diego, CA, U.S.A.
4. Singh, G. (2012). *Plant Systematics: Theory and Practice*. Oxford & IBH Pvt. Ltd., New Delhi. 3<sup>rd</sup> edition.
5. Pande, Singh and Jain, Taxonomy of Angiosperm.
6. Sundarajan, Plant Taxonomy.
7. Ecology by Chandel and Shukla
8. Ecology by Kumarsen

## Semester-III

### CCBot- III: Plant Anatomy and Embryology

60 h

**Preamble:** The paper on Plant Anatomy and Embryology is a compulsory core course for the undergraduate students with Botany at 3<sup>rd</sup> Semester deals with different aspects of plant anatomy such as, tissue system, organs, secondary growth and adoptive and protective systems and Structural organization of flower, Pollination and fertilization, Embryo and endosperm and Apomixis and polyembryony in embryology. This exposure will make the students to understand the anatomical structures and development of reproductive structures in plants.

#### Unit 1:

#### Meristematic and permanent tissues

15 h

Root and shoot apical meristems; Simple and complex tissues. Secretory tissues.

#### Organs

Structure of dicot and monocot root, stem and leaf.



**Unit 2:****Secondary Growth****15 h**

Vascular cambium – structure and function, seasonal activity. Secondary growth in root and stem, Wood (heartwood and sapwood). Anomalous secondary growth (*Amaranthus* & *Dracaena*)

**Adaptive and protective systems**

Epidermis, cuticle, stomata; General account of adaptations in xerophytes and hydrophytes.

**Unit 3:****Structural organization of flower****15 h**

Microsporogenesis, Structure of anther and pollen; Megasporogenesis, Structure and typical ovules and types of ovules; Types of embryo sacs, organization and ultrastructure of mature embryo sac.

**Pollination and fertilization**

Pollination mechanisms and adaptations; Double fertilization; Seed - Structure (Dicot & Monocot) appendages and dispersal mechanisms.

**Unit 4:****Embryo and endosperm****15 h**

Endosperm types, structure and functions; Dicot and monocot embryo; Embryo endosperm relationship.

**Apomixis and polyembryony**

Definition, types and practical applications.

**Practical**

1. Study of meristems through permanent slides and photographs.
2. Tissues (parenchyma, collenchyma and sclerenchyma); Macerated xylary elements, Phloem (Permanent slides, photographs)
3. Stem: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus*.
4. Root: Monocot: *Zea mays*; Dicot: *Helianthus*; Secondary: *Helianthus*.
5. Leaf: Dicot and Monocot leaf.
6. Adaptive anatomy: Xerophyte (*Nerium* leaf); Hydrophyte (*Hydrilla* stem).
7. Structure of anther (young and mature), tapetum (amoeboid and secretory) (Permanent slides).
8. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/campylotropous.
9. Female gametophyte: *Polygonum* (monosporic) type of Embryo sac Development (Permanent slides/photographs).
10. Ultrastructure of mature egg apparatus cells through electron micrographs.
11. Pollination types and seed dispersal mechanisms (including appendages, aril, caruncle) (Photographs and specimens).
12. Mounting of embryo and endosperm from developing seeds.
13. Calculation of percentage of germinated pollen in a given medium.

**Reference Books**

- 1) Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5<sup>th</sup> Edition.
- 2) Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA



- 3) Pandey B P. (2007). Embryology of Angiosperms S.Chand Publication New Delhi
- 4) V. Singh, Pandey and Jain. Embryology of Angiosperms Rastogi Publication Meerut
- 5) P. C. Vashishta. Plant Anatomy Pradeep Publications Jalandhar
- 6) B.P. Pandey .Plant Anatomy. S. Chand Publications New Delhi.

### Semester-IV

#### CCBOT- IV: Plant Physiology and Metabolism

60 h

**Preamble:** The paper on Plant Physiology and metabolism is a compulsory core course for the undergraduate students with Botany at 4<sup>th</sup> Semester deals with Plant-water relations, Mineral nutrition Photosynthesis Enzymes Respiration, Translocation in phloem Nitrogen metabolism Plant growth regulators Plant response to light and temperature. This exposure will make the students to understand the major chapters in plant physiology and metabolism.

#### Unit 1:

15 h

##### Plant-water relations

**Physical phenomenon in plant life:** Imbibitions, Diffusion, Osmosis, plasmolysis and DPD. Importance of water, water potential and its components, absorption of water-mechanism and factors, Theories of ascent of sap-Vital and Physical. Transpiration, types, theories of stomatal movement (starch and sugar interconversion, K pump hypothesis) and its significance; Factors affecting transpiration, Root pressure and guttation.

##### Mineral nutrition

Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

#### Unit 2:

15 h

##### Photosynthesis

Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C<sub>3</sub>, C<sub>4</sub> and CAM pathways of carbon fixation; Photorespiration.

**Enzymes** Structure and properties; Mechanism of enzyme catalysis and enzyme inhibition.

#### Unit 3:

15 h

##### Respiration

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

##### Translocation in phloem

Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading

##### Nitrogen metabolism

Biological nitrogen fixation; Nitrate and ammonia assimilation.



**Unit 4:****Plant growth regulators**

Discovery and physiological role of auxins, gibberellins, cytokinins, ABA, ethylene.

**Plant response to light and temperature**

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photo morphogenesis; Vernalization.

**Practicals**

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the effect of two environmental factors (light and wind) on transpiration by excised twig.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O<sub>2</sub> evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. Separation of amino acids by paper chromatography.

**9-Demonstration experiments.**

1. Root pressure.
2. Effect of auxins on rooting and bolting.
3. Suction due to transpiration.
4. R.Q.
5. Respiration in roots.
6. Osmosis, Plasmolysis, Imbibition.
7. Transpiration and guttation
8. CO<sub>2</sub> and light essential for photosynthesis

**Reference books**

1. V.K Jain. Fundamentals of Plant Physiology, S.Chand & Company New Delhi
2. P.S.Gill Plant Physiology. S.Chand & Company New Delhi
3. H.Shrivastav. Plant Physiology. Rastogi Publication Meerut.
4. Badracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
5. Plant Physiology by Pande Sinha and others,

**Semester-V****DSE-1: Cytology, genetics and Molecular Biology**

60 h

**Preamble:** The paper on Cytology, Genetics and Molecular Biology is a discipline specific elective course for the undergraduate students with Botany at 5<sup>th</sup> Semester deals with cell theory, cell wall, cell membrane, cell organelles, cell cycle, mutations, chromosomal aberrations, mendalism, gene interactions, cytoplasmic inheritance, multiple alleles, polygenic inheritance



sex determination, sex linked inheritance, linkage and crossing over, DNA replication, structure and functions of RNA, genetic code, protein synthesis. This course covers the basics in cytology and genetics and introduces the students to little advances in molecular biology.

**Unit 1:**

**15 h**

The Cell Theory, Prokaryotic and eukaryotic cells, Ultra structure of Cell wall, cell membrane (Fluid mosaic model), Cell components. Structure and function of mitochondria, chloroplast, ER, Golgi Body and Nucleus. Cell cycle, Mitosis and Meiosis, Mutations and Chromosomal Aberration (Structural and numerical).

**Unit 2:**

**15 h**

Genetics: Mendalian Genetics- Brief history of Pre- Mendalism and Mendalian genetics (Mono and di-hybrid crosses, Principle and terminology), Gene-interaction, incomplete dominance, supplementary, complementary and epistatic.

**Unit3:**

**15 h**

Cytoplasmic inheritance (Leaf variegation in *Mirabilis jalapa*), Multiple allelesm, pleiotropism and polygenic inheritance in plants: Sex determination in *Melandrium* and *Drosophila*, sex linked inheritance in drosophila: Linkage and Crossing over (*Zea Maize*).

**Unit 4:**

**15 h**

Nucleic acid: DNA: Ultra structure, replication in prokaryotes and eukaryotes. Experimental evidences to prove DNA as genetic material. RNA polymerase-various types, RNA-types, structure and functions, Genetic code and protein synthesis. Regulation of gene expression in Prokaryotes (Lac-Operon).

**Practical**

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. Study of mitosis and meiosis (temporary mounts and permanent slides).
4. Measure the cell size (either length or breadth/diameter) by micrometry.
5. Study the structure of nuclear pore complex by photograph (from Gerald Karp)
6. Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
7. Study DNA packaging by micrographs.
8. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.
9. Genetic problems based on theory
10. DNA isolation

**Reference Books**

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8<sup>th</sup> edition. Lippincott Williams and Wilkins, Philadelphia.



3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5<sup>th</sup> edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India.
5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
6. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
7. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.
8. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning
9. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.

## DSE-2: Analytical Techniques in Plant Sciences

60 h

### Preamble

This paper deals with the study of some important *analytical techniques such as microscopy, centrifugation, chromatography, spectrophotometry and biostatistics useful in understanding and strengthening the students in biological sciences. The students exposed to this paper will have a strong base useful in designing research programs.*

### Unit 1:

#### Imaging and related techniques

15 h

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryopreservation, negative staining, shadow casting, freeze fracture, freeze etching.

### Unit 2:

15 h

**Cell fractionation:** Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl<sub>2</sub> gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

**Radioisotopes:** Use in biological research, auto-radiography, pulse chase experiment.

**Spectrophotometry:** Principle and its application in biological research.

### Unit 3

15 h

**Chromatography:** Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ionexchange chromatography; Molecular sieve chromatography; Affinity chromatography. Characterization of proteins and nucleic acids; Electrophoresis: PAGE, SDS-PAGE

### Unit 4:

15 h



**Biostatistics:** Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

### Practicals

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. Separation of nitrogenous bases by paper chromatography.
4. Separation of sugar by thin layer chromatography.
5. Isolation of chlorophyll by differential methods.
7. Estimation of protein through Lowry's methods.
8. Separation of proteins using PAGE.
9. Separation of DNA (marker) using AGE.
10. Preparation of permanent slides (double staining).

### Suggested Readings

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

## SEC-1: Biofertilizers

30 h

### Unit 1:

7 h

General account about the microbes used as biofertilizer: Isolation and Identification of Rhizobium, *Azospirillum*, *Azotobacter*, Cyanobacteria (blue green algae), *Azolla* and *Anabaena*. Nitrogen Fixation by Rhizobium, factors affecting growth of blue green algae and *Azolla* in rice cultivation.

### Unit 2:

8 h

Mycorrhizal association, types of mycorrhizal association, colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants. Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

### Practical:

15 h

1. Isolation and identification of bacterial biofertilizers
2. Mass culture of *Azolla*



3. Effect of *Azolla* on plant growth
4. Isolation of VAM
5. Preparation of green manure and its impact on crop growth
6. Preparation of Vermicompost and its impact on crop growth
7. Visit to composting units.

#### Reference Books:

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay \_Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New \_Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic \_Farming Akta Prakashan, Nadiad

#### SEC-2: Herbal Technology

30 h

##### Unit 1:

7 h

Herbal medicines: history and scope - role of medicinal plants in Ayurveda and Siddha systems of medicine; cultivation - harvesting - processing - storage -marketing and utilization of medicinal plants.

Phytochemistry - active principles, Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).

##### Unit 2:

8 h

Pharmacology: Medicinal uses of *Ocimum sanctum*, *Zingiber officinale*, *Saraca asoca*, *Catharanthus roseus*, *Withania somnifera*, *Terminalia arjuna*, *Aloe vera* and *Centella asiatica*. Methods of screening plant crude drugs against microbial pathogens. Drug adulteration, methods of drug storage and microbial drug contaminations.

#### Practical

15 h

1. Collection and identification of local medicinal plants
2. Cultivation of medicinal plants
3. Qualitative screening of secondary metabolites
4. Quantitative analysis of secondary metabolites
5. Extraction of secondary metabolites using Soxhlet
6. Antimicrobial activity of medicinal plants.
7. Visit to medicinal plant garden.



### Reference Books:

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999. Nirali Prakashan.

## Semester-VI

### DSE-3: Plant pathology and Plant protection

60 h

**Preamble:** The paper deals with the plant diseases caused by different pathogens such as viruses, bacteria and fungi and their control using chemical, physical and biological methods and offered as a discipline specific elective course for the undergraduate students with Botany at 6<sup>th</sup> Semester. This course exposes students to the basic understanding in plant pathology and plant protection.

#### Unit 1:

Introduction: disease triangle (Host, pathogen and environment), Terminologies, Koch's postulates. Brief account on integrated pest management: Causal organism, symptoms, etiology and control measures of Leaf curl of papaya, Bunchy top of banana, Citrus canker, Angular leaf spot of cotton.

15h

#### Unit 2:

Causal organism, symptoms, etiology and control measures of the following diseases

15h

- Downy mildew of Bajara
- Grain smut of Sorghum
- Stem rust of Wheat
- Wilt of pigeon pea
- Red rot of sugarcane
- Tikka disease of Ground nut
- Sandal spike disease of mycoplasma

#### Unit 3

Physical and chemical methods of plant disease control: Classification of fungicides, insecticides and weedicides. Methods of applications of fungicides in seed and soil treatment, control of post harvest diseases. Applications of chemical fungicides- sulfur, copper, mercury, quenones.

15h



## Unit 4

15h

Biological control of plant diseases: Principles and methods of biological control: types of interaction (microbial interaction) contributing to biological control. Biocontrol agents-bacterial, fungal, viral, nematode and pests antagonistics. Biopesticides-types, examples, methods of applications, advantages and disadvantages.

### Practicals:

1. Preparation of Bacterial and fungal growth media.
2. Isolation and identification of bacterial and fungal plant pathogens.
3. Study of viral disease in plants, eg. Bunchy top of Banana and Papaya leaf curl disease.
4. Study of bacterial disease in plants eg. Citrus canker and angular leaf spot of Cotton.
5. Study of Mycoplasma disease-Sandal spike
6. Study of fungal diseases in plants (based on theory )
7. Study of fungicides eg. Bavistin and mercuric chloride.
8. Study of insecticides.
9. Demonstration of life cycle of any one pest.
10. Study of Biological control of plant diseases eg. *Trichoderma* and Neem

### References

1. Plant Pathology: Agrios G N (4th Edn, Academic, USA 1997).
2. Diseases and plant population biology: Burdon (Cambridge Univ Press)
3. Plant disease epidemiology: Nagarajan (Oxford & IBH, New Delhi 1983).
4. Population of plant pathogen: Wolfe M S and Caten C E (Black Well, Oxford 1987).
5. Innovative approaches to plant disease control: Ilan Chet (Wiley Inter Science NY 1987)
6. Fungal spores, their liberation and dispersal: Ingold C T (Oxford Univ Press 1971)
7. Principle of diagnostic techniques in plant pathology: Fox. R T V (CABI, 1993).
8. Diseases of crop plants in India: Rangaswamy G (Prentice Hall, New Delhi, 1979).
9. Introduction to principles of plant pathology: Singh R S (Oxford & IBH New Delhi)
10. An introduction to plant diseases: Wheeler (John Wiley & Sons, UK. 1972).
11. Information technology, plant pathology and biodiversity: Bridge, P., Jeffriens, P. and Morse, D.R (CAB international, 1998)
12. Applications of PCR in mycology: Bridge, P.D., Arora, D.K., Reddy, C.A. & Elander, R.P (1998)
13. Molecular Plant Pathology, Vol. I & II: Gurr, S.J. & Mc. Pherson, M.J. & Bowles, D.J. (Oxford 1992)
14. Crop diseases and their management: V.S. Pundhi (BPB Pubs, Delhi)
15. Fungal plant pathogens: Charles Lane , Paul Beales, Kevin Hughes (CABI, 2012)

## DSE-4: Economic botany and Plant Biotechnology

60 h

### Preamble

This paper deals with the study of economic importance of pulses, cereals, beverages, spices, oil yielding plants, fiber yielding plants and medicinal plants. The paper also deals with the application of Biotechnology, Transgenic plants, Genetic engineering, Recombinant DNA technology, DNA Fingerprinting, PCR technique, Hybridoma technique, ELISA test, gene Therapy,



Plant tissue culture, Methods of crop improvement, Centers of origin and domestication of crop plants and crop genetic resources. This course exposes students to the basic understanding in economic botany and plant biotechnology. The students will also be exposed to some basics of plant breeding.

#### **Unit 1**

**15 h**

**Economic Botany:** Origin, morphology and uses of **Cereals and millets** (Wheat, Jawar, Bajara). **Legumes**-General account with special reference to Bengal gram, Red gram, Green gram, Black gram and Lentil, **Spices and condiments**- General account with special reference to clove, cardamom, cinnamomum, capsicum and black pepper.

#### **Unit 2**

**15 h**

**Beverages**-Tea and coffee (morphology, processing, uses), **Oils and Fats**-General description with special reference to groundnut and sunflower, safflower, **Fibre Yielding Plants**- General description with special reference to Cotton, hemp. Medicinal and aromatic plants- Neem, Tulasi, Alove vera, Aswagandha, Sarpagandha, Mentha and Lemongrass.

#### **Unit 3:**

**20 h**

**Biotechnology:** Introduction and scope of biotechnology, Application of Biotechnology, Transgenic plant- Bt cotton and Golden rice, Genetic engineering: Introduction, tools used in genetic engineering Recombinant DNA technology (Steps of r-DNA technology): DNA Fingerprinting, PCR technique, Hybridoma technique, ELISA test, gene Therapy. Plant tissue culture: Media preparation, Steps involved in tissue culture

#### **Unit4:**

**10 h**

**Plant Breeding:** Methods of crop improvement, Hybridization, Mutation and polyploidy Centres of origin and domestication of crop plants, crop genetic resources

#### **Practicals.**

1. Study of Economically important plants- Wheat, Jawar, Bajara, Bengal gram, Red gram, Green gram, Clove, Black Pepper, Cinnamomum, Tea, Coffee, Ground nut, Sunflower Cotton, Hemp, Alove and Ashwagandha.
2. Familiarization with basic equipments in tissue culture using photographs.
3. Demonstration of media preparation and composition (MS Media).
4. Demonstration of sterilization of tissue culture equipments.
5. Study through photographs- Anther and embryo culture.
6. Hybridization technique.

#### **References**

- Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4<sup>th</sup> edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
  3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
  1. Plant propagation- Principles and practices: Hartmann, Kester, Davies, and Geneve (2011)



2. Principles of plant breeding: Robert Wayne Allard (John Wiley & Sons 1999)
  3. Principles and procedures of plant breeding-Biotechnological and conventional approaches: Chahal G S and Gosal S S
  4. Plant breeding principles and methods: Singh B D Ludhiana (Kalyani Pubs, New Delhi 1983)
  5. Principles of gene manipulation- An introduction to genetic engineering: Bold R W and Primerose S B (Black Well, London)
  6. Introduction to plant biotechnology: Chawla H S (Oxford & IBH, New Delhi 2000).
  7. Plant Cell Culture – A practical approach: Dixan and Ganzales RA (Oxford Univ Press NY 1994).
  8. Hand Book of Plant Cell Culture vol.-I: Evans *et al.* (Macmillan, New York 1983).
  9. Plant cell, tissue and organ culture- Fundamental method: Gambarg O L and Phillips (Narosa, New Delhi.1996)
  10. Applied and Fundamental Aspects of Plant cell, tissue and organ culture: Reinert J and Bajaj Y P S (Narosa, New Delhi 1988).
  11. Cell culture and somatic cell genetics of plants vol.-II: Vasil I K (Academic, New York 1985).
  12. Genome analysis-A laboratory manual vol-I: Birren *et al.* (Panima, New Delhi/Blore).
- Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7<sup>th</sup> edition.
7. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2<sup>nd</sup> edition.
8. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

### SEC-3: Nursery and Gardening

30 h

#### Unit 1:

7 h

Nursery: Introduction, infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants. Seed: Seed dormancy; causes and methods of breaking dormancy, Seed storage and seed testing. Sowing/raising of seeds and seedlings - Transplanting of seedlings.

Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants – green house - shade house and glass house.

#### Unit 2:

8 h

Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations. Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomato and carrots - Storage and marketing.

#### Practical:

15 h

1. Testing and breaking of seed dormancy
2. Seed germination and viability



3. Study of efficacy of natural fungicides.
4. Vegetative propagation, layering and cuttings.
5. Testing of seed borne diseases.
6. Cultivation of vegetables.
7. Visit to nursery and green houses.

### Reference Books

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.

### SEC-4: Floriculture

30 h

#### Unit 1:

8 h

Introduction: Importance and scope of floriculture and landscape gardening. Ornamental Plants: Shade and ornamental plants; Ornamental bulbous plants; Cacti and succulents; Palms and Cycads; Ferns. Cultivation of plants in pots, Indoor gardening, Bonsai. Principles of Garden Designs: Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds; Shrubbery, Borders, Water garden. Some Famous gardens of India.

#### Unit II:

7 h

Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to storage of cut flowers; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold, Rose, Liliium, Orchids). Diseases and Pests of Ornamental Plants.

#### Practical:

15 h

1. Methods and designs of landscape for floriculture
2. Pot cultivation of flowering plants
3. Preparation for bonsai plants.
4. Methods of storage of cut flowers
5. Disease management of important ornamental plants
6. Preparation of Jam and Gulkand from rose petal.
7. Visit to Horticulture institute.

#### Reference Books:

1. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.



**PRACTICAL EXAMINATION MODEL QUESTION PAPERS**

**GULBARGA UNIVERSITY KALABURAGI  
B.Sc. I. SEMESTER PRACTICAL EXAMINATION**

**Time: 3h**

**CCBOT 1:**

**Max.Marks: 40**

- 
- 
- |   |    |
|---|----|
| 1. Stain the given material 'A' by positive staining using Safranin/Crystal violet.<br>Write procedure and Identify with reasons.   | 08 |
| 2. Identify, classify, giving reasons of followings,<br>B-algae C-fungi, D-lichens, E-bryophytes, F-pteridophytes<br>G-gymnosperms, | 18 |
| 3. Describe the anatomy of specimens <b>I</b> (Pteridophytes); <b>J</b> (Gymnosperms)   | 06 |
| 4. Mounting of Spores/gemmae of "K"   | 03 |
| 5. Records / submission.  | 05 |

---

---

**Total Marks: 40**

**GULBARGA UNIVERSITY KALABURAGI  
B.Sc. II. SEMESTER PRACTICAL EXAMINATION**

**Time: 3h**

**CCBOT 2:**

**Max.Marks: 40**

- 
- 
- |   |    |
|---|----|
| 1. Identify and assign the plant to respective ecological group with neat labeled diagrams giving reasons, <b>A</b> , (Morphological and anatomical characters) | 06 |
| 2. Determine the P <sup>H</sup> of the given soil sample, <b>B</b> ,  | 04 |
| 3. Assign the plants ' <b>C</b> -Dicot ' <b>D</b> -dicot ' <b>E</b> -dicot, <b>F</b> -monocot to their respective Families giving important characters.         | 16 |
| 4. Identify and comment on the Ecological Instruments <b>F</b> and <b>G</b>   | 04 |
| 5. Describe the specimen ' <b>H</b> ' (in technical terms)  | 05 |
| 6. Records and submissions  | 05 |

---

---

**Total Marks 40**



GULBARGA UNIVERSITY KALABURAGI  
B.Sc. III SEMESTER PRACTICAL EXAMINATION  
CCBOT 3:

Time: 03 h

Max. Marks: 40

---

1. Prepare a temporary safranin stained T.S. of material 'A' and identify with reasons leave the preparation for observation/valuation	8
2. Mount the endosperm/embryo of 'B'. Sketch and label the parts and leave the preparation for evaluation.	8
3. Mount/Take the T.S. of the given material 'C'. (Pollen grains,/pollenia,/placentation. ) Sketch and label the parts and leave the preparation for evaluation	6
4. Macerate/Mount the specimen 'D' identify any two types of elements (cells with Labeled sketches and give reasons/type of stomata/trichomes	4
5. Identify and comment on micro slides of 'E, F, embryology and G Anatomy with reasons.	9
6. Records/Submission	5
<b>Total</b>	<b>- 40</b>

---

UNIVERSITY KALABURAGI  
B.Sc. IV SEMESTER PRACTICAL EXAMINATION  
CCBOT 4:

Time: 3h

Max.Marks: 40

---

1. Perform the physiology expt. 'A' records your observation and show to examiner (Major expt.)	10
2. Perform the physiology expt. 'B' record your observation and show to examiner (Minor expt.)	08
3. Demonstration the experiments C	05
4. Identify and comment on the physiological experiment 'D', 'E', 'F' and 'G'	12
5. Submission of Records.	05
<b>Total</b>	<b>40</b>

---





GULBARGA UNIVERSITY KALABURAGI  
**B.Sc. V SEMESTER PRACTICAL EXAMINATION**

Time: 3h

**DSEBOT 1:**

Max.Marks: 40

- |   |    |
|---|----|
| 1. Make a squash / smear preparation of specimen 'A'. Identify, Sketch and label any two stages and show the preparation to the examiner. | 08 |
| 2. Conduct/ Demonstrate DNA isolation from the material C   | 08 |
| 3. Solve the given dihybrid genetic problem 'D'   | 07 |
| 4. Identify and comment on E, F, G and H (Slides/Photographs)   | 12 |
| 5. Records and Submission   | 05 |

**Total Marks 40**

GULBARGA UNIVERSITY KALABURAGI  
**B.Sc. V SEMESTER PRACTICAL EXAMINATION**

Time: 3h

**DSEBOT-2:**

Max.Marks: 40

- |  |    |
|--|----|
| 1. Demonstration of ELISA technique 'A'.                                       | 08 |
| 2. Isolation of pigments by TLC/paper Chromatography B and write the procedure | 10 |
| 3. Estimate /Demonstrate protein by lowry's method C                           | 08 |
| 4. Identify and comment on D, E, F (Blotting techniques Photographs)           | 09 |
| 5. Records and Submission  | 05 |

**Total Marks 40**





GULBARGA UNIVERSITY KALABURAGI  
B.Sc. VI. SEMESTER RACTICAL EXAMINATION

Time: 3h	DSEBOT 3:	Max.Marks: 40
1. Identify the Viral/Bacterial/Fungal disease of the given specimen 'A' describe the symptoms and Etiology of the causal organism.		06
2. Isolate and Identify fungal/ bacterial plant pathogens B Giving reasons (Show the preparation to the examiner for evaluation)		06
3. Write the procedure of pathogen inoculation technique /PDA media preparation, C		06
4. Demonstrate and write the procedure of seed and soil treatment technique 'D'		05
5. Identify the Specimens/ photographs giving reasons. E- Pathology. F- Pathology.G-- Biological control. H- Chemical control		12
6.Records and submissions of five disease materials		05
<b>Total Marks 40</b>		

GULBARGA UNIVERSITY KALABURAGI  
B.Sc. VI. SEMESTER BOTANY PRACTICAL EXAMINATION

Time: 3h	DSEBOT 4:	Max.Marks: 40
1. Identify AND Comment on Economic importance of A B C D .		08
2. Write the common name, Botanical name, family, part used of E F G H		12
3. Write the procedure of DNA finger printing/PCR technique I		06
4. Demonstrate inoculation technique J		05
5. Identify and comment on K L (Tools of Biotechnology)		04
6.Records and submissions		05
<b>Total Marks 40</b>		



**Model Question paper for theory examination for Core and DSE papers:**

GULBARGA UNIVERSITY, KALABURAGI  
B.Sc ----- Semester Degree Theory Examination in Botany, month, year.  
Paper:

**Time: 3 h**

**Max.Marks:80**

**Instruction to Candidates:** 1. Answer all the questions.  
2. Draw diagrams wherever necessary

---

---

**I. Answer any TEN of the followings in two or three sentences**

**(2x10=20)**

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

**II. Answer any FOUR of the followings in brief**

**(4x5=20)**

- 13.
- 14.
- 15.
- 16.
- 17.
- 18.

**III. Answer any FOUR of the followings**

**(4x10=40)**

- 19.
  - 20.
  - 21.
  - 22.
  - 23.
  - 24.
- 
- 





Model Question paper for internal theory examination for Core and DSE papers:

**GULBARGA UNIVERSITY, KALABURAGI**


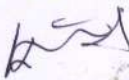
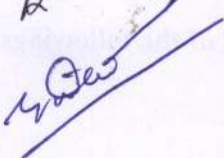
**B.Sc ----- Semester Degree Theory Internal Examination in Botany, month, year.**  
**Paper:**

**Time: 1 h**

**Max.Marks:20**

- 
- I. Answer the followings in two or three sentences** (1x5=5)
- 1.
  - 2.
  - 3.
  - 4.
  - 5.
- II. Answer any ONE of the followings in brief** (1x5=5)
- 6.
  - 7.
- III. Answer any ONE of the followings** (1x10=10)
- 8.
  - 9.
- 

**Members of Board of Studies**

1. Dr. Ashok Kumar Khajapur Member 
2. Dr. Latadevi Karikal Member 
3. Dr. Prashant Kumar Member 
4. Ms. Nagashree B Member (External) approved through e-mail
5. Dr. S N Agadi Member (External) approved through e-mail

6. Dr. G M Vidyasagar

  
Chairman

**Professor & Chairman**  
**Department of P.G. Studies**  
**& Research in Botany**  
**Gulbarga University Kalaburagi-585106**  
**Karnataka**