

THIRUVALLUVAR UNIVERSITY

BACHELOR OF SCIENCE

B.Sc. MICROBIOLOGY

DEGREE COURSE

CBCS PATTERN

(With effect from 2017-2018)

The Course of Study and the Scheme of Examinations

S.NO	Part	Study Components		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
SEMESTER I									
1	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2	II	English	Paper-1	6	4	English	25	75	100
3	III	Core Theory	Paper-1	6	5	Fundamentals of Microbiology	25	75	100
4	III	Core Practical	Practical-1	3	0		0	0	0
5	III	ALLIED - 1	Paper-1	4	4	Biochemistry I	25	75	100
6	III	Allied Practical	Practical-1	3	0		0	0	0
7	IV	Environ. Studies		2	2	Environmental Studies	25	75	100
				30	19		125	375	500
SEMESTER II									
8	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
9	II	English	Paper-2	4	4	English	25	75	100
10	III	Core Theory	Paper-2	6	5	Microbial Physiology	25	75	100
11	III	Core Practical	Practical-1	3	3	Subjects covering Core Papers 1 & 2	25	75	100
12	III	ALLIED-1	Paper-2	4	4	Biochemistry II	25	75	100
13	III	Allied Practical	Practical-1	3	2	Biochemistry	25	75	100

B.Sc. Microbiology: Syllabus (CBCS)

14	IV	Value Education		2	2	Value Education	25	75	100
15	IV	Soft Skill		2	1	Soft Skill	25	75	100
				30	25		200	600	800
SEMESTER III							CIA	Uni. Exam	Total
16	I	Language	Paper-3	6	4	Tamil/Other Languages	25	75	100
17	II	English	Paper-3	6	4	English	25	75	100
18	III	Core Theory	Paper-3	3	3	Immunology	25	75	100
19	III	Core Practical	Practical-2	3	0		0	0	0
20	III	ALLIED-2	Paper-3	4	4	Human anatomy and physiology	25	75	100
21	III	Allied Practical	Practical-2	3	0		0	0	0
22	IV	Skill based Subject	Paper-1	3	3	Haematology and blood banking	25	75	100
23	IV	Non-major elective	Paper-1	2	2	Computer Applications in Biology	25	75	100
				30	20		150	450	600
SEMESTER IV							CIA	Uni. Exam	Total
24	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
25	II	English	Paper-4	6	4	English	25	75	100
26	III	Core Theory	Paper-4	3	3	Microbial Genetics	25	75	100
27	III	Core Practical	Practical-2	3	3	Subjects covering Core Papers 3 & 4	25	75	100
28	III	ALLIED-2	Paper-4	4	4	Bio-statistics	25	75	100
29	III	Allied Practical-2	Practical-2	3	2	Human anatomy and physiology	25	75	100
30	IV	Skill based Subject	Paper-2	3	3	Vermi tech	25	75	100

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31	IV	Non-major elective	Paper-2	2	2	Human microbial diseases, causes and control	25	75	100
				30	25		200	600	800
SEMESTER V							CIA	Uni. Exam	Total
32	III	Core Theory	Paper-5	7	5	Molecular Biology and Genetic Engineering	25	75	100
33	III	Core Theory	Paper-6	7	5	Medical Bacteriology	25	75	100
34	III	Core Theory	Paper-7	7	5	Medical Virology, Mycology and Parasitology	25	75	100
35	III	Core Practical	Practical-3	3	0	Subjects covering Core Papers 5, 6 & 7	0	0	0
36	III	Elective	Paper-1	3	3	Herbal Technology	25	75	100
37	IV	Skill based Subject	Paper-3	3	3	Mushroom culture techniques	25	75	100
				30	21		125	450	600
SEMESTER VI							CIA	Uni. Exam	Total
38	III	Core Theory	Paper-8	5	5	Food Microbiology	25	75	100
39	III	Core Theory	Paper-9	5	4	Soil, Agricultural and Environmental Microbiology	25	75	100
40	III	Core Theory	Paper-10	5	5	Industrial and Pharmaceutical Microbiology	25	75	100
41	III	Core Practical	Practical-3	3	3	Subjects covering Core Papers 5, 6 & 7	25	75	100
42	III	Core Practical	Practical-4	3	3	Subjects covering Core Papers 8 & 9	25	75	100
43	III	Elective	Paper-2	3	3	Bio inoculants technology	25	75	100
44	III	Elective	Paper-3	3	3	Food analysis and quality control	25	75	100

B.Sc. Microbiology: Syllabus (CBCS)

45	IV	Skill based Subject	Paper-4	3	3	Bioinstrumentation	25	75	100
46	V	Extension Activities		0	1		100	0	100
				30	30		300	600	900

Part	Subject	Papers	Credit	Total credits	Marks	Total marks
Part I	Languages	4	4	16	100	400
Part II	English	4	4	16	100	400
Part III	Allied (Odd Sem)	2	4	8	100	200
	Allied (Even Sem)	2	4	8	100	200
	Allied -Prac(Even Sem)	2	2	4	100	200
	Electives	3	3	9	100	300
	Core	10	(3-7)	45	100	1000
	Core Practical	4	3	12	100	400
Part IV	Env. Science	1	2	2	100	100
	Soft skill)	1	1	1	100	100
	Value Education	1	2	2	100	100
	Lang. & Others/NME	2	2	4	100	200
	Skill Based	4	3	12	100	400
Part V	Extension	1	1	1	100	100
	Total	41		140	1400	4100

THIRUVALLUVAR UNIVERSITY

B.Sc. MICROBIOLOGY

SYLLABUS

UNDER CBCS PATTERN

(With effect from 2017-2018)

SEMESTER I

PAPER - 1

FUNDAMENTALS OF MICROBIOLOGY

Objective

To make the students to understand the fundamentals on microbes.

UNIT-I

Definition and scope of Microbiology - History of Microbiology. The origin of Microbial life - Theory of spontaneous generation. Pasteurs's Tyndall experiments fermentation studies. Contributions of Leewenhoek, Lister, Robert Koch, Thomas J.Burrill, Sergei N. Winogeadsky, Willen Beijerinck, Emil Christian Hansen, S.A. Wakmann, Alexander flaming, Stanely Iwenewsky - Impact of Microbiology and the future.

UNIT-II

Microscopy - simple, compound, dark field, phase contrast, Florescence & Electron microscopy. Staining methods and its principles.

UNIT-III

Microbial Evolution and Diversity - Endosymbiotic theory. Binomial nomenclature of Microbes. Classification - Five kindom concept - eight kindom concept (Cavalier Smith).

UNIT-IV

Anatomy of prokaryotes - cell wall, cytoplasmic membrane, cilia flagella capsule, cytoplasmic inclusions, sporulation.

UNIT-V

Sterilization - methods of sterilization and Disinfection. Antimicrobial chemotherapy - tests for sensitivity to antimicrobial agents.

Text Books:

1. Rajan. S and Selvi Christy (2015). Essentials of Microbiology, Anjanaa Book House Publishers, Chennai.
2. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). "Microbiology"- 5th Edition Mc Graw Hill Inc. New York.
3. Ananthanarayan and Panikers (2013) Textbook Microbiology 9th edition, Universities Press (India) Private Ltd.
4. David, B.D., Delbecco, R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.
5. Dubey RC and Maheswari DK (2005). A text book of Microbiology, Revised Multicolour edition, S.Chand Publishers, New Delhi.
6. Purohit SS (2005). Microbiology - Fundamentals and Applications. Student Edition Publishers, Jodhpur.
7. Powar & daginawala (2005). General Microbiology Vol.I & II 8th Edition, Himalaya Publishing House, Mumbai.
8. Salle, AJ (2001). Fundamentals & Principles of Bacteriology. 7th edition. Tata McGraw-Hill, Davis,
9. Delbecco, Eisen & Ginsburg (1990) Microbiology 5th Edition Harper & raw, New York

Reference Books:

1. Lansing M. Prescott., John. P. Harley., Donald A, Klein, "Microbiology"-Mc Graw Hill Inc. New York.
2. Robert F.Boyd., "General Microbiology" 2nd Edition, Times MIRROR/Moshy College Publishing Virginia.

**ALLIED - 1
PAPER - 1
BIOCHEMISTRY I**

UNIT-I: Chemistry of Carbohydrates

Definition and Classification of carbohydrate. Monosaccharides - occurrence, structure; physical and chemical properties, linear and ring forms (Haworth formula) for glucose and fructose. Disaccharides - occurrence, structure; physical and chemical properties of sucrose and lactose. Polysaccharides - occurrence, structure, physical and chemical properties of starch.

UNIT-II: Chemistry of amino acids

Definition and classification of amino acids. Reaction with ninhydrin, common properties of amino acids, amphoteric nature, isoelectric point, isoelectric pH and Zwitter ion.

UNIT-III: Chemistry of Proteins

Classification based on solubility, shape and size. Physical properties: salting in and salting out, denaturation, peptide bond. Structure of protein: primary, secondary, tertiary and quaternary structure.

UNIT-IV: Chemistry of Lipids

Definition, classification and functions of lipids. Occurrence, chemistry and biological functions 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: Chemistry of Nucleic acids

Definition - nucleoside, nucleotide and polynucleotide. Double helical model of DNA and its biological functions. Structure, types and functions of RNA: tRNA, mRNA and rRNA. Differences between DNA and RNA.

References:

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan worth Publishers.
2. Harper's Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, and Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
6. Biomolecules-C. Kannan , MJP Publishers, Chennai - 5.

**SEMESTER II
PAPER - 2
MICROBIAL PHYSIOLOGY**

Objective

To make the students to understand the physiology of microbes.

UNIT-I

Basic concepts of metabolism - Nutritional types of microorganisms uptake of nutrient in to the cell. Transport of nutrients by active and passive ways.

UNIT-II

Cultivation of microbes - Bacteria fungi, virus. Culture technique - media preparation. Types of media. Isolation of pure culture - preservation of cultures.

UNIT-III

Microbial growth - Growth curve measurement of microbial growth - Measurement of cell number, measurement of cell mass. Factors affecting growth.

UNIT-IV

Control of microbial growth by Antiseptics. Antiparasitic and Antiviral drugs - Antimicrobial resistance.

UNIT-V

Basic concepts of metabolism - Mechanism of ATP formation - Substrate phosphorylation. Electron transport, phosphorylation, photophosphorylation. Energy production during oxidation of organic substrate - Amino acid and assimilatory pathway. Bacterial enzymes - coenzymes - isoenzymes - structure, classification and properties.

Text Books:

1. Rajan. S and Selvi Christy (2015). Essentials of Microbiology, Anjanaa Book House Publishers, Chennai.
2. Ananthanarayan and Panikers (2013) Textbook Microbiology 9th edition, Universities Press (India) Private Ltd.
3. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). "Microbiology"- 5th Edition Mc Graw Hill Inc. New York.

4. Sale, A.J (1992) "Fundamentals Principles of Bacteriology", 7th Edition. McGraw Hill Publishing Co. Ltd., New York.
5. Dubey, R.C. and Maheswari, D.K. (2005) A Text book of microbiology. S. Chand & Company Ltd. New Delhi.
6. David, B.D., Delbecco, R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.
7. Dubey RC and Maheswari DK (2005). A text book of Microbiology, Revised Multicolour edition, S.Chand Publishers, New Delhi.
8. Purohit SS (2005). Microbiology - Fundamentals and Applications. Student Edition Publishers, Jodhpur.
9. Powar & duginawala (2005). General Microbiology Vol.I & II 8th Edition, Himalaya Publishing House, Mumbai.
10. Delbecco, Eisen & Ginsburg (1990) Microbiology 5th Edition Harper & raw, New York

Reference Books:

1. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (1986). "General Microbiology" -Mac Milan Education Ltd. London.
2. Dall, D.O and Rao, K.K (1995) "Photosynthesis" –Cambridge University press.
3. Chandar Sbekar, C.N. (2006). Manipal Manual of Physiology, CBS Publishers and distributors Pvt. Ltd., Chennai.
4. Pal, G.K and Pravathi Pal (2016), A text book of Practical Physiology, 4th Edition Universities Press (India) Pvt Ltd,

**CORE PRACTICAL
PAPER 1 & 2**

Objective:

To impart hand on training on basics of microbiology and microbial physiology.

1. Cleaning of glass ware.
2. Sterilization principle and methods-moist heat - dry heat and filtration methods.
3. Media preparation: Liquid media, solid media, Agar deep, Agar slants, Agar plates, Basal, enriched, selective media preparation - quality control of media, growth supporting properties and sterility check of media.
4. Pure culture technique: Streak plate, pour plate, spread plate, decimal dilution.
5. Cultural characteristics of microorganisms: Growth on different media, growth characteristics and description. Demonstration of pigment production and extraction.
6. Microscopy: Light microscopy, bright field microscopy, dark field microscopy and phase contrast microscopy.
7. Motility demonstration: Hanging drop preparation, wet mount, dark field microscopy, semisolid agar, Craigies tube method.
8. Staining techniques: Smear preparation, simple staining, Gram's staining, Acid fast staining, staining for metachromatic granules.
9. Morphology of microorganisms: Morphological variations in algae. Morphology of fungi, yeasts, slide culture techniques.
10. Antibiotic sensitivity testing: Disc diffusion test - Quality control with standard strains.
11. Micrometry: Determination of size of Bacteria, yeast. Fungal filaments.
12. Physiological characteristics: IMViC test, MR-VP test, H₂S, Oxidase, catalase, urease test, gelatin liquefaction, casein, starch degradation. Carbohydrate fermentation, Maintenance of pure culture, Paraffin method - Stab culture - maintenance of mound culture.

References Book:

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

ALLIED - 1
PAPER - 2
BIOCHEMISTRY II

UNIT-I: Metabolism

Glycolysis, TCA cycle and its energetics, HMP shunt pathway. Deamination, transamination reaction, transaminase enzymes, Urea cycle.

UNIT-II: Metabolic Disorders

Diabetes mellitus, Glycogen storage diseases, Glycosuria, Ketosis, Jaundice, Phenyl ketonuria, Alkaptonuria. Dehydration: definition, causes, symptom and prevention.

UNIT-III: Enzymes

Definition, classification of enzymes with one example. Mechanism of enzyme action - Lock and key mechanism, Induced Fit theory. Michaleis-Menton equation. Enzyme inhibition: competitive, uncompetitive and non competitive. Biological functions of enzymes.

UNIT-IV: Molecular Biology

Central dogma of molecular biology. DNA and RNA act as genetic material. Replication: Definition, types, mode of action of replication, mechanism of replication. General mechanism of transcription and translation. Genetic code.

UNIT-V: Vitamins

A brief outline of source, requirement, biological function and deficiency of Vitamins (fat soluble and water soluble vitamins).

References:

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan worth Publishers.
2. Harper's Biochemistry-Robert K. Murray, Daryl K. Grammer, McGraw Hill, and Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.
5. Biochemistry-Dr. Ambika Shanmugam, Published by Author.
6. Biomolecules-C. Kannan, MJP Publishers, Chennai-5.

**ALLIED PRACTICAL
BIOCHEMISTRY I & II**

PRACTICAL I

Volumetric Estimation

1. Estimation of HCl using Na₂CO₃ as link and NaOH as primary standard.
2. Estimation of Iron in Ferrous Ammonium Sulphate using potassium permanganate as link solution and oxalic acid as primary standard.
3. Estimation of Glucose by Benedict's method.
4. Estimation of Glycine by formal titration.
5. Estimation of Ascorbic acid.

**SEMESTER III
PAPER - 3
IMMUNOLOGY**

Objective:

To make the students to understand the immune system

UNIT-I

History of Immunology - Immunohaematology. Blood groups - Blood transfusion - Host parasite relationships. Microbial infections.

UNIT-II

Structure and function of the cells, tissues and organs of immune system. Types of immunity - Humoral and cell-mediated, innate, acquired immunity. Complement system - function and pathways.

UNIT-III

Antigen - types, properties. Hapten, adjuvants, Immunoglobulins: Structure types properties and their function - Theory of antibody production.

UNIT-IV

Vaccines and Immunization - Types and their characteristics. Monoclonal Antibody - Hybridoma Technology. Cell mediated immune response - Lymphokines, Cytokines.

UNIT-V

Antigen-antibody interaction in vitro Agglutination, complement fixation, Precipitation, ELISA, RIA, Flow cytometry and Fluorescence immunoblotting – Hypersensitivity. Skin tests (In vivo).

Text Books:

1. Roitt, I.M (1998) Essential Immunology Blackwell Scientific Publishers.
2. Kuby, J. (1994) Immunology, 2nd edition, W.H. Freeman and Company. New York.
3. Leffel, Donnenberg, A: and rose, W.1997 hand book of human Immunology Boca Raton Fla: C.R.C Press.
4. Ajoy Paul (2016). Text Book of Immunology, Books and Allied (P) Ltd, Kolkatha.
5. Sudha Gangal and Shubhangi Sontakke, (2013) Text Book of basic and clinical Immunology, Universities Press (India) Private Ltd.

Reference Book:

1. Abbas, A.K. Lichtman, A.M. and Pober, J.S. (1997) Cellular and Molecular immunology 3rd edition Philadelphia: W.B. Saunders.

ALLIED - 2
PAPER - 3
HUMAN ANATOMY AND PHYSIOLOGY

Objective: To make the students to understand the importance of human anatomy.

UNIT-I: Respiratory System (RS) and Special Sensory Organs (SSS)

Introduction to applied human anatomy and physiology.

Respiratory System (RS): Different organs of the Respiratory System. Functions of the different organs of the Respiratory System.

Special Sensory Organs (SSS): Introduction to special sensory organs. Function and functions of eye, ear, nose, tongue, and skin.

UNIT-II: Gastro Intestinal (GI) System

Gastro Intestinal (GI) System: Different organs associated with the Gastro Intestinal system: (Salivary glands, Pancreas, Liver and Gall bladder and others).

UNIT-III: Musculoskeletal System (MSS), Skin and Nervous System (NS)

Musculoskeletal System (MSS) and Skin: Introduction of musculo-skeleton system. Different parts of involved in skeleton system. Function of skeleton. Parts and function of skin.

Nervous System (NS): Introduction to nervous system. Different organs and function of central nervous system (CNS) and peripheral nervous system PNS and related to infection

UNIT-IV: Circulatory System (CS) and Endocrine System (ES)

Circulatory System (CS): Blood: Site of formation, composition, functions of blood cells, Different parts of the circulatory system and its function.

Endocrine System (ES): Introduction to endocrine system.

UNIT-V: Reproductive System (RS) and Urinary System (US)

Reproductive System (RS): Introduction Male reproductive system – physiological anatomy, spermatogenesis and its regulation, testicular hormones, composition of semen Female reproductive system – menstrual cycle, pregnancy and parturition, lactation and family planning.

Urinary System (US): Different organs and Functions of Urinary System. Mechanism of urine formation and composition of urine.

Text books:

1. Sampath Madhyastha, (2016) Manipal Manual of Anatomy, 3rd Edition, CBS Publishers and Distributors Pvt Ltd. Chennai.
2. Chandar Sbekar, C.N. (2006). Manipal Manual of Physiology, CBS Publishers and distributors Pvt Ltd., Chennai.
3. Chaurasia, B.D, (2005) Handbook of Human anatomy 3rd Edition, CBS Publishers and Distributors Pvt Ltd. Chennai.
4. Human physiology, 2nd edition- BJ Mejer, HS Meij, AC Meyer, AITBs publishers abd distributers.
5. Cell physiology by Giese, 5th edition, W.B Saunders Company, Tokyo, Japan.
6. A text book of animal physiology, KA Goel, KV Sastri, Rastogi publications Meerut.
7. Animal physiology and Biochemistry- RA Agarval, Anil. K, Srivastava, Kausshal Kumar, S. Chand & Co.
8. A Hand Book of Basic Human physiology- K. Saradha subramanyam, S. Chand & Co., Ltd.

References Books:

1. Srivastava, (2013), Text book of Anatomy, Books and Allied (P) Ltd, Kolkatha.
2. Suresh.R, (2012), Essentials of Human Physiology, Books and Allied (P) Ltd, Kolkatha.
3. Asis Das (2006), Medical Physiology, Books and Allied (P) Ltd, Kolkatha.
4. Guide to physiology- Y. Rajakshmi, S. Chand & Co., Ltd. Cathleen JW Wilson OBE Anne Wanhg: Anatomy and physiology in Health and illness. Churchill Livingstone Publication, UK, NK, 1996.
5. Waugh A., Grant, A Ross and Wilson's Anatomy and Physiology in Health and Illness, 9th Edition, Churchill Livingston, London.2001.
6. Guyton AC and Hall JE. Guyton Human Physiology and Mechanisms of Disease. Hartcourt Publishers, Limited, 1996.
7. Williams PL (Ed). Gray' anatomy, Churchill Livingstone, London.

**SKILL BASED SUBJECT
PAPER - 1
HEMATOLOGY AND BLOOD BANKING**

UNIT-I

Blood: Definition, Characters, Composition. Collection of Blood - Capillary Blood: from Adults / Infants, Examinations employed. Advantages/Disadvantages - venous blood: from Adults / Infants, Examinations employed Advantages/Disadvantage. Anticoagulants: Definition - Type: Wintrob's /EDTA /Heparin /Citrate, Concentration, Examinations, Advantages /Disadvantage.

UNIT-II

Counting of Blood Cells: Neubauer counting chamber - Total RBC count : diluting fluids , Macro dilution / Micro dilution technique , Falsely Low and High Counts , Normal values - Total WBC count : diluting fluids , Macro dilution / Micro dilution technique , Falsely Low and High Counts , Normal values - correction for TWBC - Absolute Eosinophil count - Differential Leucocyte count: Granulocyte / Agranulocytes, Morphology / Function, Staining Technique - Platelet Count : Morphological characters / Functions , Direct /Indirect method - Reticulocyte count, Dry/ Wet smear technique. Haemoglobin: Composition/Normal Values: Determinations: Tallqvist/Acid Haematin /Alkaline Haematin, Haldane's Carboxy/Drabkins /Dare, Spencers/Specific gravity/ Gasometric, Chemical.

UNIT-III

Coagulation Mechanism: Factors: Bleeding time, Clotting time. Haematological indices:- Packed cell volume : Wintrob's / Micro HCT method - Mean corpuscular Volume - Mean corpuscular haemoglobin - Mean Corpuscular haemoglobin concentration - Volume index- volume thickness index - Mean corpuscular diameter - saturation index. Erythrocyte sedimentation etc, Principle-Determination: Wintrob's / Westgren Method - advantages / disadvantages - Factors influencing.

UNIT-IV

Preparations of stains and staining techniques: Wright stain - Leishman's stain - Giemsa's stain -Jaswanth Singh and Bhattacharji stain - Fields stain - Peroxidase stain: Examination of Blood smear:-Peripheral smear report: Size/colour/shapes/inclusions -Blood parasites: Malarial parasite/Microfilaria.

UNIT-V

ABO Grouping: History/Discovery - slide / Tube technique - Rh. Typing: Slide / Tube technique, Bovine replacement technique - Coombs test: Direct /Indirect - Donor screening - Cross matching: Major / Minor - Collection Of blood / preservation /storage.

Text books:

1. Mukerjee, K.L. (1988). Medical Laboratory Technologies Vol I – III Tata McGraw Hill. Publishers, New Delhi.
2. Mukerjee, K.L. (1988). Medical Laboratory Technology: A Procedures Manual for Routine Diagnostic Tests. Tata McGraw Hill. Publishers, New Delhi.
3. Gadkar, P.B and Gadakar, D.P. Textbook Medical Laboratory Technology by Gudkar.
4. Medical Laboratory Technologies by Samuel. 5. Medical Laboratory Technologies by Malhotra.
5. Rajan. S and Selvi Christy (2010). Experimental Procedures in Life Sciences, Anjanaa Book House Publishers, Chennai.
6. Pal, G.K and Pravathi Pal (2016), A text book of Practical Physiology, 4th Edition Universities Press (India) Pvt Ltd,

**NON-MAJOR ELECTIVE
PAPER - 1
COMPUTER APPLICATIONS IN BIOLOGY**

Objective

To make the students to understand the applications of computers in biology.

UNIT-I

Introduction to Computers. History of Computers, Basic Anatomy of Computers.

UNIT-II

Input and output devices, hardware and software. Operating system. MS Windows, Desk top publishing: MS Word, Data bases and graph generation: MS-Excel, project presentation: MS-PowerPoint.

UNIT-III

Programming in C (Basic) Introduction, simple programs, Decision is making and looping, functions, structures, input and output filing system.

UNIT-IV

Basic of WEB Design using HTML: Basic HTML, text styles, list and special characters, adding pointers and links, adding pictures, backgrounds and music, tables and frames.

UNIT-V

Computers in Taxonomy and Systemic Data Analysis in Microbiology. Computers in clinical microbiology - Computer applications in fermentation - Technology Computers in Drug - Designing using various software's in Drug designing.

Text Books:

1. Dave Taylor 1995 HTML. Tata McGraw - Hill Publishing Company Ltd, New Delhi
2. Paul McFedries 1997. Microsoft office 97 sams publishing techmedia, New Delhi.
3. Rajagopalan 1987. Understanding Computers Tata McGraw-Hill Publishing Company Ltd, New Delhi.
4. Sharon Crawford 1998. Windows 98 No Experience Required. BPB publications, New Delhi.
5. Yashwant Canetrar 1980. Let us C. BPP Publishers, New Delhi.

**SEMESTER IV
PAPER - 4
MICROBIAL GENETICS**

Objective:

To make the students to understand the genetics of microbes.

UNIT-I

Genetics - Historical Introduction - Discovery of DNA structure and organization of DNA and RNA - DNA and RNA as genetic material - Genetic code.

UNIT-II

Organization & functioning of prokaryotic genome plasmids - Structure and types - Replication of DNA.

UNIT-III

Gene transfer mechanism - transformation, transduction, Conjugation.

UNIT-IV

Oncogenes and cancer - Mutation - its types, transforming viruses carrying oncogenes - Retroviral oncogenes - Immortalization & transformation.

UNIT-V

RNA and Protein synthesis in prokaryotes and eukaryotes. Operon concept - Lac & Try Operon. Mutagenesis - Mutation - Mutants - Types of mutants - DNA repair mechanism.

Text Books:

1. Lodish, H. Baltimore Daerk . A. Zipsury, S.L. Marsudaisa. P. Darnel. J. (1995) Molecular cell biology.
2. Gardner- Simon snustad Principles of genetics, 8th Edition. John Wiley & sons. Inc. New York.

Reference books:

1. Maloy, S.R. Cronan Jr. J.E, Freifelder D (1994), Microbial genetics. Jones and Barlett publishers.
2. Ajoy Paul (2011). Text Book of Genetics- from Genes to Genomes, Books and Allied (P) Ltd, Kolkatha.

CORE PRACTICAL - 2
PAPER 3 & 4

Objective:

To impart hands on training on immunology and microbial genetics.

1. Blood groups and Rh. typing coomb's test.
2. Precipitation reaction in gel. Ouchterlony double immuno diffusion test, single redial immuno diffusion test.
3. VDRL, RPR
4. Agglutination reactions: Slide and Tube methods RBC agglutination IHA, TPHA, Bacterial agglutination: Widal, typing of bacteria Latex agglutination: RA, ASLO (Latex) B HCG.
5. Complement fixation test. Titration of amboceptor complements (Demonstration only)
6. Immunofluorescence, ELISA (Demonstration only).
7. Isolation of Buffy coat, using heparin lymphocytes (T cells, B cells) enumeration of different cells types, Peripheral blood cell counts, absolute cell counts.
8. Antibody productions in rabbits against sheep RBC and its titration (Demonstration only).
9. Anaphylactic reactions in guinea pigs. Authorities' reaction in rabbits. (Demonstration).
10. Skin tests. Both immediate and delayed hypersensitivity reactions of egg proteins, bacterial, fungal antigens.

**ALLIED - 2
PAPER - 4
BIOSTATISTICS**

Objective:

To make the students to understand the biostatistics.

UNIT-I

Nature and scope of statistical methods and their limitations - compilation
Classification and tabulation of statistical - data.

UNIT-II Events and sets - samples space - concepts of probability - Addition and multiplication theorem on probability - conditional probability and independence of events.

UNIT-III

Coefficient of correlation - scattered diagram - regression lines.

UNIT-IV

Standard distributions - Binomial Poisson and normal distributions - Standard distributions - Binomial Poisson and normal distributing. To test based on normal - t, Chi - square and R- non parametric test run median, Sign, Mann, Whitney and Wilcoxon signed rank test.

UNIT-V

Principles of scientific experiment Randomization replication and local control
Analysis of Variance - One way and two way classifications.

ALLIED PRACTICAL-2
(Subjects covering Paper- Allied - 2
Paper – 3 only)

HUMAN ANATOMY AND PHYSIOLOGY

Objective:

To impart hands on training on human anatomy and physiology

1. Absolute Eosinophil Count
2. Demonstration of ECG/Echo and its interpretation techniques.
3. Determination of Bleeding Time and Clotting Time
4. Determination of Erythrocyte Sedimentation Rate
5. Determination of Specific Gravity of Blood
6. Estimation of Bile Salt
7. Estimation of Hemoglobin Concentration
8. Estimation of Urine albumin,
9. Estimation of Urine sugar
10. Hair perforation Test
11. Measurement of Pulse, BP
12. Preparation and Examination of Blood smear
13. Serum cholesterol analysis
14. Serum Sugar analysis
15. Study of different histological slides
16. Total Platelet count

Reference books:

1. Rajan. S and Selvi Christy (2010). Experimental Procedures in Life Sciences, Anjanaa Book House Publishers, Chennai.
2. Pal, G.K and Pravathi Pal (2016), A text book of Practical Physiology, 4th Edition Universities Press (India) Pvt Ltd.

SKILL BASED SUBJECT

PAPER - 2

VERMITECH

UNIT-I

General properties of the soil - structure of the soil -sand, clay, salt, types of soils - soil organisms.

UNIT-II

Physical properties of soil - soil colour, soil moisture, soil temperature, bulk density of soil, chemical properties of soil PH, Electrical conductivity, organic, Nitrogen, Phosphate and potash.

UNIT-III

Soil biota -Earthworms -Ecological classification of earth worms as Epigeics - Introduction to earthworm biology -physical and chemical effects of earth worms on soils - Role of earthworms in soil -classification of earthworms based on ecological strategies- Burrowing activity of earthworms- Drilospheres -Microorganisms and their relationship with earthworms.

UNIT-IV

Composting -anaerobic composting, aerobic composting, types of composting, vermicompost- earthworm species used in vermicompost production - endemic species, exotic species.

UNIT-V

Vermicompost -setting up vermicompost quality N, P, K, C, N, Microbial quality applications - vermiculture -vermiwash -role of vermicompost in organic farming - its quality and advantages over chemical inputs. Earthworms in Bio-reclamation of soil. Problems in vermiculture units - remedial suggestions. Vermicomposting as a tool for solid waste management - a small scale industry and its economics.

Reference Books:

1. Brady, C.N, 1974 "The Nature and Properties of soils" Macmillan publishing Co. New York, London.
2. Edwards, C.A., and Bohlen, P.J., 1996. Biology and Ecology of Earthworms, Chapman and Hall, London
3. Ismail, S.A., 1997, Vermicology: The Biology Earth worm Orient Longman.
4. Kale Radha,D 1998. Earthworm: Cinderella of organic farming. Prism Books Pvt. Ltd., Bangalore.
5. Satchell, J.E., 1983 Earthworm ecology: From Darwin to Agriculture. Chapman and Hall, London
6. StephensonJ., 1923. The fauna of British India -Oligo.

NON MAJOR ELECTIVE

PAPER – 2

HUMAN MICROBIAL DISEASES, CAUSES AND CONTROL

UNIT I:

Morphology, pathogenicity and laboratory diagnosis of Gram positive organisms, *Staphylococcus aureus*, *Streptococcus pyogenes*, *Bacillus anthracis*, *Corynebacterium diphtheriae*, *Clostridium perfringens*, *Clostridium tetani*. Morphology, pathogenicity and laboratory diagnosis of Gram negative organisms - *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Salmonella typhi*, *Shigella dysenteriae*, *Pseudomonas aeruginosa*, *Vibrio cholerae*.

UNIT II:

Morphology, pathogenicity and laboratory diagnosis of *Mycobacterium tuberculosis*, *Mycobacterium leprae*, *Treponema pallidum*, *Leptospira icterohaemorrhagans*, *Chlamydia trachomatis*, *Rickettsia rickettsi*.

UNIT III:

Mycology, superficial infections – Dermatophytes – *Microsporum* – *Trichophyton*, *Epidermophyton* – Madura mycosis – Opportunistic fungal infections – *Candida albicans*, *Aspergillus*, *Mucor*.

UNIT IV:

Parasitic diseases – *Plasmodium vivax*, *Giardia*, *Taenia solium*, *Ancylostoma*, *Ascariasis*, *Wuchereria bancrofti*, *Enterobius*, *Trichuris trichura*.

UNIT V:

Antibiotics and chemotherapeutic agents – mechanism of actions – Drug resistance – Antimicrobial susceptibility testing – Disc diffusion – Kirby Bauer - MIC, MBC, Serum killing power.

Text books:

1. Ananthanarayanan, R. and C.K., Jayaram Paniker, Textbook of Microbiology. Orient Longman, 5th Edition, (1994).
2. Jawetz, E., Melnic, J.L. and Adelberg E. A., Review of Medical Microbiology Lange Medical publications, USA, 4th Edition, (1998).

Reference books:

1. Mackie and Mc Cartney, Medical Microbiology No 1 and II. Churchill Livingstone, 14th Edition, (1994).
2. Chakraborty, P. A text book of microbiology, New central Book agency pvt Ltd. Calcutta, 2nd Edition, (1995).
3. Bailey and Scotts, Diagnostic Microbiology, Baron and Finegold CV Mosby publications, 9th Edition, (1994).

SEMESTER V
PAPER - 5
MOLECULAR BIOLOGY AND GENETIC ENGINEERING

Objective

To make the students to understand the molecular biology and genetic engineering.

UNIT-I

Historical perspectives - Synthetic DNA, DNA amplification technique - PCR.

UNIT-II

Preparation of genomic library, DNA library, gene cloning system, vectors enzymes, expression system.

UNIT-III

Application of genetic engineering in medical field - genetherapy, vaccines preparation, Hybridoma and monoclonal antibody techniques.

UNIT-IV

Application in agricultural field - Production of biotechnological products. Food - SCP (algae, yeast, mushrooms, Biopesticide) 'Nif' gene - transfer - development of resistant plant variety,

UNIT-V

Application in Pharmaceuticals - antigens, interferons, vaccines, insulin, Social impact of recombinant DNA technology.

Text Books:

1. Old, R.S. and Primrose, S.B. (1995) Principles of Gene manipulation. An introduction to genetic Engineering. 5th Edition. Blackwell Scientific Publication, London.
2. Lodish, H. Baltimore Daerk . A. Zipsury, S.L. Marsudaisa. P. Darnel. J. (1995) Molecular cell biology.

Reference Books:

1. Click. B.R. and-Pasternat J.J. (1994) Molecular Biotechnology. ASM press. Washington DC.
2. Benjamin Lewin (1997) Genes VI, Oxford University Press.
3. Ajoy Paul (2007). Textbook of Cell and Molecular Biology, Books and Allied (P) Ltd, Kolkatha.

PAPER - 6
MEDICAL BACTERIOLOGY

Objective:

To make the students to understand the medical bacteriology.

UNIT-I

Normal microbial flora of human body; General attributes and virulence factors of bacteria causing infections. Host Parasite relationships.

UNIT-II

Specimen Collection, Transport and Storage; Specimen processing. (Blood, Urine, GSF, Sputum, other body fluids)

UNIT-III

Classification morphology, cultural characteristics, pathogenicity, epidemiology, laboratory diagnosis, treatment, prevention and control of diseases caused by: Staphylococci, Streptococci, Pneumococci, Neisseriae (Gonococci and Meningococci), Corynebacterium, Mycobacterium, Clostridium, Bacillus, Pseudomonas and Haemophilus.

UNIT-IV

Human Pathogens - of Salmonella, Shigella, Vibrios, Brucella, Bordetella, Escherichia, Gramnegative anaerobes, Spirochaetes, Rickettsiae, Chlamydiae, Mycoplasmas and Ureoplasmas.

UNIT-V

Zoonotic diseases and their control; Hospital acquired infections and their control; Hospital waste disposal; Ethical committee and their functions.

Text Books:

1. Ananthanarayanan R. and Jayaram Panicker C.K. (1994). Text book of Microbiology. Orient Longman.
2. Balasubramanian, A. and Senthil kumar, P.K, (2017) Medical Microbiology. Darshan Publication, Rasipuram.
3. Salle, A.J. (1992). Fundamental Principles of Bacteriology. 7th Edition, Mc. Graw Hill Publishing Co. Ltd., New York.
4. Baron, E.J. and Finegold S.M. (1995). Scientific Company. Diagnostic Microbiology. Blackwell Scientific Company.

Reference Book: 1. Bergeys Manual of determinative Bacteriology.

PAPER - 7
MEDICAL VIROLOGY, MYCOLOGY AND PARASITOLOGY

Objective

To make the students to understand the medical virology, mycology and parasitology.

UNIT-I

General properties of viruses - Detection of viruses and antigens in clinical specimens - Serological diagnosis of virus infections. Cultivation of viruses. Structure & properties of viroids, prions.

UNIT-II

Arthropod borne and rodent borne virus diseases - Picorna viruses and diseases, Hepatitis viruses-Rabies and other neuro viruses - Orthomyxo and paramyxo viruses. Pox, Adeno, Horpes, Reo, Rota and AIDS viruses. Oncogenic viruses. Viral vaccines, their preparation and their immunisation schedules. Viruses of importance to plants and soil.

UNIT-III

Viruses of importance to bacteria - Bacteriophages - Their structure, types - Uses in Microbiology - Typing and application in bacterial genetics.

UNIT-IV

General Introduction Morphology and taxonomy of fungi of medical importance. Detection and recovery of fungi from clinical specimens. Dermatophytes and agents of superficial mycoses. Yeasts of medical importance dimorphic fungi causing systemic mycoses.

UNIT-V

Classification Morphology, Pathogenicity, lab diagnosis of common protozoan diseases - Amoebiasis, Giardiasis, Balantidiosis, Trypanosomiasis, Malaria, Toxoplasmosis, Leishmaniasis. Classification Morphology, Pathogenicity, lab diagnosis of common parasitic metazoan diseases – Ascariasis, Hook worm, Filariasis, Hydatidosis, Taenia infection.

Text Books:

1. Rajesh Karykarte and Ajit Damle (2003). Medical Parasitology, 3rd Edition. Books and Allied (P) Ltd, Kolkatha.
2. Balasubramanian, A. and Senthil kumar, P.K, (2017) Medical Microbiology. Darshan Publication, Rasipuram.
3. Morag C. and Timbury M.C. (1994). Medical Virology, 10th Edition. Churchill Livingstone London.
4. Dimmock N.J., Primrose S.B. (1994). Introduction to Modern Virology 4th Edition. Blackwell Scientific Publications. Oxford.
5. Conrat, HF, Kimball, PC and Levy JA, (1994). Virology. 12th Edition. Prentice Hall, Englewood Cliff. New Jersey.
6. Parija, S.C. (1996). Textbook of Medical Parasitology. Orient Longman.
7. Jagdish Chandra (1996) Textbook of Medical mycology. Orient Longman.

Reference Books:

1. Baker, F.J. and Brech (1990) Medical Microbiological techniques. Butter worths, London.
2. Chatterjee, K.D. Parasitology, M.D. 12th Edition. Chatter (1980) Joe media Publishers Culcutta.

**ELECTIVE
PAPER - 1**

HERBAL TECHNOLOGY

OBJECTIVES

To enable the students to understand the basic knowledge in Herbal technology.

UNIT - I

Pharmacognosy: Pharmacology - Definition and history, Indian systems of medicine - Siddha, ayurvedha, and Unani systems. Taxonomy of locally available medicinal plants, their chemical constituents and medicinal uses - Classification of Crude drugs - Chemistry of Drugs - Future of pharmacognosy.

UNIT - II

Classification of medicinal plants - Vernacular name and family - Geographical source, cultivation, collection, and processing for market and commerce in crude drugs. Morphological and histological studies, chemical constituents - Therapeutic and other pharmaceutical uses. Underground stem - ginger, Alpinia - Roots - Rauolfia - Belladonna - Aerial parts - Bark - Cinchona.

UNIT - III

Leaves - Adathoda, Eucalyptus - Flower - Clove fruits seeds - Nux vomica Nutmegs, Gooseberry - unorganized drugs - Gum - Acacia - Resin - Turpentine, fixed oil - castor oil.

UNIT - IV

Herbal medicines for Human ailments - Drugs acting on cardiac diseases, cerebral diseases, Nasal, diseases - Blood pressure Drugs acting on Nervous system - Depressants. - stimulants - Respiration and Drugs - Urogenital system and drugs - Psychoactive plants.

UNIT - V

Propagation of medicinal plants - Micro and macro propagation conservation of rare medicinal plants Role of biotechnology in medicinal plants banks - cultivation of medicinal and aromatic plants - Drug adulteration - methods of Drug evaluation, Herbal food - Food processing - packaging - Herbal sale and Export of medicinal plants - marketing - Intellectual property rights - Export laws.

Reference books:

1. Agarwal, S.S and Paridhavi, M (2012) Herbal Drug Technology, 2nd Edition. Universities Press (India) Private Ltd.
2. Wallis, T.E, Text book of pharmacognosy by 5th edition. CBS publishers and distributors Chennai.
3. Kuntal Das (2014). Herbal Plants and their Applications in Cosmeceuticals, CBS publishers and distributors Pvt. Ltd., Chennai.
4. George Edward Trease and W.C. Evans - Pharmacognosy 12th edition, English Language Books Society, Baelliere Tindall.
5. Handa, S.S. and Kapoor, V.K. Pharamcognosy by 2nd Edition, Vallabh Prakashan Publishers, New Delhi.
6. Jain, S.K (1980) Indian Medicinal plants.
7. Kokate, C.K., Durohit, A.P. and Gokhale, S.R., Pharmacognosy by 12th edition - Nirali Prakasham Publishers, Pune.
8. Kumar N.C. (1993) Introduction to Medical Botany and Pharmacognosy.
9. Nadkarni (1981) Indian Materia Medica.
10. Shah, S.C. and Qudary (1990). A text book of Pharmacognosy.

**SKILL BASED SUBJECT
PAPER - 3
MUSHROOM-CULTURE TECHNIQUES**

UNIT-I

Edible and non-edible mushroom (Historical account, most commonly cultivated mushrooms in the world, distribution and production in various countries).

UNIT-II

Cultivation of button mushroom -morphology raising a pure culture & spawn preparation. Preparation of compost & cultivation of *Agaricus bisporus*, *Pleurotus flabellatus*, harvest.

UNIT-III

Cultivation of oyster and paddy straw mushroom - preparation of pure culture & spawn cultivation methods, harvest.

UNIT-IV

Pests and diseases of Edible mushrooms (Environmental, fungal, bacterial, viral, insect pests and Nematode diseases and competitor moulds).

UNIT-V

Economics of mushroom cultivation (fixed assets, recurring expenditure, labour, economics of cultivation throughout the year and seasonal growing formulation of project report for getting finance from funding agencies). Precautions in mushroom cultivation (precaution to be taken while selecting the area, spawn preparation, spawn run, during cropping harvesting etc.). Mushroom recipes (western and Indian recipes, pickles, powders, jams etc).

Reference books:

1. Chang. T. W.A. Haynes 1978. "Biology and cultivation of Mushrooms" Acad Press.N.Y.
2. Zadrazil. F & K. Grabbe 1983 "Edible Mushroom, Biotechnology" Vol. 3, Weinheim: Verlag Chemie, Berlin.
3. Kannaiyan. 2001. Handbook of Edible Mushrooms" TNAU Publication.

**SEMESTER VI
PAPER - 8
FOOD MICROBIOLOGY**

Objective

To enable the students to understand the microbes in the food.

UNIT – I

Food as a substrate for microorganisms - factors affecting the growth of microorganism in food. Mold, yeast and bacteria- general characteristics, classification & importance.

UNIT – II

Principles of food preservation – Methods of food preservation – asepsis, removal of microorganism anaerobic conditions, high temperature- low temperature, drying and food additives – Canning.

UNIT – III

Contamination and spoilage of milk and milk products, meat and meat products, fish and fish products, vegetables and fruits and canned food.

UNIT – IV

Fermented foods – Bread, malt beverages, Beer & wine, vinegar, fermented vegetables – Fermented Dairy products. Microorganisms as food –SCP.

UNIT –V

Food bore disease – food borne infections and intoxication – laboratory testing – preventing measures - food sanitation – plant sanitation.

Text books:

- 1) Frazier, W.C and Westhoff, D.C (1988). Food microbiology, 4th edition, Tata Mac Graw Hill, New Delhi.
- 2) Adams, M.R and Moss M.O (1995) Food Microbiology New Age International (p) Limited Publishers.
- 3) Banwart, G.J., (1989). Basic Food Microbiology, 2nd Edition CBS Publishers and Distributors, New Delhi.
- 4) Robinson R.K (1990) Dairy Microbiology, Elsevier Applied science, London.
- 5) Hobbs BC Roberts D (1993). Food Poisoning and Food Hygiene Edward Arnold, London.

PAPER - 9

SOIL, AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

Objective

To enable the students to understand the microbes in the Agriculture and environment.

UNIT-I

Soil – physical and chemical properties of soil – types of soil – Microflora of soil.

UNIT-II

Biogeochemical cycles – carbon, nitrogen, phosphorus, sulphur and iron. Organic matter decomposition - Composting & Vermicomposting. Biopesticide (Bacterial, Viral & Fungal).

UNIT-III

Microbial interaction between microorganisms, plants and animals – Rhizosphere, phyllosphere. Rumen microbiology.

UNIT-IV

Microbiology of air – Sources of microorganisms in air – Assessment of air quality – air sampling techniques – Enumeration of air borne organisms – air borne diseases – air sanitation.

UNIT-V

Aquatic Microbiology – Ecosystems – Fresh water (Ponds, Lakes, Streams, Marine, Estuaries, Mangrooves, Deep sea). Microbial assessment of water quality – Water purification. Water borne diseases. Waste treatment – Solid and liquid waste treatment.

Text Books:

1. Alexander. (1997). Introduction to soil Microbiology. John Wiley and Sons. N.Y.
2. Subba Rao, N.S. (1995) .Soil Micro organisms and plant growth, Oxford and IBH publishing Co. Pvt. Ltd.
3. Atlas, R. M. and Bartha. R. (1992). Microbial Ecology: Fundamentals and Applications. 3 rd Edition. Benjamin| Cummings. Redwood City. CA.

Reference Books:

1. Michell, R. (1974). Introduction to Environmental Microbiology. Prentice- Hall. Inc. Englewood Clilffs – New Jersy.
2. Paul, E.A. and Clark. F.E. (1989). Soil Microbiology and Biochemistry. Academic pres New York.
3. Subba Rao, N.S. (1995). Biofertilizers in Agriculture and Forestry. 3rd Edition. Oxford and IBH publication Co. Pvt. Ltd., New Delhi.

PAPER - 10
INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

Objective

To enable the students to understand microbial processes in industries and pharmaceutical companies.

UNIT-I

Industrially important microbes and their products, screening, strain development strategies.

UNIT-II

Food fermentations and food produced by microbes, bread, fermented dairy products. Microbial cell as food, feed, SCP.

UNIT-III

Bioreactors – Structure and types. Fermentation media, media sterilization, Types of fermentation (Batch and Continuous) and downstream processing.

UNIT-IV

Microbial productions of citric acid, lactic acid, acetic acid, alpha amylase. Ethanol. Production of pharmaceutical compounds through microbes – TPA, Insulin, Recombinant Vaccines.

UNIT-V

Tannery technology – Tanning – types of tanning – chrome tanning and vegetable tanning. Tanning Process (pre tanning, tanning, post tanning and finishing). Treatment of tannery effluents by microbes.

Text Books:

1. Hugo, W.B., Russell, A.D, pharmaceutical Microbiology 4th edition. Blackwell scientific publications / Oxford.
2. Balasubramanian D, Bryce CFA, Dharmalingam K, Green J, Jayaraman K. (1996). Concepts in Biotechnology, University Press, India.
3. Satyanarayana.U, Biotechnology, Books and Allied (P) Ltd, Kolkatha: 2005.
4. Glazer AN, Nikaido H. (1994) Microbial Biotechnology - Fundamentals of Applied Microbiology WH Freeman and Company, New York.
5. Arumugam, N. and Kumaresan, V. (2016) Fundamentals of Biotechnology, Saras Publication, Nagercoil.

Reference Books:

1. Russell and Ayliffe, G.A.J (1982) Principles and practice of Disinfection, preservation and sterilization Oxford:
2. Gregory P.H. Microbiology of the atmosphere, 2nd edition. Leonard Hill.
3. Mann, I. Process of utilization of Animal by products, FAO Rome 1962.
4. Scaria .K.J. Mahendrakumar and Divakaran, S. Animal byproducts – Their processing and utilization, CLRI, Madras, 1961.

CORE PRACTICAL - 3

PAPERS 5, 6 & 7

Objective

To impart hands on training on molecular biology, genetic engineering and medical microbiology.

1. General requirements of collections, transport of clinical specimens Direct examinations - staining of specimens, - Methods of enriched, selective and enrichment culture techniques used to isolate organisms from clinical materials.
2. Wet mounts examinations of stool for parasites. Cholera stool, vaginal specimens for Trichomonas.
3. KOG and Lacto phenol preparations for skin scrapings, for fungi and for scabies mites.
4. Simple, differential and special staining of clinical materials viz. Throat swab, vaginal swab, slit smears, pus, urine, sputum, stool etc.,
5. Enumeration of Bacteria in urine. Quantitative test for yeasts.
6. Estimation of worm burden in stool. Floatation and sedimentation techniques of stool examination.
7. Germ tube, Assimilation, fermentation tests for yeasts.
8. Isolation and identification of bacterial pathogens from clinical specimens their biochemical reactions.
9. Antimicrobial sensitivity testing and determination of MIC and quality control.
10. Identification of pathogenic microbes including viruses in slides / smears / specimens as spotters.

CORE PRACTICAL - 4

PAPERS - 8 & 9

Objective

To impart hands on training on microbes of food, agriculture and environment and industrial and pharmaceutical microbiology.

1. Water analysis by MPN technique Presumptive coli forms test Confirmed coli forms test Completed coli forms test.
2. Isolation of microorganisms from air - air sampler technique - settle plate method.
3. Isolation and counting of fecal bacteria from water.
4. Detection of bacteria in milk by SPC - Dye reduction test Detection of number of bacteria in milk.
5. Litmus mil reaction. 6. Isolation of lactobacilli and staphylococcus from curd.
7. Azolla - Morphological study; Seed inoculation with rhizobia.
8. Isolation of bacteria and fungi from spoiled food. 9. Isolation of fungi from molting leaves.

**ELECTIVE
PAPER - 2
BIOINOCULANTS TECHNOLOGY**

UNIT- I

General account of the microbes used as biofertilizers for crop plants and their advantages. Symbiotic N₂ fixers: Rhizobium - Isolation, characterization, identification, Classification, inoculum production and field application. Frankia - Isolation, characterization - actinorrhizal nodules - non-leguminous crop symbiosis.

UNIT- II

Non - Symbiotic N₂ fixers - Azospirillum - Free living - Azotobacter - free isolation, characterization, mass inoculum production and field application.

UNIT-III

Symbiotic N₂ fixers - Cyanobacteria, Azolla - Isolation, characterization, mass multiplication - Role in rice cultivation - Crop response – field application - immobilization.

UNIT-IV

Phosphate solubilizers - Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field application - Phosphate solubilization mechanism.

UNIT-V

Mycorrhizal bioinoculants - classification - importance of mycorrhizal Ectomycorrhizae - Endomycorrhizae - Ectendo mycorrhizae - Taxonomy of mycorrhizae - Isolation of VA mycorrhizae - Quantification and assessment of VAM in roots - Mass inoculum production of VAM - field applications of Ectomycorrhizae and VAM.

Reference:

1. Kannaiyan, S. (2003). Bioetchnology of Biofertilizers, CHIPS, Texas.
2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
3. Reddy, S.M. et. al. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
4. Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.
5. Subba Rao N.S. (1988) Biofertilizers in Agriculture and forestry Oxford and IBH Publishing Co., Ltd., New Delhi.

**ELECTIVE
PAPER - 3
FOOD ANALYSIS AND QUALITY CONTROL**

Objectives: The paper focuses on physical, chemical, microbial and sensory analysis of food, concepts of quality control and quality management, national and international food loss and adulterants in various food products

UNIT-I

Sampling – Sampling techniques and preparation of food samples.

Techniques used in food analysis – Chromatography, Electrophoresis, Electrometric determinations, Refractometry and Polarimetry Spectrophotometry, Fluorimetry, Radio - active tracer techniques, Atomic absorption

UNIT-II

Physico chemical methods for food analysis - Moisture and Total solids, Carbohydrates, Proteins, Fats, Fiber, Ash and its types, Minerals, Vitamins. Enzymatic methods

Biological methods of food analysis - Standard plate count; Plate loop method; Spiral plate; Droplet technique; Dye reduction; Catalase test and ELISA. Testing of food for organisms such as *B. cereus*, *C. botulinum*, *E. coli*, *L. monocytogenes*, *S.aureus*, *Salmonella* and *Shigella*.

UNIT-III

Sensory assessment of food quality –Appearance of food, Flavor of food, Texture of food.

Sensory Tests – Difference, Rating and Sensitivity tests. Types of panels, Testing area and schedule.

Quality control of following food products – Milk and milk products, Oils and Fats, Cereal grains and flours, Fruits and vegetable products, Canned foods, Egg and egg products, Meat and Meat products

UNIT-IV

Food quality management – Objectives, Importance and Functions of quality control. Total quality, management, Good manufacturing practices, seven principles of HACCP and codex in food. Quality control, methods of – a. raw materials, b. manufacturing process and c. finished products.

UNIT-V

Food Safety – Role of voluntary agencies and legal aspects of consumer protection. National and International food laws – PFA, FDA, BIS, AGMARK, Essential Commodity Act, Export (quality and inspection act, Consumer protection act), Nutritional labeling requirements of foods, Food adulteration.

INDUSTRIAL VISIT: Food and Pharmaceuticals Industry and Report.

References books:

1. Pomeranz.Y, Meloan.C.E, 1996, Food Analysis – Theory & Practice, CBS Publiushers, New Delhi.
2. Adams, M.R and Moss M.O (1995) Food Microbiology New Age International (p) Limited Publishers.
3. Ananthanarayanan R and CK Jayaram Panicker, 1994, Textbook of microbiology Orient Longman.
4. Chakraborty P 1995, A Text book of microbiology, New Central Book Agency Pvt Ltd. Calcutta.
5. Rajan. S and Selvi Christy (2010). Experimental Procedures in Life Sciences, Anjanaa Book House Publishers, Chennai.
6. Debnath, 2005, Tools & Techniques of Biotechnology, Pointer Publishers, Jaipur.
7. Frazier, W.C and Westhoff, D.C (1988). Food microbiology, 4th edition, Tata Mac Graw Hill, New Delhi.
8. Jacobs.M.B., 1999, Chemical Analysis of Food & Food Products, CBS Publiishers, New Delhi.
9. Jay.J.M, 1996, Modern Food Microbiology, CBS Publishers, New Delhi.
10. Nielsen, S.S, 2004, Introduction to chemical Analysis of foods, CBS Publishers, New Delhi.
11. Ranganna. S., 2001, Handbook of Analysis & Quality control for Fruit & Vegetable Products, Tata McGraw Hill, New Delhi.
12. Robinson R.K (1990) Dairy Microbiology, Elsevier Applied science, London.
13. Salle, A.J. (1992). Fundamental Principles of Bacteriology. 7th Edition, Mc. Graw Hill Publishing Co. Ltd., New York.

**SKILL BASED SUBJECT
PAPER - 4
BIOINSTRUMENTATION**

UNIT-I

Centrifuge: Basic principles of sedimentation – relative centrifugal force – Types of centrifuges (clinical, high speed, refrigerated and ultra). Centrifugation - Principles and various types – Applications.

UNIT-II

Calorimetry – principle, Beer – Lambert's law – Applications. Spectrophotometry – UV & Visible, Parts of a spectrophotometer – IR, NMR & Atomic absorption spectrophotometry – Applications.

UNIT-III

Chromatography – Paper, TLC, Column, Adsorption, Ion exchange, GC & HPLC – Principle & applications.

UNIT-IV

Electrophoresis techniques: proteins and nucleic acids – Types of electrophoresis – Paper, Gel, Immunoelectrophoresis.

UNIT-V

Radioisotopes and their applications. Radioisotopic techniques – RIA. Detection and measurement of radioactivity – GM counter, Scintillation counter, Autoradiography. Biosensor & its types.

Text books:

1. Keith Wilson and John Walker, 1994. Practical Biochemistry – principles and techniques. Cambridge Press, New York.
2. Principles of Applied Biomedical Instrumentation – A. Geddes and L.E Baker John Wiley & Sons.
3. Instrumental methods of analysis – Den, Williard & Merrit. Asian Edition.

Industrial Visit (IV)

Factory Industrial Visit (M. Sc. Applied Microbiology)

Course Objectives: Students will be exposed to professional work environment to acquire the knowledge, independent working capacity and leadership so that at the end of the course they will be able to manage the laboratory and research work with full responsibility and reliability.

Factory Industrial Visit Guide Line: Internship will be conducted in an institute under the supervision of supervisor/s.

During the **Industrial Visit**, students should his/her visiting work should be submitted to the supervisor/department. A report of an industrial Visit should be submitted to the department after completion of the work should be authorized by the concerned supervisor of the institute/factory.
