THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE
B.Sc. MICROBIOLOGY
DEGREE COURSE

(With effect from 2020 - 2021)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		SEMESTER I					**CIA**	**Uni. Exam**	**Total**
1	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3	III	Core Theory	Paper-1	6	4	Fundamentals of Microbiology	25	75	100
4	III	Core Practical	Practical-1	4	0	Experiments in Basic Microbiology	0	0	0
5	III	Allied -1	Paper-1	4	3	Biochemistry - I	25	75	100
6	III	Allied- 1	Practical-1	2	0	Biochemistry	0	0	0
7	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
8	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
		SEMESTER II					**CIA**	**Uni. Exam**	**Total**
8	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
9	II	English (CE)	Paper-2	6	4	**Communicative English II**	25	75	100
10	III	Core Theory	Paper-2	5	4	Microbial Physiology	25	75	100
11	III	Core Practical	Practical-1	3	2	Experiments in Basic Microbiology (Contd.)	25	75	100
12	III	Allied-1	Paper-2	4	3	Biochemistry - II	25	75	100
13	III	Allied Practical - 1	Practical-1	2	2	Biochemistry (Contd.)	25	75	100
14	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
15	IV	Value Education		2	2	Value Education	25	75	100
16	IV	Soft Skill		2	1	Soft Skill	25	75	100
		Sem. Total		**36**	**25**		**225**	**675**	**900**

THIRUVALLUVAR UNIVERSITY

B.Sc. MICROBIOLOGY

SYLLABUS
CBCS PATTERN
(With effect from 2020 - 2021)

SEMESTER I

CORE PAPER - 1

FUNDAMENTALS OF MICROBIOLOGY

Course Objective: To provide an insight on the fundamentals of Microbiology and microbes as a major component of the ecosystem.

Course Outcomes:
At the end of the course, the student will be able to

1. Understand the scope and relevance of Microbiology as a scientific discipline.
2. Decide on the correct type of microscopy and staining.
3. Gain knowledge on the various classification of microorganisms.
4. Study the morphology and structure of microorganism.
5. Get acquainted with various sterilization techniques.

Unit 1: History of Microbiology - Definition and Scope of Microbiology; History of Microbiology; The origin of Microbial life - Theory of Spontaneous generation; Contributions of Anton Van Leewenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Thomas J. Burrill, Sergei N. Winogrdsky, Beijerinck, Emil Christian Hansen, S.A. Waksman, Alexander Fleming; Endosymbiotic theory; Microbiology and the future.

Unit 2: Microscopy and staining - Microscopy - Simple, Compound, Dark field, Phase contrast, Fluorescence and Electron microscopy; Staining methods and principles - Simple, Differential (Grams staining) and Special staining techniques (Acid fast staining, Spore staining, Capsule staining, Flagellar staining, Negative staining, Staining of metachromatic granules).

Unit 3: Classification of microorganisms - Microbial Diversity - Prokaryotes and Eukaryotes; Binomial nomenclature of Microbes; Classification – Three Kingdom, Five Kingdom, Eight Kingdom (Cavalier Smith) Concepts; Bacterial classification according to Bergey's Manual; Classification outlines of Algae, Fungi, Protozoa and Virus.

Unit 4: Structure of microorganisms - Morphology and Anatomy of bacteria - cell wall, cytoplasmic membrane, capsule, cilia, fimbriae and flagella - structure and types, intracellular organelles and cytoplasmic inclusions; Endospore – sporulation.

Unit 5: Concept of sterilization - Control of microbial growth by Sterilization and Disinfection – Definitions, methods; Physical, Chemical methods – Antiseptics; Antimicrobial agents – Antibacterial, antifungal and antiviral agents with examples – Resistance mechanisms.

Text Books

1. Microbiology. 6th Edition. Pelczar Jr. M.J., Chan E.C.S and Kreig, N.R. (2006). McGraw Hill Inc., New York.
2. Text Book of Microbiology. 9th edition. Ananthanarayan R and Paniker C.K.J. (2013). Universities Press, Hyderabad.
3. A Text of Microbiology. Revised edition. Dubey R.C and Maheswari D.K. (2012). S. Chand & Company Ltd., New Delhi.

Reference books

1. Microbiology. 8th Edition. Lansing M. Prescott, John P. Harley, Donald Klein. (2011). McGraw Hill Inc., New York.
2. General Microbiology. 2nd Edition. Robert F. Boyd (2000). Times Mirror / Moshy College Publishing, Virginia.
3. Principles of Microbiology. 1st Edition. Geeta Sumbali and Mehrotra R.S (2009). Tata McGraw Hill P. Ltd., New Delhi.
4. Microbiology. 5th edition. David B.D., Delbeco R., Eisen, H.N. and Ginsburg, H.S (1990). Harper and Row, New York.
5. Fundamental Principles of Bacteriology, 7th edition. Salee A.J (1992). McGraw Hill Publishing Co. Ltd., New York.

ALLIED - 1

PAPER – 1

BIOCHEMISTRY I

OBJECTIVE:

To acquire knowledge on the structure and functions of biomolecules

At the end of the course, the students will be able to

CO1	Explain the structure, biological importance of carbohydrates, from monosaccharides to polysaccharides
CO2	Identify the structure and classification of amino acids,
CO3	Classify proteins and explain their properties
CO4	Define and classify lipids with examples, explain the properties of fats and describe the structure and biological functions of phospholipids, glycolipids and sterols
CO5	Illustrate the structure of nucleotides, distinguish DNA and RNA and describe the structure of DNA, types of RNA and their biological functions

UNIT-I: Carbohydrates

Definition and Classification of carbohydrate. Monosaccharides–Glucose, Fructose and Arabinose, Linear and ring forms (Haworth formula)for glucose and fructose. Anomer, epimer and enatiomers-Definition with examples. Disaccharides –Definition- Sucrose, maltose and Lactose occurrence, structure and functions. Polysaccharides – Homopolysaccharides -Starch -Structure and functions. Heteropolysacharides-Aminosugars and sugar acids.

UNIT-II: Amino acids

Definition and classification of amino acids. Reaction of amino acids with ninhydrin, Color reactions of amino acids (Xanthoproteic test, Morners test, Millons test, Sakaguchi test, Lead acetate test and Pauly's test), Amphoteric nature, isoelectric pH and Zwitter ion.

UNIT-III: Proteins

Proteins-Definition. Peptide bond formation. Classification of proteins based on solubility, shape and size. Denaturation. Structure of protein: primary, secondary, tertiary and quaternary structure.

UNIT-IV: Lipids

Definition, classification and functions of lipids. Occurrence, chemistry and biologicalfunctions of simple lipids, compound lipids (e.g. phospholipids) and derived

lipids:steroids (e.g. cholesterol). Physical property-emulsification. Chemical property-saponification. Functions of bile acids and bile salts.

UNIT- V: Nucleic acids

Nucleic acid- Composition of nucleic acid. Definition - nucleoside, nucleotide and polynucleotide. Double helical model of DNAand its biological functions. Chargaff's rule. RNA-Structure, types and functions of RNA: tRNA, mRNAand rRNA. Differences between DNA and RNA

REFERENCES

1. J. L. Jain, Nitin Jain, Sunjai Jai., Fundamentals of Biochemistry 7th editionS. Chand @ Co.Ltd .,2016
2. U. Satyanarayanan BiochemistryElseiver 2017
3. David.L.Nelson, Michael. M.Cox Lehninger principles of Biochemistry 7theditionFreeman. W.H. and Company2017
4. Victor Rodwell Harper's Illustrated Biochemistry McGrew. Hill 2018

SEMESTER I

CORE PAPER- 2

MICROBIAL PHYSIOLOGY

Course Objective: To provide an in depth understanding on the physiological requirements for the growth of microorganisms and microbial metabolism.

Course Outcomes:
At the end of the course, the student will be able to

1. Outline on the nutritional requirement and nutritional types of bacteria.
2. Demonstrate various techniques employed in the cultivation of microorganisms.
3. Discuss on the different phases of microbial growth.
4. Explain the basic concepts of microbial metabolism.
5. Elaborate on the biosynthesis of bacterial cell wall and mechanism of photosynthesis.

Unit 1: Nutritional requirements of microorganisms – micro and macro elements; Nutritional types of microorganisms - Autotrophs, Heterotrophs, Photoautotrophs, chemoautotrophs, Lithotrophs, oligotrophs; Transport of nutrients by active and passive transport mechanism.

Unit 2: Cultivation of microbes - Bacteria, Fungi and Virus; Preparation of Culture media – types of culture media, liquid and solid media preparation; Pure culture techniques - Streak, Pour and spread plate methods; Preservation of cultures.

Unit 3: Different phases of growth curve - generation time; Factors influencing microbial growth - oxygen, temperature, pH, pressure, salt concentration, nutrient; synchronous growth and continuous cultivation - diauxic growth.

Unit 4: Metabolism – TCA cycle - electron transport chain - oxidative and substrate level phosphorylation; Bacterial enzymes; Anaerobic respiration - Sulphur, nitrogenous compounds and carbon dioxide as final electron acceptor; Fermentations - alcoholic, propionic and mixed acid fermentation.

Unit 5: Photosynthesis - Oxygenic and anoxygenic carbon dioxide fixation; Biosynthesis of bacterial cell wall; biosynthesis of amino acids (glutamic acid family); Bioluminescence.

Text Books

1. Microbiology, 5th Edition. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). McGraw Hill Inc. New York.
2. Essentials of Microbiology. Rajan. S and Selvi Christy (2015). Anjanaa Book House Publishers, Chennai.
3. The Physiology and Biochemistry of Prokaryotes. 4th edition. David white (2011). Oxford university press, UK

Reference books

1. General Microbiology, Schlegel H.G., (1993, 7th Edition), Cambridge University Press.
2. Microbial physiology, 4th edition. Moat G, John W. Foster and Michael P. Spector

(2002). A John Wiley sons, Inc. publication. New Delhi.
3. Microbiology. 8th Edition. Lansing M. Prescott, John P. Harley, Donald Klein. (2011). McGraw Hill Inc., New York.
4. Fundamental Pinciples of Bacteriology, 7th edition. Salee A.J (1992). McGraw Hill Publishing Co. Ltd., New York.
5. Microbial Physiology & metabolism, Caldwell, D.R., (1995) Wm. C. Brown Communications, Inc., USA.

CORE PRACTICAL - 1

EXPERIMENTS IN BASIC MICROBIOLOGY

Course Objective: To enable the students to perform sterilization of glasswares; to prepare culture media and sterilize them; to stain and observe various microorganisms; to perform biochemical test to differentiate bacteria.

LIST OF EXPERIMENTS

Rules and Regulations in Microbiology Laboratory

Safety precautions

Preparation of cleaning solutions

Sterilization of Glasswares and Culture Media

Microscopy – Parts and functions of a compound microscope

Staining – Simple staining, Gram staining

Motility demonstration: Hanging drop technique

Morphology of Algae – wet mount

Morphology of fungi – LPCB staining

Micrometry - Determination of size of Bacteria, yeast.

Media preparation - Liquid media, solid media, Agar slants, Agar plates

Pure culture technique - Streak plate

Oxidase and catalase tests

Biochemical tests - IMViC tests, urease test, TSI, Carbohydrate fermentation

Reference Manuals

1. Experimental Procedures in Life Sciences. Rajan. S and Selvi Christy (2015). Anjanaa Book House Publishers, Chennai.

2. Microbiology: A Laboratory Manual. Cappuccino and Sherman. (7th edition, 2004) Berjamin Cummings Publications.

ALLIED - 1

PAPER – 2

BIOCHEMISTRY II

OBJECTIVE:

To acquire a wide knowledge on metabolism, disorders of metabolism and biological functions of vitamins and minerals

At the end of the course, the students will be able to

CO1	Illustrate the reactions of various metabolic pathways
CO2	Acquire knowledge on the various metabolic disorders
CO3	Classify enzymes and explain their functions
CO4	Define and classify vitamins with examples, explain the sources, RDA and functions of fat soluble and water soluble vitamins
CO5	Illustrate the sources, RDA and functions of minerals

UNIT-I: Metabolism

Metabolism-Catabolism and anabolism-Definition. Reactions of glucose oxidation-Glycolysis, TCA cycle and its energetics, HMP shunt and its significance. Amino acid-transamination and Deamination,reaction, Urea cycle- Formation of urea.

UNIT-II: Metabolic Disorders

Diabetes mellitus- definition. Types and symptoms. Glycogen storage diseases-Types, Renal Glycosuria-Definition and causes. In born errors of amino acid metabolism- Phenylketonuria, Alkaptonuria (Black urine syndrome) and albinism

UNIT-III: Enzymes

Enzymes-Definition, IUB system of classification with one example. Mechanism of enzyme action- Lock and key mechanism, Induced Fit theory. Michaleis-Menton equation. Coenzymes- Vitamins as coenzymes (Tabulation of Coenzymes with functions in metabolism)

UNIT-IV: Vitamins

Vitamins- fat soluble (Vitamin A, D, E and K) and water soluble vitamins (Vitamin B1, B2, B3 and B12),Vitamin C - sources, RDA, biological function and deficiency of Vitamins of the above mentioned vitamins

UNIT V-Minerals

Minerals- sources, RDA, biological functions and deficiency of Calcium, Iron, Phosporus, Sodium and potassium. Examples of minerals as cofactors in metabolism.

REFERENCES

1. J. L. Jain, Nitin Jain, Sunjai Jai., Fundamentals of Biochemistry 7th edition S. Chand @ Co.Ltd .,2016
2. U. Satyanarayanan BiochemistryElseiver 2017
3. David.L.Nelson, Michael. M.CoxLehninger principles of Biochemistry 7th editionFreeman. W.H. and Company2017
4. Victor RodwellHarper's Illustrated BiochemistryMcGrew. Hill 2018

ALLIED PRACTICAL

PRACTICAL I

BIOCHEMISTRY I & II

CO NUMBER	CO Statement
CO1	Quantify glucose in unknown solution by benedicts method
CO2	Quantify ascorbic acid in lemon by Dichlorophenol indo phenol dye method
CO3	Quantify glycine by Sorenson's formal titration method
CO4	Qualitatively analyze the carbohydrates and amino acids and report the type of carbohydrate based on specific tests
CO5	Differentiate the carbohydrates based microscopic examination of the crystal structure.

Volumetric Estimation

1. Estimation of Glucose by Benedict's method.
2. Estimation of Ascorbic acid by 2, 6 dichlorophenol indophenols dye method.
3. Estimation of Glycine by Sorenson's formal titration.

A) Qualitative analysis of Carbohydrates

1. Qualitative analysis of Glucose,
2. Qualitative analysis of Fructose,
3. Qualitative analysis of Sucrose
4. Qualitative analysis of Maltose,
5. Qualitative analysis of Starch

B) Qualitative analysis of Amino acids

1. Qualitative analysis of Arginine,
2. Qualitative analysis of Cysteine,
3. Qualitative analysis of Tryptophan
4. Qualitative analysis of Tyrosine
5. Qualitative analysis of Histidine

REFERENCES

1. J. Jayaraman,Laboratory Manual in Biochemistry New Age International Pvt Ltd Publishers

2011

2. S. K. SawhneyRandhir Singh Introductory Practical Biochemistry Alpha Science International, Ltd,2 edition, 2005.
3. Irwin H.Saegal Biochemical calculations Liss, Newyork 1991

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