



## Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

### Shri Vaishnav Institute of Science Department of Life Science B.Sc. (Major - Biotechnology)

#### SEMESTER III

COURSE CODE	Category	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BSCBT301	Major	Basic Microbiology	60	20	20	30	20	4	-	4	6

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

**\*Teacher Assessment shall be based following components: Quiz / Assignment / Project / Participation in Class, given that no component shall exceed more than 10 marks.**

**Course Objectives:** The objectives of this course are


- To introduce the field of microbiology and understand the significance and importance of microorganisms.
- To familiarize with general characters of prokaryotic and Eukaryotic microorganisms for conventional and molecular characterization using modern methods.
- To introduce students to the basics of microbial growth, nutrition, methods for control of microbes, gene transfer and host microbe interactions.


**Student Learning Outcomes:** Students should be able to:


- Identify major categories of microorganisms and analyze their classification, diversity, and ubiquity
- Demonstrate to culture and control the growth of microorganisms
- Understand the nutritional requirements of microorganisms, and the pattern of their growth and methods of controlling microbial growth
- Acquaintance with the diversity of viruses and techniques for their cultivation and identification
- Analyze the gene transfer mechanism in bacteria and evaluate interactions between microbes, hosts and environment.


#### Unit – I: History, Microbial Diversity and classification

History of Microbiology and major contributions; Microbial diversity-Structure and general characters of Bacteria, Archaea, Fungi and Algae, Protozoa. Bacterial Classification Systems; Advances in Bacterial Taxonomy using Ribotyping, r-RNA sequencing and fatty acid profiling.

  
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**BSCBT301 Basic Microbiology**

**Unit – II: Characteristics of Bacteria**

Nutritional uptake mechanism in bacteria; Nutritional classes of Bacteria; Culture Media, Microbial Growth; Bacterial Growth Curve; Methods of Measurement; Factors affecting bacterial growth: Temperature, Oxygen, pH, Osmotic concentration, and water activity, Batch and Continuous Culture.

Bacterial genetics: mutation and recombination in bacteria, plasmids, transformation, transduction and conjugation; Operon concept.

**Unit – III: Virology**

Morphology and General Properties of Viruses, Viroids and Prions; Classification of Viruses; Plants and Animals Viruses; Bacteriophages – Morphology, Genome Organization and Life Cycle of T4, T7, M13, Lambda Phage; Cultivation of Viruses.

**Unit – IV: Control of Microorganisms**

Sterilization; Physical and Chemical Methods for Control of Microorganisms; Biological Control of Microorganisms; Antimicrobial agents and their Mechanism of action; Drug Resistance Mechanism; Antibiotic sensitivity testing.


**Unit – V: Host-Microbe Interactions**


Host-microbe interaction and their types; Rhizosphere and Phyllosphere Microorganisms; Symbiosis in Legumes and Ruminants, Plant Pathogens - Disease Symptoms, Transmission, Mechanism of Pathogenicity; Microbial Control of Insects and Pests.


Infectious Diseases in Humans – Mechanism of Pathogenesis; Host-pathogen interaction, Evasion of Host Defenses, Beneficial effects: Human microbiome, prebiotics and probiotics.


**PRACTICAL**

1. Isolation and characterization of microorganisms from extreme environments
2. Determination of bacterial growth rate and factors influencing it
3. Sterilization, disinfection and safety in microbiological laboratory
4. Preparation of media for cultivation of bacteria
5. Study of colony and growth characteristics of some common bacteria:  
*Bacillus*, *E. coli*, *Staphylococcus*, *Streptococcus*, etc.
6. Preparation of bacterial smear and Gram's staining.
7. Enumeration of bacteria: standard plate count.

  
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#### Department of Life Science


#### B.Sc. (Major - Biotechnology)


#### BSCBT301 Basic Microbiology


8. Antimicrobial sensitivity test and demonstration of drug resistance
9. Maintenance of stock cultures: slants, stabs and glycerol stock cultures
10. Determination of phenol co-efficient of antimicrobial agents
11. Determination of Minimum Inhibitory Concentration (MIC)
12. Isolation of Bacteriophages
13. Study of colony and growth characteristics of some common fungi: *Penicillium*, *Rhizopus*, *Mucor*, *Aspergillus sp.*


#### BOOKS

1. Pelczar, M. J., Reid, R. D., & Chan, E. C. (2001). Microbiology (5th Ed.). New York: McGraw-Hill.
2. Willey, J. M., Sherwood, L., Woolverton, C. J., Prescott, L. M., & Willey, J. M. (2011). Prescott's Microbiology (8th Ed, New York: McGraw-Hill.
3. Matthai, W., Berg, C. Y., & Black, J. G. (2005). Microbiology, Principles and Explorations. Boston, MA: John Wiley & Sons.
4. Cappuccino, J. G., & Welsh, C. (2016). Microbiology: a Laboratory Manual. Benjamin-Cummings Publishing Company.
5. Collins, C. H., Lyne, P. M., Grange, J. M., & Falkinham III, J. (2004). Collins and Lyne's Microbiological Methods (8th Ed.). Arnolds.
6. Tille, P. M., & Forbes, B. A., Bailey & Scott's Diagnostic Microbiology. (2018) 14th Edition

  
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BSCCH301	Minor	Organic Chemistry	60	20	20	30	20	4	-	4	6

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#### Course Educational Objectives (CEOs):

The course Organic chemistry aims to provide the student with:

1. To understand the chemistry of saturated, unsaturated, and aromatic hydrocarbons.
2. To acquire the knowledge about Bayer's strain theory, Regioselectivity, and Thermodynamic aspects of organic reactions, and applications of Saytzeff rule.
3. To discuss the properties of Cycloalkanes, Cycloalkenes and Dienes.
4. To acquaint the students with practical knowledge and industrial applications of Organic chemistry.


#### Course Outcomes (COs):


1. Students will gain the basic knowledge of IUPAC nomenclature of alkanes, alkenes, dienes, and physical, chemical properties of the commercially important molecules.
2. Students can be able to understand Aromaticity, Kekule structure, Huckel's rule, and Aromatic electrophilic substitution reactions with mechanism.
3. They can understand the chemistry of Biomolecules with structures, properties, and biological importance of Carbohydrates and Aminoacids.
4. They can learn the industrial utility of Organic chemistry and practical knowledge to become good chemist.


#### Syllabus


##### Unit I: Alkanes and Cycloalkanes

IUPAC nomenclature of branched and unbranched alkanes, the alkyl group, classification of carbon atom in alkanes, isomerism in alkanes, methods of preparation – Wurtz reaction, Kolbe reaction, Corey-House reaction, and decarboxylation of carboxylic acids. Physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes: orientation, reactivity, and selectivity. Cycloalkanes - nomenclature, preparation methods, chemical reactions. Bayer's strain theory and its limitations. Ring strain in small rings (Cyclopropane and cyclobutane). The case of cyclopropane ring, banana bonds.

  
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#### BSCCH301 Organic Chemistry

##### Unit II: Alkenes and Cycloalkenes

IUPAC nomenclature of alkenes, methods of formation, mechanism and regioselectivity of dehydration of alcohols and dehydrohalogenation of alkyl halides. Saytzeff rule, Hofmann elimination, physical properties, and relative stabilities of alkenes. Chemical reactions of alkenes – hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction. Epoxidation, ozonolysis, hydration, hydroxylation, and oxidation with  $\text{KMnO}_4$ . Polymerization of alkenes, Industrial applications of ethylene and propene. Methods of formation, physical properties, and chemical reactions of cycloalkenes.

##### UNIT III: Dienes and Alkynes

Nomenclature and classification of dienes: isolated, conjugated, and cumulated dienes, Structure of allenes and butadiene, methods of formation, chemical reaction – 1, 2 and 1, 4 additions, Diels-Alder reaction, and polymerization. Nomenclature, structure and bonding in alkynes, methods of formation, chemical reactions of alkynes, acidity of alkynes, hydroboration-oxidation, metal-ammonia reductions, oxidation, and polymerization.

##### UNIT IV: Arenes and Aromaticity

Nomenclature of benzene derivatives, Structure of benzene - Kekule structure, stability and carbon-carbon bond lengths of benzene, resonance structure, MO picture. Aromaticity: The Huckle rule, aromatic ions. Aromatic electrophilic substitution – general pattern of the mechanism, role of  $\sigma$  and  $\pi$  complexes, Mechanism of nitration, halogenation, sulphonation, mercuriation and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio, Birch reduction.

##### UNIT V: Biomolecules

[A] **Carbohydrates:** Introduction, classification, Osazone formation, epimerization, step-up and step-down reactions of monosaccharides, simple structures of glucose and fructose, Fischer's proof of configuration of D-glucose.

[B] **Amino acids:** Introduction of amino acid, Classification, and properties of amino acids, Zwitter ion, Isoelectric point, Strecker's and Gabriel phthalimide synthesis of amino acids.


##### Guidelines for Practical:


A two-credit lab is to be conducted by covering the most relevant and useful topics from above mentioned syllabus.

##### List of Textbooks:

1. Robert Thorn Morrison and Robert Neilson Boyd, Textbook of Organic Chemistry, Prentice Hall of India Pvt Ltd, New Delhi, 6<sup>th</sup> Edition, 1992.
2. Bhupinder M4. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry, S. Chand & Company Ltd., New Delhi, 1<sup>st</sup> Edition, 2003.

  
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**BSCCH301 Organic Chemistry**

3. James B Hedrickson Donald J. Cram and George S. Hammond, Organic Chemistry, McGraw-Hill Kogakusha, Ltd., 3<sup>rd</sup> Edition.
4. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry, S. Chand & Company Ltd., New Delhi, 1<sup>st</sup> Edition, 2003.
5. I.L.Finar, Organic Chemistry Vol-I & Vol-II, Pearson Education Ltd, New Delhi, 5<sup>th</sup> Edition, 2016.
6. G.Marc Loudon, Organic Chemistry, Oxford University Press, 4<sup>th</sup> Indian edition, 2010.
7. P.S.Kalsi, Text book of Organic Chemistry, MacMillan, India Pvt. Ltd., 1999.


**Reference Books:**

1. Pine, S., Hendrickson, J. B., Cram, D.J., Hammond, S. Organic Chemistry, 8<sup>th</sup> Edition, McGraw-Hill, New York. 2012
2. John McMurry, Brooks Cole, Organic Chemistry, 6<sup>th</sup> Edition, John-Wiley International Edition.
3. Graham, T.W., Solomons, S., and Craig B. Fryhle, Organic Chemistry, 8<sup>th</sup> Edition, John-Wiley International Edition.
4. Francis A. Carey and Richard J. Sundberg, Advanced Organic Chemistry Part-A & B, 7<sup>th</sup> Edition, McGraw-Hill, 2015.

  
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