DEPARTMENT OF BOTANY

B.Sc. BOTANY

(Students admitted during 2019-2020 Onwards)

(Under CBCS with Outcome Based Education (OBE) Pattern)

SYLLABUS

III & IV SEMESTER

GOBI ARTS & SCIENCE COLLEGE

(Govt. Aided Autonomous Co-educational Institution, Affiliated to
Bharathiar University, Coimbatore, Accredited with 'A' Grade by NAAC (4th cycle)
and Recognised as a STAR College by DBT, Government of India)

KARATTADIPALAYAM POST,

GOBICHETTIPALAYAM - 638453

ERODE DISTRICT.

BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN

K1-Remember; **K2**- Understanding; **K3**- Apply; **K4**-Analyze; **K5**- Evaluate

I. END OF SEMESTER (EOS) EXAMINATIONS:

1. Part I, II & III-Theory: 70 Marks

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	15 × 1 = 15	MCQ	70
K2	B (Either or Pattern)	5 × 5 = 25	Short answers	
K3 & K4	C (Answer 3 out of 5)	3 × 10 = 30	Descriptive/Detailed	

2. Practical Examinations: 70 Marks

Knowledge Level	Section		Total
	Practical	Record work	
K3	60	10	70
K4			
K5			

II. CONTINUOUS INTERNAL ASSESSMENT (CIA):

1. Test – I & II: 30 Marks (Theory)

Knowledge Level	Section	Marks	Description	Total
K1	A (Answer All)	10 × 1 = 10	MCQ	30
K2	B (Answer 2 out of 3)	2 × 5 = 10	Short answers	
K3 & K4	C (Answer 1 out of 2)	1 × 10 = 10	Descriptive/Detailed	

2. Practical Internal Assessment: 30 Marks

Knowledge Level	Section		Total
	Test	Lab Performance	
K3	20	10	30
K4			
K5			

Components of Continuous Internal Assessment (CIA)

Components		Calculation	CIA Total
Test 1	30	$\frac{\text{Test 1 + Test 2}}{2}$	30
Test 2	30		

Programme Code:	B.Sc.	Programme Title:	Botany	
Course Code:	19UABO03	Course Title:	Batch:	2019
Total Hours:	105	Cell Biology, Anatomy and Embryology	Semester:	III
			Credits:	5.0

Course Objective

The course aims

- To study the cellular structure of plants and their functions.
- To study about the tissues and anatomical characters of higher plants.
- To understand the developmental and reproductive processes of plants.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1	CO1	Describe the structure and functions of plant cell and its organelles.
K2	CO2	Explain the structure of nuclear materials and the process of cell division.
K3	CO3	Describe and compare the structure and development of different plant organs.
K3	CO4	Illustrate different tissue systems of plant.
K2	CO5	Describe the development and functions of embryological structures of angiosperms.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Cell Biology:** Ultra structure and functions of Plant Cell, Cell Wall, Plasma Membrane (Fluid mosaic model), Mitochondria, Ribosomes, Chloroplast and Golgi Complex.	**21**
II	Nucleus, Chromosomes, Nucleic Acids: Structure of DNA (Watson & Crick Model) and RNA types and structure; Cell Cycle; Cell division: Mitosis and Meiosis.	**21**
III	**Anatomy**: Meristems: Shoot apex (Apical cell theory, Tunica Corpus Theory); Root apex (Apical cell theory, Korper-Kappe theory). Tissues: Structure, Types and Functions of Simple tissues (Parenchyma, Collenchyma, Sclerenchyma); Complex tissues (Xylem and Phloem). Primary structure of Root, Stem, and Leaf (Dicot – Sun flower and Monocot - Maize).	**21**
IV	Normal Secondary growth in Dicot and Monocot (stem and root); Anomalous secondary growth: Cortical bundles ***(Nyctanthes)***; Medullary bundles and successive cambium ***(Boerhaavia)***; Intraxylary phloem ***(Leptadenia)*** and Interxylary phloem ***(Achyranthes)***; Monocot ***(Dracaena)***.	**21**
V	**Embryology:** Microsporangium: Structure and Development; Megasporangium: Structure and Development; Types of ovules; Development of embryosac; Classification of embryo sac ***(Polygonum, Allium, Peperomia).*** Endosperm: Types and development; Embryo: Structure and development of Dicot embryo ***(Capsella bursapastoris)*** and Monocot embryo ***(Luzula)***.	**21**

Text Books:

1. Agarwal, C.B., Cell Biology.
2. Pandey, B.P., Plant Anatomy, S. Chand & Company Ltd, New Delhi.
3. Bojwani, S.S. and Bhatnagar, S.P., The embryology of Angiosperms, Vikas Publishing House, New Delhi.
4. Vashista, Plant Anatomy, S.Nagin & Co, New Delhi.

Reference Books:

1. Verma, P.S. and Agarwal, V.K., Cytology.
2. Easu, K., Plant Anatomy, Wiley Eastern, New Delhi.

E-references:

Cell Biology (Unit I and II):

1. https://courses.lumenlearning.com/wm-biology2/chapter/plant-cells/
2. https://www.biologydiscussion.com/plants/structure-of-plant-cell-explained-with-diagram/2511
3. https://alevelbiology.co.uk/notes/structure-of-dna/
4. https://courses.lumenlearning.com/biology1/chapter/the-cell-cycle/

Anatomy (Unit III and IV):

1. http://bio1520.biology.gatech.edu/growth-and-reproduction/plant-development-i-tissue-differentiation-and-function/
2. http://www.biologyreference.com/A-Ar/Anatomy-of-Plants.html
3. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/30%3A_Plant_Form_and_Physiology/30.2%3A_Stems/30.2C%3A_Primary_and_Secondary_Growth_in_Stems
4. http://virtualplant.ru.ac.za/Main/ANATOMY/prac5.htm

Embryology (Unit V):

1. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(OpenStax)/6%3A_Plant_Structure_and_Function/32%3A_Plant_Reproduction/32.1%3A_Reproductive_Development_and_Structure
2. https://www.yourarticlelibrary.com/biology/various-types-of-endosperm-of-flowering-plants/11785

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	M	S	S	H	S
CO2	S	H	S	H	H	S
CO3	S	H	S	S	M	H
CO4	S	H	S	H	H	S
CO5	S	H	S	S	M	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	B.Sc.	Programme Title:	Botany	
Course Code:	19UBCH04	Course Title:	Batch:	2019
Total Hours:	90	Chemistry	Semester:	III
			Credits:	3.0

Course Objective

The course aims

- To learn about the basic concepts of bonding in chemistry.
- To understand the basic knowledge in organic chemistry and nuclear chemistry.
- To understand the concepts of photochemistry, adsorption and chemical kinetics.

Course Outcomes (CO)

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K1, K2	CO1	Formulate the electronic configuration of elements and utilize the hybridization and geometry of the various molecules.
K1	CO2	Compile bonding in organic chemistry and types of organic reactions.
K4	CO3	Predict nuclear stability, nuclear fission and nuclear fusion reactions.
K3	CO4	Analyze various photochemical reactions, adsorption and absorption methods.
K2	CO5	Discuss the rate of chemical reactions.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Chemical bonding:** Electronic configuration of first thirty elements – Pauling's exclusion principle – Aufbau principle – Hund's rule - Chemical bonding – Ionic bond – examples: NaCl, $MgCl_2$ – Covalent bond – examples: H_2, N_2. Valence bond theory – limitations of VBT – sigma and pi bonds –Hybridization and geometry in $BeCl_2$, BF_3, NH_3, PCl_5 and SF_6, VSEPR theory. **Molecular orbital theory:** examples for homonuclear (H_2, N_2, O_2, H_2^+) and heteronuclear molecules (CO, HF) – Comparison of VBT and MOT, para and diamagnetic characteristics.	**18**
II	**Nature of valency of carbon in organic compounds** – tetrahedral arrangement of valency of carbon – hybrization and geometry of methane, ethylene and acetylene. Bond breaking and bond forming in organic reactions – homolytic cleavage and heterolytic cleavage – types of attacking reagents – electrophiles, nucleophiles, free radicals and leaving groups – definition with examples. Reaction intermediates – Carbocations, carbanions, free radicals – stability. **Types of reactions:** Substitution – addition – elimination – rearrangement and polymerization – illustration with examples. **Polar effects:** Inductive, Mesomeric, Hyperconjugative and Resonance effects.	**18**
III	**Nuclear chemistry** – composition of nucleus – mass defect – nuclear binding energy – packing fraction – nuclear stability. Isotopes, Isobars and Isotones – definition – examples.	**18**

	Nuclear transformation – Artificial transmutation of elements – nuclear fission – atomic bomb – nuclear reactors – nuclear fusion – hydrogen bomb – stellar energy – applications of radio isotopes.	
IV	**Photochemistry:** Definition of photochemical reactions - Comparison of thermal and photochemical reactions - laws of photochemistry – quantum efficiency – reason for high and low quantum yield – determination of quantum efficiency - consequence of light absorption by atoms and molecules – Jablonski diagram – fluorescence – phosphorescence – photosensitization – chemiluminescence – applications of photochemistry **Adsorption:** Definition – adsorption, absorption, adsorbate and adsorbent – physical adsorption – chemical adsorption – differences between these two types – factors influencing adsorption.	**18**
V	**Chemical Kinetics:** Rate of reaction - Order, Molecularity, First order reaction – Derivation of rate constant – Half life period – Second order reaction reactions – derivation of rate constant – Half life period. Determination of order – Graphical method – half life method – Ostwald's method. Effect of temperature on the rate of reaction – Arrhenius equation – Energy of activation.	**18**

<* - ***Self study: Definition of specific reaction rate and rate constant***>.

Text Books:

1. Jain and Jain, Engineering chemistry, Dhanpat Rai Publishing Company, 14th edition.
2. P.L. Soni, Textbook of Inorganic chemistry, Sultan Chand and Sons, 20th edition.
3. Arun Bahl and B.S. Bahl, Advanced Organic chemistry, S. Chand and Sons Publishers.
4. Puri and Sharma, Principles of physical chemistry, Vishal publishing company, 44th edition.

Reference Books:

1. James E. Huheey, Inorganic chemistry, Pearson education Ltd, 4th edition.
2. H.J. Arnikar, Essentials of Nuclear chemistry, New age international publishers, 4th edition (1995).
3. Gurdeep R. Chatwal, Organic Photochemistry, Himalaya publishing house, 1st edition (2007).
4. Keith J. Laidler, Chemical kinetics, Dorling Kindersley (India) Pvt. Ltd, 3rd edition (2003).

E-references:

1. https://www.wou.edu/las/physci/poston/ch222/pdf/ch10_Chang_w09.pdf
2. https://www.svce.ac.in/departments/chemistry/CITM/CY6151%20presentation%20PDF/Unit%20III%20-%20Photochemistry.pdf

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	H	H	S	S
CO2	S	S	M	H
CO3	S	H	H	S
CO4	H	S	S	H
CO5	S	M	H	S

S - Strong; **H -** High; **M -** Medium; **L -** Low

Programme Code:	B.Sc.	Programme Title:	Botany	
Course Code:	19UABO04	Course Title:	Batch:	2019
Total Hours:	105	Microbiology	Semester:	IV
			Credits:	5.0

Course Objective

The course aims

- To study the basics of structure, classification and culture of microbes.
- To study the applications of microbes in industries.
- To know the impact of microbes on environment.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K2	CO1	Describe the structure, reproduction and economic importance of bacteria and virus.
K3	CO2	Explain the cultural practices and isolation of bacteria and fungi.
K2	CO3	Outline the fermentation techniques and industrial applications of microbial enzymes.
K2	CO4	Account the role of microorganisms in food and dairy industries with reference to food processing and spoilage.
K3	CO5	Elucidate the interactions of microbes in the environment.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 –** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
I	**Bacteria:** Structure, nutrition, reproduction and economic importance. Gram staining. **Virus**: General characters; Structure and multiplication of Tobacco mosaic virus (TMV) and T_4 Bacteriophage; Virus transmissions. **AIDS**: Structure of HIV, disease symptoms, infection and control.	**21**
II	**Media preparation:** Nutrient medium: Agar broth; Semisynthetic medium: PDA; Synthetic medium: Czapek's Dox; Sterilization process: Moist heat, Dry heat & Membrane filtration methods. Culturing techniques: Agar slant, Agar deep, Serial dilution, Pour plate, Streak plate and Enrichment culture; Growth curve.	**21**
III	**Industrial Microbiology:** Fermentation: Structure and function of Fermenter; Techniques and Types employed in Industrial processes; Important microbial enzymes in industries (Amylase, Pectinase, Lactase, Zymase, Protease); Production of vinegar (Quick generator method) and Vitamin $B_{12.}$	**21**
IV	**Food Microbiology**: Microflora of common foods; Factor affecting the kinds and amount of microorganism; General biochemical changes caused by microorganisms in foods. Kinds and sources of microorganisms in Milk, Pasteurization of milk, Production of Cheese; Beverage (Wine production); Methods of food preservation.	**21**
V	**Environmental Microbiology**: Common airborne bacterial and fungal pathogens; Waterborne diseases; Microbial analysis of water: Multiple tube test (Most probable number), Membrane filtration technique; Major groups of soil microorganisms; Humus: Types and function; Anthropogenic influences on soil microbiota: Land Use Pattern and Chemical pollutants.	**21**

Text Books:

1. Pelczer, M.J., Reid, R.D. and Chan, E.C.S., Microbiology.
2. Dubey, R.C. and Maheshwari, K., A Text Book of Microbiology.
3. Power, C.B. and Daginawala, H.F., General Microbiology Vol. I & II.
4. Schiesel, H.B., General Microbiology.

Reference Books:

1. Frazier, W.C. and Westhoff, D.C., Food Microbiology.
2. Reed, G., Prescott and Dunns, Industrial Microbiology.
3. Casida, L.E., Microbiology.

E-references:

1. https://microbiologysociety.org/why-microbiology-matters/what-is-microbiology/bacteria.html
2. http://textbookofbacteriology.net/nutgro.html
3. https://www.idmod.org/docs/hiv/hiv-disease-overview.html
4. https://milnepublishing.geneseo.edu/suny-microbiology-lab/chapter/bacteriological-culture-methods/
5. https://www.researchgate.net/figure/List-of-various-industrial-enzymes-and-their-major-industrial-applications_tbl1_268892217
6. https://foodsafetyhelpline.com/what-are-the-different-methods-of-food-preservation/
7. https://www.biologydiscussion.com/water/determining-the-presence-of-coliforms-in-water-microbiology/66600

Mapping with Programme Specific Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	S	H	S	S	S
CO2	H	H	S	S	H	H
CO3	H	S	S	H	H	S
CO4	S	S	M	H	H	S
CO5	S	H	S	S	S	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	B.Sc.	Programme Title:	Botany	
Course Code:	19UABOP2	Course Title:	Batch:	2019
Total Hours:	90	Core Practical - II	Semester:	IV
			Credits:	5.0

Course Objective

The course aims

- To understand the anatomical and cellular structures of plants.
- To analyze the embryological characters of angiosperms.
- To practice basic techniques in microbiology.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K2	**CO1**	Sketch the cytological structures and cell division.
K3	**CO2**	Illustrate and distinguish anatomical structures of plant organs.
K2	**CO3**	Identify and describe the structure and development of embryological structures of angiosperms.
K3	**CO4**	Demonstrate basic techniques involved in Microbiology (sterilization, culture and staining techniques in Microbiology).
K4	**CO5**	Identify some common microbes associated with food spoilages and analyse the microbial quality of air and soil.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SYLLABUS
(COVERING SEMESTER III & IV)

Unit	Content	No. of Hours
I	Identification of ultrastructure of plant cell and cell organelles included in the syllabus with the help of Photographs and Diagrams. Observation of different stages of mitosis by making squash preparations of onion root.	**15**
II	Making suitable micropreparations for studying anatomy of root, stem, and leaf of Dicots and Monocots included in the syllabus. Observation and identification of normal and anomalous secondary growth in the species included in the syllabus by making micropreparations.	**15**
III	Observation and identification of anther (different stages of development), pollen grains, female gametophyte, endosperms from permanent slides. Preparation of embryo mounting (***Tridax***).	**15**
IV	Demonstration of growth media preparation (Fungal and Bacterial); Culture and Isolation: Serial dilution, Pour plate, Streak plate, Agar slant and Stab culture. Demonstration of hanging drop method and colony counter.	**24**
V	Differentiation and Identification of Bacteria by Gram staining. Observation of photographs and diagrams depicting the structures of Bacteria, TMV, Bacteriophage and HIV. Identification of common microorganisms involved in the spoilage of fruits and vegetables.	**21**

Note: To maintain a Record Note Book for the above practical works.

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	S	M	H	S	M	S
CO2	S	S	H	S	H	H
CO3	S	S	S	S	H	S
CO4	S	M	H	S	H	S
CO5	S	S	S	S	S	S

S - Strong; **H -** High; **M -** Medium; **L –** Low

Programme Code:	B.Sc.	**Programme Title:**	Mathematics, Physics & Botany	
Course Code:	19UBCHP1	**Course Title:**	**Batch:**	2019
Total Hours:	90	Allied Core Chemistry Practical	**Semester:**	IV
			Credits:	2.0

Course Objective

The course aims

- To develop the experimental skill in volumetric analysis.
- To analyze the organic compounds.

Course Outcome

On the successful completion of the course, students will be able to

Knowledge Level	CO Number	Course Outcome
K4	**CO1**	Estimate quantitatively the metal ions.
K5	**CO2**	Identify the various organic substances.

K1 - Remember; **K2 -** Understanding; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate

SYLLABUS		
Unit	**Content**	**No. of Hours**
	I. Volumetric analysis (Standard solution is to be given) **1. Acidimetry:** a. Estimation of sodium carbonate. b. Estimation of bicarbonate and Carbonate in a mixture using two indicators. **2. Permangonometry:** a. Estimation of Ferrous iron. b. Estimation of oxalic acid. **3. Dichrometry:** a. Estimation of Ferrous iron using internal indicator. **4. Complexometry:** a. Estimation of Zn. b. Estimation of Mg. c. Estimation of Total hardness of water. **II. Organic Chemistry** 1. Detection of elements (N,S and Halogens) 2. To distinguish between aliphatic and aromatic, saturated and unsaturated compounds. 3. Functional group tests for phenols, aromatic amines, acids, amides and carbohydrates.	**90**

Text Books:

1. V. Venkateswaran, R. Veerasamy and A.R. Kulandaivelu, Basic principles of Practical Chemistry, Sultan Chand and Sons, 2nd edition (1997).
2. P.K. Mani and A.O. Thomas, Textbook For Practical Chemistry for B.Sc. Main students, Xavier press, Cannanore (2003).
3. Gnanapragasam and Ramamurthy, Organic chemistry lab manual, Viswanathan S. Printers and publishers Pvt, Ltd. (2009).

Reference Books:

1. J. Mendham, Vogel's Quantitative Chemical Analysis, Pearson Education; 6th edition (2009).
2. V.K. Ahluwalia, S. Dhingra, A. Gulati, College Practical Chemistry, Universities Press (India) Limited (2012).
3. B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5th edition, Pearson Education Ltd. Singapore (2004).

E-references:

1. http://www.federica.unina.it/agraria/analytical-chemistry/volumetric-analysis/
2. http://wwwchem.uwimona.edu.jm/lab_manuals/c10expt25.htm

Mapping with Programme Outcomes

PSO / CO	PSO1	PSO2	PSO3	PSO4
CO1	H	S	S	H
CO2	S	S	H	H

S - Strong; **H** - High; **M** - Medium; **L –** Low

Question Paper Pattern

(Common for Major, Allied, Allied Optional and Major Optional Papers)

For EOS Examinations: 70 Marks

The Question Paper is to be divided into THREE Sections.

Section-A Carries 15 Marks, Section-B Carries 25 Marks and Section-C Carries 30 Marks.

Section-A Contains 15 Multiple Choice Questions. (15 x 1 = 15 Marks)

Three Questions from each unit. (Q. No: 1 to 15)

Section-B Contains 5 Either or Choice Questions. (5 x 5 = 25)

Each Question carries 5 Marks. Both (a) and (b) from the same unit.

Q. No.: 16 (a) or (b) to 20(a) or (b)

Section-C Contains 5 Questions out of which, 3 Questions are to be answered. (3 x 10 = 30)

Each Question carries 10 Marks. One Question from each unit. Q. No.: 21 to 25

For CIA Examinations: 30 Marks

Section-A: 10 Multiple Choice Questions. (10 x 1 = 10)

Section-B: Two Questions out of Three. (2 x 5 = 10)

Section-C: One Question out of Two. (1 x 10 = 10)