

ALAGAPPA UNIVERSITY, KARAIKUDI
NEW SYLLABUS FOR AFFILIATED COLLEGES
UNDER CBCS PATTERN WITH EFFECT FROM 2022-23 ONWARDS

B.Sc. MICROBIOLOGY AND CLINICAL LAB TECHNOLOGY
Programme structure

Sem.	Part	Course Code	Courses	Title of the Paper	T/P	Credits	Hours/Week	Max. Marks		
								Int.	Ext.	Total
I	I	2211T	T/OL	Tamil /Other Languages -I	T	3	6	25	75	100
	II	712CE	E	Communicative English - I	T	3	6	25	75	100
	III	22BMC1C1	CC	Cell Biology	T	5	5	25	75	100
		22BMC1P1	CC	Practical I –Cell Biology	P	4	4	40	60	100
		-	AL – IA	Microbiology/ Biotechnology/ Biochemistry/ Zoology	T	3	3	25	75	100
	IV	-	AL - IA	Practical - Respective Allied Theory Course	P	2	2	40	60	100
		22BVE1	SEC -I	Value Education	T	2	2	25	75	100
				Library			2			
				Total		22	30	205	495	700
II	I	2221T	T/OL	Tamil/Other Languages-II	T	3	6	25	75	100
	II	722CE	E	Communicative English - II	T	3	6	25	75	100
	III	22BMC2C1	CC	General Microbiology	T	5	5	25	75	100
		22BMC2P1	CC	Practical-II –General Microbiology	P	4	4	40	60	100
		-	AL – IB	Microbiology/ Biotechnology/ Biochemistry/ Zoology	T	3	3	25	75	100
	IV	-	AL - IB	Practical - Respective Allied Theory Course	P	2	2	40	60	100
		22BES2	SEC -II	Environmental Studies	T	2	2	25	75	100
		Naan Mudhalvan Course		Language Proficiency for Employability(Effective English)	-	2	2	25	75	100
				Total		24	30	230	570	800
III	I	2231T	T/OL	Tamil/Other Languages-II	T	3	6	25	75	100
	II	2232E	E	English for Enrichment - I	T	3	6	25	75	100
	III	22BMC3C1	CC	Human Anatomy and Haematology	T	3	3	25	75	100
		22BMC3C2	CC	Clinical Biochemistry	T	3	3	25	75	100
		22BMC3P1	CC	Practical-III – Human Anatomy, Haematology and Clinical Biochemistry	P	3	3	40	60	100
	IV	-	AL – IIA	Microbiology/ Biotechnology/ Biochemistry/ Zoology	T	3	3	25	75	100
-		AL - IIA	Practical - Respective Allied Theory Course	P	2	2	40	60	100	

	IV	22BE3	SEC-III	Entrepreneurship	T	2	2	25	75	100
		-	NME- I	1.Adipadai Tamil (or) 2.Advance Tamil (or) 3.IT Skills for Employment (or) MOOC'S	T	2	2	25	75	100
				Total		24	30	255	645	900
IV	I	2241T	T/OL	Tamil /Other Languages -IV	T	3	6	25	75	100
	II	2242E	E	English for Enrichment - II	T	3	3	25	75	100
	III	22BMC4C1	CC	Molecular Biology and Microbial Genetics	T	4	4	25	75	100
		22BMC4C2	CC	Clinical Parasitology and Mycology	T	4	4	25	75	100
		22BMC4P1	CC	Practical –IV –Molecular Biology, Clinical Parasitology and Mycology	P	3	3	40	60	100
		-	AL – IIB	Microbiology/ Biotechnology/ Biochemistry/ Zoology	T	3	3	25	75	100
	-	AL - IIB	Practical - Respective Allied Theory Course	P	2	2	40	60	100	
	IV	-	NME- II	1.Adipadai Tamil (or) 2.Advance Tamil (or) 3. Small Business Management (or) MOOC'S	T	2	2	25	75	100
		Naan Mudhalvan Course		Digital Skills for Employability – (Microsoft-Office Fundamentals)	-	2	3	25	75	100
					Total		26	30	255	645
V	III	22BMC5C1	CC	Systematic Bacteriology and Virology	T	4	4	25	75	100
		22BMC5C2	CC	Clinical Immunology	T	4	4	25	75	100
		22BMC5C3	CC	Recombinant DNA Technology and Molecular Diagnostics	T	4	4	25	75	100
		22BMC5C4	CC	Clinical Bioinstrumentation and Diagnostics	T	4	4	25	75	100
		22BMC5P1	CC	Practical-V- Bacteriology, Virology and Bioinstrumentation & Diagnostics	P	4	6	40	60	100
		22BMC5P2	CC	Practical-VI - Clinical Immunology and rDNA Technology	P	4	6	40	60	100
IV			Career development/ employability skills			2				
				Total		24	30	180	420	600
VI	III	22BMC6I	DSE	Internship		24	26	150	250	400
	IV	Naan Mudhalvan Course		Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	-	2	4	25	75	100
				Total		26	30	175	325	500
				(Or)						
	III	DSE	22BMC6E1		Basics of Bioinformatics	T	6	6	25	75
22BMC6E2				Food and Dairy Microbiology	T	6	6	25	75	100
22BMC6E3				Agricultural Microbiology	T	6	6	25	75	100
22BMC6E4				Environmental Microbiology	T	6	6	25	75	100

	IV	-	Library / Yoga etc	-	-	2	-	-	-
			Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	T	2	4	25	75	100
			Total		26	30	125	375	500
		22BMC6PR	Project		6	8	25	75	100
	III	22BMC6E5	Medical Microbiology	T	6	6	25	75	100
		22BMC6E6	Microbial Physiology and Metabolism	T	6	6	25	75	100
		22BMC6E7	Communicable and Non-Communicable Diseases	T	6	6	25	75	100
	IV	Naan Mudhalvan Course	Employability Readiness* (Naandi /Unnati/Quest/IBM Skills build)	T	2	4	25	75	100
			Total		26	30	125	375	500
			Grand Total		146	--	--	-	4400

*Employability Readiness -Women's Colleges Naandi course and for all other Colleges IBM Skills build Course.

Sem.	Part	Course Code	Title of the Paper	Credits	Hrs./ Week	Max. Marks		
						Int.	Ext.	Total
I	III	71BEPL - I	Professional English for Life Science -I	4	5	25	75	100
II		72BEPL - II	Professional English for Life Science -II	4	5	25	75	100
III		*	Professional English for Life Science -III	4	5	25	75	100
IV			Professional English for Life Science -IV	4	5	25	75	100

*The Syllabus of Professional English for III & IV Semester will be provided after Receiving the syllabus from TANSCHÉ.

As per TANSCHÉ, the Professional English book will be taught to all four streams apart from the existing hours of teaching/additional hours of teaching (1hour/day) as a 4 credit paper as an add on course on par with Major paper and completion of the paper is a must to continue his/her studies further.

- T/OL-Tamil/Other Languages,
 - E –English
 - CC-Core course –Core competency, critical thinking, analytical reasoning, research skill & teamwork
 - Allied -Exposure beyond the discipline
 - AECC- -Ability Enhancement Compulsory Course (Professional English & Environmental Studies) - Additional academic knowledge, psychology and problem solving etc.,
 - SEC-Skill Enhancement Course - Exposure beyond the discipline (Value Education , Entrepreneurship Course, Computer application for Science, etc.,
 - NME -Non Major Elective – Exposure beyond the discipline
 - DSE – Discipline specific elective – -Student choice – either or
 - Internship
 - If internship – Marks = Internal =150 (75+75) two midterm evaluation through Viva voce and External 250 marks (Report =150 +Viva Voce=100) =Total 400marks
 - Theory papers or
 - Project + 3 theory papers.
 - MOOCs – Massive Open Online Courses
- *T-Theory, P-Practical

Semester - I						
Course code: 22BMC1C1	Core Course I			T/P	C	H/W
	Cell Biology			T	5	5
Objectives	<ul style="list-style-type: none"> ➤ Make the students to understand the different aspects to the classification of Prokaryotes and Eukaryotes. ➤ Make the students knowledgeable on the role of cell organelles. ➤ In-depth an on knowledge on the cell cycle and cell signaling. 					
Unit-I	Cell as basic unit of living systems: History of cellbiology, cell as basic unit of life, cell theory, protoplasm theory and organismal theory, broad classification of cell types, Bacteria, Archaea (prokaryotic) and eukaryotic cells and their similarities and differences.					
Unit-II	Structure and function of cell organelles: Structure and functions of cell wall: bacterial cell wall – plant cell wall and fungal cell wall, plasma membrane – exocytosis, endocytosis, phagocytosis – vesicles and their importance in transport. Cytoskeleton structure – microtubules, microfilaments, intermediate filament.					
Unit-III	Structure and functions of cell organelles:- Endoplasmic reticulum (rough endoplasmicreticulumandsmoothendoplasmicreticulum),golgiapparatus,lysosomes, microbodies (peroxysomes and glyoxysomes), vacuoles, ribosomes, centriole and basal bodies. Mitochondria – organization of respiratory chain, chloroplasts – photophosphorylation, nucleus, nucleolus, nuclear membrane and organization of chromosomes.					
Unit-IV	Cell cycle: - Eukaryotic cell cycle and its regulation, Cell division- Mitosis and Meiosis Cell death:- Development of cancer, causes and types, Programmed cell death. Cell renewal: - Stem cells Embryonic stem cell, induced pluripotent stem cells.					
Unit-V	Cell signaling: - Overview – types of cell signaling – Signalling molecules and their receptors– signal amplification — Function of cell surface receptors, Quorum sensing. Pathways of intra-cellular receptors – Cyclic AMP pathway, cyclic GMP and MAP kinase pathway.					
Reference and Textbooks:-						
Alberts, B., Johnson, A., Lewis, J., Raff, M.,&Roberts, K. (2002). <i>Molecular Biology of the Cell</i> (4 th ed). NewYork: Garland Publishing (Taylor & Francis Group).						
Cooper, G. M.,&Hausman, R. E.(2007). <i>The Cell:A Molecular Approach</i> (4 th ed). ASM Press, Massachusetts: Washington D.C. & Sinauer Associates, Inc.						
De Roberties, E.D.P., & De Roberties. (1995). <i>Cell and Molecular Biology</i> (8 th ed). New Delhi: Waverly Pvt. Ltd.						
Karp, G., & Harris, D. (1999). <i>Cell and Molecular Biology – Concepts and Experiments</i> (2 nd ed). NewYork: John Wiley & Sons.						
Lewin, B. (2004). <i>Genes VIII</i> . Pearson Prentice Hall.						
Lodish,H. (2004). <i>Molecular Cell Biology</i> (5 th edition.)New York: W.H.Freeman and Company.						
Outcomes	<ul style="list-style-type: none"> ➤ The students will get depth knowledge in fundamental principles of cellular biology ➤ Able to understand the principles behind cell movement, cell growth, cell division, cell death, and cell signaling. ➤ Aware of the pathways of intracellular receptors. 					

Semester –I				
Course code: 22BMC1P1	Core Practical I	T/P	C	H/W
	Lab in Cell Biology	P	4	4
Objectives	<ul style="list-style-type: none"> ➤ Improve the student’s knowledge and impress upon them the important aspects of microorganisms ➤ Give practical knowledge and skill in the isolation and handling of microorganisms. ➤ Make acquainted with pure culture techniques and methods of culturing preservation and maintenance of microorganisms 			
<ol style="list-style-type: none"> 1. Principles of sterile techniques and cell propagation 2. Detection of different stages of Mitosis. 3. Detection of different stages of Meiosis. 4. Identification of given plant, animal and bacterial cells and their components by microscopy 5. Staining for different stages of mitosis in <i>AlliumCepa</i>(Onion) 6. Examination of polyploidy in Onion root tip by colchicines treatment. 7. Separation of Peripheral Blood Mononuclear Cells from blood 8. Identification of cells by Giemsa staining and Leishman staining. 9. Enumeration of cells by Tryphan blue assay 10. Osmosis and Tonicity 				
Reference and Textbooks				
<p>Cooper,G.M.,&Hausman,R.E.(2009).<i>TheCell:AMolecularApproach</i>(5th Edition). ASM Press & Sunderland, Washington, D.C.; Sinauer Associates,MA.</p> <p>De Robertis, E.D.P.,&De Robertis E.M.F. (2006). <i>Cell and Molecular Biology</i>(8th edition). Philadelphia: Lipincott Williams and Wilkins.</p> <p>Greenwood, D., Slack, R., &Peutherer, J. F. (2002). <i>Medical Microbiology</i>(16thed). London: Churchill, Livingstone.</p> <p>Hardin, J.,Bertoni,G., &Klein smith,L. J.(2010).<i>Becker’sWorldoftheCell</i>(8thedition). Pearson.</p> <p>Jawetz, & Melnick, (2002). <i>Review of Medical Microbiology</i>. NewYork: Lange.</p> <p>Karp, G. (2010) <i>Cell and Molecular Biology: Concepts and Experiments</i>(6th edition. John Wiley & Sons.Inc.</p> <p>Mukherjee, K. L. (2010).<i>Medical Laboratory Technology</i>. CBSpublishers</p> <p>Rajan, S. &Selvi Christy, R. (2012).Experimental Procedures in Life Sciences. Chennai: Anjanaa Book house.</p> <p>Rajan, S. (2012). <i>Manual for Medical Laboratory Technology</i>. Chennai: Anjanaa Book House.</p> <p>Timbury, M. C. (2002). Notes on Medical Microbiology and Immunology. London: Churchill Livingstone.</p>				
Outcomes	<ul style="list-style-type: none"> ➤ The students are be able to identify standard methods for the isolation, identification and culturing of microorganisms. ➤ The students can able to identify the different groups of microorganisms from different habitats. 			

Semester - II				
Course code: 22BMC2C1	Core Course II	T/P	C	H/W
	General Microbiology	T	5	5
Objectives	<ul style="list-style-type: none"> ➤ Become familiar with the basic concepts of history of Microbiology ➤ Impart knowledge on structural organization and morphology of microbes ➤ Gain the knowledge of microscopy, sterilization and staining concepts. 			
Unit-I	History and Scope of Microbiology: Definition and scope of microbiology. History- Spontaneous generation, Contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Lazaro Spallanzani, John Tyndall, Joseph Lister, Alexander Fleming and Kary B Mullis. Microbial Kingdoms- Haeckel's Three Kingdom and Whittaker's Five Kingdom concept. Bacterial classification (outline) according to Bergey's manual of systemic Bacteriology.			
Unit-II	General characteristics and Ultra structure of bacteria: Size, shape and arrangement of bacterial cells, Cell wall of Gram negative, Gram positive bacteria, Capsule composition and function, Cell membrane structure and functions, Structure and function of flagella, cilia and pili, gas vesicles, chlorosomes, carboxysomes, magnetosomes and phycobilisomes. Reserve food materials – polyhydroxybutyrate, polyphosphates, cyanophycin and sulphur inclusions, Bacterial endospores. Bacterial Reproduction.			
Unit-III	Staining techniques, Bacterial Growth and Nutrition: Types of staining – Principle and procedure – Simple, Differential – Gram, Acid fast, Structural – capsule, endospore. Bacterial Growth curve – Lag Phase, Exponential Phase and decline Phase. Factors influencing and affecting microbial growth – pH, temperature and light. Nutritional groups of bacteria.			
Unit-IV	Principles and methods of Sterilization and Types of media: Physical methods (Heat, Filtration and radiation) and Chemical methods. Chemotherapy – antibiotics – source – classification – mode of action – antimicrobial resistance. Types of growth media (natural, synthetic, complex, enriched and selective media).			
Unit-V	Microscope Principles and applications: Principles of microscopy, Simple, compound light microscopy– construction and function of parts, principle, construction, and applications of Dark field, Phase contrast and Fluorescence microscopes. Electron microscopy – TEM and SEM – principle, construction, and uses.			
Reference and Textbooks:-				
Atlas, R.A., & Bartha, R. (2000). <i>Microbial Ecology, Fundamentals and Application</i> . New York: Benjamin Cummings.				
Madigan, M.T., Martinka, M., Parker, J., & Brock, T.D. (2000). <i>Biology Microorganisms</i> (12th ed). New Jersey: Prentice Hall.				
Pelczar, M.J., Schan, E.C., & Kreig, N.R. (2010). <i>Microbiology: An Application Based Approach</i> . Tata McGraw Hill Education Private Limited.				
Prescott, Willey, J., Sherwood, L., & Christopher, J.W. (2017). <i>Microbiology</i> (10th ed). New York: McGraw Hill.				
Stanier R.Y., & Ingraham, J.L. <i>General Microbiology</i> . New Delhi: Prentice Hall of India Private Limited.				
Tortora, G.J., Funke, B. R., & Case, C.L. (2009). <i>Microbiology</i> (9th ed). Noida: Dorling Kindersley (India) Pvt. Ltd.				
Outcomes	<ul style="list-style-type: none"> ➤ Can clearly understand history and classification of bacteria ➤ The students are getting depth knowledge of various microscopes and their application. 			

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| | <ul style="list-style-type: none">➤ Able to understand various (physical and chemical) methods of control of microorganisms➤ The students are aware of the structure of bacterial cells and also the staining methods used to identify the bacteria. |
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Semester –II					
Course code: 22BMC2P1	Core Practical II		T/P	C	H/W
	Lab in General Microbiology		P	4	4
Objectives	<ul style="list-style-type: none"> ➤ Improve the student's knowledge and impress upon them the important aspects of microorganisms ➤ Practical knowledge and skill in the isolation and handling of microorganisms. ➤ Make acquainted with pure culture techniques and methods of culturing preservation and maintenance of microorganisms 				
<ol style="list-style-type: none"> 1. Safety measures and rules of conduct to be followed in a microbiological laboratory. 2. Cleaning of Glasswares and media Preparation; Bacterial Culture Characteristics & identification 3. Handling and Care of Microbiological Instruments. Preparation & dispensing of Culture media 4. Enumeration of microbes by serial dilution method 5. Pure culture techniques- Spread plate, streak plate and pours plate technique. 6. Staining Techniques – Gram's staining, Acid-fast staining, Endospore Staining and Capsulestaining 7. Test for Motility of bacteria - Hanging droptechnique 8. Identification of bacteria by biochemical reactions. 9. Identification of bacteria using selective media. 10. Micrometry – Microscopic measurements of Bacterial cell 					
Reference and Textbooks:-					
<p>Cooper, G.M., & Hausman, R.E. (2009). <i>The Cell: A Molecular Approach</i> (5th Edition). ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.</p> <p>De Robertis, E. D. P., & De Robertis E. M. F. (2006). <i>Cell and Molecular Biology</i> (8th edition). Philadelphia: LipincottWilliams and Wilkins.</p> <p>Greenwood, D., Slack, R., & Peutherer, J. F. (2002). <i>Medical Microbiology</i> (16thed). London: Churchill, Livingstone.</p> <p>Hardin, J., Bertoni, G., & Kleinsmith, L. J. (2010). <i>Becker's World of the Cell</i> (8th edition). Pearson.</p> <p>Jawetz & Melnick. (2002). <i>Review of Medical Microbiology</i>. New York: Lange.</p> <p>Karp, G. (2010). <i>Cell and Molecular Biology: Concepts and Experiments</i> (6th edition). John Wiley & Sons. Inc.</p> <p>Mukherjee, K. L. (2010). <i>Medical Laboratory Technology</i>. CBS publishers</p> <p>Rajan, S. (2012). <i>Manual for Medical Laboratory Technology</i>. Chennai: Anjanaa Book House.</p> <p>Rajan, S., & Selvi Christy, R. (2012). <i>Experimental Procedures in Life Sciences</i>. Chennai: Anjanaa Book house.</p> <p>Timbury, M. C. (2002). <i>Notes on Medical Microbiology and Immunology</i>. London: Churchill Livingstone.</p>					
Outcomes	<ul style="list-style-type: none"> ➤ The students are able to identify standard methods for the isolation, identification and culturing of microorganisms. ➤ The students can able to identify the different groups of micro organisms from different habitats. 				

Semester - III					
Course code: 22BMC3C1	Core Course III		T/P	C	H/W
	Human Anatomy and Haematology		T	3	3
Objectives	<ul style="list-style-type: none"> ➤ Understand the cellular and tissue level organization in the human body ➤ Provide an in-depth knowledge about the structure and functions of the internal organs. ➤ Understand the human blood and its disorders based on an up-to-date knowledge. ➤ Provide in-depth knowledge about the pathology and pathophysiology of haematological disorders. 				
Unit-I	<p>Cellular level of organization: - Structure and functions of cell, transport across cell membrane, cell division, cell junctions. General principles of cell communication, intracellular signaling pathway activation by extracellular signal molecule, Forms of intracellular signaling: a) Contact-dependent b) Paracrine c) Synaptic d) Endocrine.</p>				
Unit-II	<p>Tissue level of organization:- Classification of tissues, structure, location and functions of epithelial, muscular, nervous and connective tissues. Structure, organization and functions of Integumentary system (skin), Respiratory System, Digestive System, Circulatory System and Skeletal system: - Divisions of skeletal system, types of bone, salient features and functions of bones of axial and appendicular skeletal system. Organization of skeletal muscle, physiology of muscle contraction, neuromuscular junction.</p>				
Unit-III	<p>Endocrine system:- Classification of hormones, mechanism of hormone action, structure and functions of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, pineal gland, thymus and their disorders. Nervous system:- Organization of nervous system, neuron, neuroglia, classification and properties of nerve fibre, receptors, synapse, neurotransmitters. Central nervous system: Meninges, ventricles of brain and cerebrospinal fluid. Structure and functions of brain (cerebrum, brain stem, cerebellum), spinal cord (gross structure, functions of afferent and efferent nerve tracts, reflex activity). Peripheral nervous system: Classification of peripheral nervous system: Structure and functions of sympathetic and parasympathetic nervous system. Origin and functions of spinal and cranial nerves.</p>				
Unit-IV	<p>Composition of Blood and its functions:- Definition, Plasma, Red blood cells (erythrocytes), white blood cells (Leucocytes) and platelets. Plasma proteins- Albumin, globulin and fibrinogen. Common anticoagulants - composition, amount and mechanism of action. Haemopoietic system of the body- Leukopoiesis, erythropoiesis and thrombopoiesis. Physiology and anatomy of bone marrow. Haematopoiesis- Definition, haematopoietic stem cell lineages and growth factors, regulation of haematopoiesis and programmed cell death. Components for control of haematopoiesis-cytokines and growth factors. Haemostasis:- Definition, mechanism of preventing blood loss- Vasoconstrictive phase, platelet phase and Coagulation phase.</p>				
Unit-V	<p>Blood clotting factors: - plasma coagulating factors and platelet coagulating factors- Extrinsic and intrinsic pathways – Blood clotting inhibitors:- anticoagulant, heparin and antithrombin, fibrinolysis by plasmin. Blood Disorder: - blood disorders that cause a decrease in blood components - anemia, leucopenia and thrombocytopenia. Blood disorders that cause an increase in blood</p>				

	<p>components- erythrocytosis, leukocytosis and thrombocythemia or thrombocytosis. Types of white blood cell disorders: - lymphoma, leukemia and myeloma.</p>
Reference and Textbooks:-	<p>Amitrano, R., & Tortora, G. (2012). Update: anatomy & physiology laboratory manual. Cengage Learning.</p> <p>Fischbach, F.T., & Dunning, M. B. (2002). A Manual of Laboratory and Diagnostic Tests. Baltimore:</p> <p>Godkar, P.B., & Godkar, D.P. (1996). Textbook of Medical Laboratory Technology (2nd edition). Bhalani publication House.</p> <p>Lewis, J. A. (1994). Illustrated guide to diagnostic tests – students version, Springhouse corporation.</p> <p>Lippincott Williams and Wilkins.</p> <p>Mukherjee, K. L. (1996). Medical Laboratory Technology (Volume-I). New Delhi: Tata Mc GrawHill.</p> <p>Pal, G.K., & Pravati, P., (2010). Text Book of Practical Physiology (3rd edn.). Universities Press (India) Private Limited.</p> <p>Pal, G.K., Pal, P., Nanda, N., & Amudharaj, D. (2015). Atlas of Human Anatomy (1st ed.). J. Vignie. Chambarlen Press.</p> <p>Sanyal, S. (2000). Clinical pathology. New Delhi: B. I. Churchill Livingstone (p) Ltd.</p> <p>Tortora, G.J., & Derrickson, B. (2014). Anatomy and Physiology-WorkBook. CBS publication.</p>
Outcomes	<p>After completion of the course, students are expected to be able to:</p> <ul style="list-style-type: none"> ➤ Identify the structure and functions of internal organs. ➤ Acquire knowledge on cellular level and tissue level organizations. ➤ Identify the structure and functions of the blood cell ➤ Correlate hematological findings with those generated in other areas of the clinical laboratory.

Semester - III				
Course code: 22BMC3C2	Core Course IV Clinical Biochemistry	T/P T	C 3	H/W 3
Objectives	<ul style="list-style-type: none"> ➤ Learn the structure and classification of Biomolecules. ➤ Gain knowledge on clinically important enzymes and diagnostic tests. 			
Unit-I	Clinical sample Collection and preservation - Blood, Plasma, Serum, CSF, Urine and feces. Acid base balance. Buffer systems and Electrolytes. Clinically important enzymes.			
Unit-II	Carbohydrates: Definition and applications- Monosaccharides, Disaccharides, Oligosaccharides and polysaccharides. Disorders of carbohydrate metabolism- Hypo and hyperglycemia, Diabetes Mellitus- Types, Clinical features and metabolic changes. Glucose tolerance test (GTT) importance and principle and techniques of GTT.			
Unit-III	Lipids: Definition, Classification and properties of lipids. Disorders of lipid metabolism- Lipidosis and Xanthomatosis. Atherosclerosis- aetiology, clinical features and complication			
Unit-IV	Amino acids and Proteins: Amino acids – classifications, structure and properties. Protein- Classification and structures (primary, secondary, tertiary & quaternary). Disorders in protein metabolism- Introduction, aetiology and clinical features of phenylketonuria and cystinuria. Clinical Significance of non-protein nitrogen- urea, uric acid & creatinine.			
Unit-V	Vitamins and Function Tests: Deficiency disorders of vitamins. Function Test: Liver function test (Serum - Bilirubin SGPT, SGOT & Alkaline phosphatase and urine analysis – Bile salts, bile pigments and urobilinogen). Kidney function test (Urea, Uric acid, Creatinine). Pediatric Clinical chemistry: Diseases of new born and their complications.			
Reference and Textbooks:-				
Campbell, P.N., & Smith, A. D. (2010). <i>Biochemistry Illustrated</i> (4th ed). Churchill Livingstone.				
Deb, A.C. (2002). <i>Fundamentals of Biochemistry</i> . Books and allied (P)Ltd.				
Murray, R. K., Granner, D. K., Mayes, P. A., & Rodwell, V. W. (2009). <i>Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/McGraw-Hill Lehninger Principles of Biochemistry</i> 4th Ed by David L. Nelson and Michael M. Cox, WH Freeman and Company.				
Satyanarayanan, U. (2002). <i>Essentials of Biochemistry</i> . Books and allied (P)Ltd.				
Zubay, G.L. (1998). <i>Biochemistry</i> . New York: W.M.C. Brown Publishers.				
Outcomes	<ul style="list-style-type: none"> ➤ The students are able to understand the basic fundamentals of Biomolecules ➤ The students can able to identify the different groups of enzymes from different habitats and their clinical importance. 			

Semester –III				
Course code: 22BMC3P1	Core Practical III	T/P	C	H/W
	Lab in Human Anatomy, Haematology and Clinical Biochemistry	P	3	3
Objectives	<ul style="list-style-type: none"> ➤ Equip students with a basic understanding of the underlying principles of quantitative and qualitative research methods. ➤ Provide hands-on training for the collection of blood sample and staining methods ➤ Provide in depth knowledge about the estimation of ESR and Hb. 			
<ol style="list-style-type: none"> 1. Collection and preparation of blood for separation of plasma & serum 2. Determination of bleeding time and clotting time 3. Preparation and staining of blood smears 4. Differential counting of blood cells in normal and pathological smears 5. Estimation of erythrocyte sedimentation rate 6. Testing blood by anti-globulin test 7. Estimation of haemoglobin and blood glucose 8. Test for urine sugar (Benedict's method) 9. Estimation of blood glucose, cholesterol and iron. 10. Kidney function tests: Quantitative Determination of Urine Creatinine 11. Liver function tests: blood SGOT, SGPT & bilirubin 12. Identification of human models 				
Reference and Textbooks				
<p>Fischbach, F.T., & Dunning, M. B. (2002). <i>A Manual of Laboratory and Diagnostic Tests</i>. Baltimore: Lippincott Williams and Wilkins.</p> <p>Greenwood, D., Slack, R., Peutherer, J. F. (2002). <i>Medical Microbiology</i> (16th edition). London: Churchill, Livingstone.</p> <p>Jawetz, & Melnick, (2002). <i>Review of Medical Microbiology</i>. New York: Lange.</p> <p><u>Kanai</u>, L .M, (2010). <i>Medical Laboratory Technology</i>. CBS publishers.</p> <p>Lewis, J. A. (1994). <i>Illustrated Guide to Diagnostic Tests – Students Version</i>, Springhouse corporation. Praful, B., & Godkar, et al., (1996). <i>Extbook of Medical Laboratory Technology</i> (2nd edition). Bhalani publication House.</p> <p>Morag, C. T. (2002). <i>Notes on Medical Microbiology and Immunology</i>. London: Churchill Livingstone.</p> <p>Rajan, S (2012). <i>Manual for Medical Laboratory Technology</i>. Chennai: Anjanaa Book House.</p> <p>Rajan, S., & Selvi, C. R. (2012). <i>Experimental Procedures in Life Sciences</i>. Chennai: Anjanaa Book house.</p> <p>Shimeld, L. A., Delmar. (1999). <i>Essential of Diagnostic Microbiology</i>. New York.</p>				
Outcomes	<ul style="list-style-type: none"> ➤ The students are able to identify standard methods for the isolation, identification and culturing of microorganisms. ➤ The students can able to identify the different groups of microorganisms from different habitats. 			

Semester - IV				
Course code: 22BMC4C1	Core Course V	T/P	C	H/W
	Molecular Biology and Microbial Genetics	T	4	4
Objectives	<ul style="list-style-type: none"> ➤ Expand the knowledge on structure and functions of genetic material ➤ Obtain depth knowledge of genome organization, transcription, and translation process in Prokaryotes. ➤ Understand the principles of gene regulation and oncogenes. 			
Unit-I	Gene: Structure and function. DNA as a genetic material (Griffith, Avery and Mcleoid, Hershey and Chase experiments). Genetic code: Definition, deciphering of codons. DNA: Structure (Watson and Crick model) and forms of DNA. RNA: Structure, types and Function.			
Unit-II	Mutation: Definition and Types of mutations: Spontaneous and induced, Base pair changes, Frameshift, Deletion, Inversion, Tandem duplication, Insertion. Mutagens: Mode of action of Physical and chemical mutagens. DNA damage and repair (Direct, Excision and recombination repair). Gene transfer among bacteria – Transformation, Transduction and Conjugation			
Unit-III	DNA replication: Types of replication (Semiconservative replication, experimental evidence for semi conservative replication), Enzymes and proteins involved in DNA replication. Mechanism of DNA replication. Inhibitors of DNA replication. Various models of DNA replication: Rolling circle, D- loop (mitochondrial), Θ (theta)			
Unit-IV	Transcription: Initiation, Elongation, Termination; Differences between prokaryotic and eukaryotic transcription process. Inhibitors of transcription, Reverse transcription, RNA Polymerase. Translation: ribosomal cycle including phenomena of initiation, elongation, termination; Post translational modifications.			
Unit-V	Regulation of gene in prokaryotes - Operon concept- lac, trp, arabinose operons, Functional units in gene -promoters, repressors, operator, enhancer, introns and exons. Oncogenes: Activation of oncogenes. Oncogenic proteins - protein kinases, growth factors, ras protein.			
Reference and Textbooks:-				
Freifelder, D. (1990). <i>Microbial Genetics</i> . NewDelhi: Narosa Publishing House.				
Freifelder, D. (1997). <i>Essentials of Molecular Biology</i> . NewDelhi: Narosa Publishing House.				
Glazer, A. N., & Nikaido, H. (1995). <i>Microbial Biotechnology – Fundamentals of Applied Microbiology</i> . NewYork: W.H. Freeman and company.				
Glick, B. P., & Pasternack, J. (1998). <i>Molecular Biotechnology</i> . USA: ASM Press, Washington D.C.				
Jeyanthi, G.P. (2009). <i>Molecular Biology</i> , Chennai: MJP Publishers.				
Old, R.W., & Primrose, S.B. (1994) <i>Principles of Gene Manipulation</i> . NewYork: Blackwell Science Publication.				
Verma, P. S., & Agarwal, V.K. (2004). <i>Cell Biology, Genetics, Molecular Biology, Evolution and Ecology</i> . NewDelhi: S. Chand & Co. Ltd.				
Outcomes	After completion of the course, students are expected to be able to: <ul style="list-style-type: none"> ➤ Able to understand the function of genes and their regulation ➤ Understand the level of gene expressions ➤ Acquire depth knowledge on the activation of oncogenes. 			

Semester - IV						
Course code: 22BMC4C2	Core Course VI			T/P	C	H/W
	Clinical Parasitology and Mycology			T	4	4
Objectives	<ul style="list-style-type: none"> ➤ Obtain the knowledge on parasitic infections and their diagnostic techniques. ➤ Know about the structure and functions of fungi and the action of fungal toxins ➤ Understand the characteristics of helminthes and nematodes. 					
Unit-I	Introduction and definitions, common pathogenic effects of human parasites-host parasite relationship. General diagnostic procedures for parasitic infections (direct methods and indirect methods). Immunology of parasitic infections, and Prophylaxis.					
Unit-II	Protozoology: General characters, morphology, life cycle, epidemiology, pathogenesis - clinical sign, and control measures of amoebae (<i>Entamoeba histolytica</i>), Flagellates (Haemoflagellates-I – Leishmania, Haemoflagellates-II – Trypanosomes), Sporozoites (Plasmodium,) and ciliates (Balantidium).					
Unit-III	Medical Mycology: General properties structure and classification of fungi, structure and applications. Mycotic infections such as superficial mycosis, cutaneousmycosis,subcutaneousmycosis,systemicmycosis(dimorphic,endemic mycosis).					
Unit-IV	Actinomycetes infections, hypersensitivity to fungi, mycotoxins, and antifungal chemotherapy. Lab diagnosis and treatment of fungal infections.					
Unit-V	Helminthology and Nematodology: General characters, morphology, life cycle, epidemiology, pathogenesis - clinical sign, and control measures of Platyhelminthes (flat worm- <i>Taenia solium</i> , trematode), Nematelminthes (round worm- <i>Ascaris lumbricoides</i>), Nematodes (<i>Wuchereria bancrofti</i>).					
Reference and Textbooks:-						
Ballows, A. et al., (1998). Laboratory Diagnosis Oo Infectious Diseases(Volume 1).New York: Springer-Verlag.						
Chatterjee, K. D. (1890). <i>Parasitology</i> (12 Edition). Calcutta Chatterjee Medical Publishers.						
Chiodini, P. L. (2000). <i>Atlas of Medical Helminthology and Protozoology</i> (4 th Edition). London: Churchill Livingstone.						
Cook, G. C. (1996). <i>Manson's Tropical Diseases</i> (20 th edition). WBSaunders.						
Murray, P. R., Baron, E., Jorgensen, J. H., Pfaller, Y., & Robert, H. (2003). Manual of Clinical Microbiology. Washington: ASM Press.						
Outcomes	<ul style="list-style-type: none"> ➤ Able to understand the effects of human parasites and their diagnostic methods. ➤ Able to prevent the parasitic and helminthic infections. ➤ Acquire depth knowledge on the role of mycotoxins and other fungal toxins. 					

Semester –IV						
Course code: 22BMC4P1	Core Practical-IV			T/P	C	H/W
	Lab in Molecular Biology, Microbial Genetics, Clinical Parasitology and Mycology			P	4	4
Objectives	<ul style="list-style-type: none"> ➤ Know to isolate genomic and plasmid DNA from bacteria ➤ Determine the ability of microorganisms to produce mutants. ➤ Become familiar with gradient plate method for isolating antibiotic resistant mutants. ➤ Provide knowledge to identify fungi isolated from clinical specimens 					
	<ol style="list-style-type: none"> 1. Isolation of Genomic DNA from bacteria 2. Isolation of plasmid DNA from bacteria 3. Characterization of plasmid DNA by agarose gelelectrophoresis 4. Restriction digestion of DNA 5. Isolation of UV induced mutants of <i>E. coli</i> 6. Isolation of mutants by spontaneous mutation – Gradient plate technique 7. Isolation of Auxotrophic Antibiotic Resistant mutant by Induced mutagenesis in Bacteria by Replica plating technique 8. Microscopic examination of stool specimens for ova & parasites 9. Dip stick test for Malaria 10. Isolation and identification of common pathogenic fungi from clinical specimens 					
Reference and Textbooks						
<p>Ballows, A. et al., (1998). <i>Laboratory Diagnosis of Infectious Diseases</i> (Volume 1). New York: Springer-Verlag.</p> <p>Sambrook, J., & Russell, D. W. (2001). <i>Molecular Cloning: A Laboratory Manual</i> (4th ed.). Cold Spring Harbour Laboratory press.</p> <p>De Robertis, E. D. P., & De Robertis, E. M. F. (2006) <i>Cell and Molecular Biology</i> (8th ed.). Philadelphia: Lippincott Williams and Wilkins.</p> <p>Gardner, E. J., Simmons, M. J., & Snustad, D. P. (2008). <i>Principles of Genetics</i> (8th ed.). Wiley-India.</p> <p>Karp, G. (2010) <i>Cell and Molecular Biology: Concepts and Experiments</i> (6th ed.), John Wiley & Sons, Inc.</p> <p>Krebs, J., Goldstein, E., & Kilpatrick, S. (2013). <i>Lewin's Essential Genes</i> (3rd ed.). Jones and Bartlett Learning.</p>						
Outcomes	<ul style="list-style-type: none"> ➤ Able to perform isolation of nucleic acids and its confirmation by gel electrophoresis ➤ Understand the principles of inducing mutation ➤ Students will be familiar with the identification of pathogenic organism from clinical samples. 					

Semester - V						
Course code: 22BMC5C1	Core Course VII			T/P	C	H/W
	Systemic Bacteriology and virology			T	4	4
Objectives	<ul style="list-style-type: none"> ➤ Study about the basic principles and application relevance of clinical disease. ➤ Learn the biology of bacteria and viruses related with infectious diseases. 					
Unit-I	General characteristics, epidemiology, pathogenicity, Laboratory diagnosis and treatment of diseases caused by Gram positive bacteria- <i>Staphylococcus aureus</i> , <i>Streptococcus pyogenes</i> , <i>Corynebacterium diphtheria</i> . Gram negative bacteria: - <i>E.coli</i> , <i>Shigella dysenteriae</i> , <i>Neisseria gonorrhoea</i> and <i>Pseudomonas aeruginosa</i> .					
Unit-II	General characteristics, Epidemiology, Pathogenicity, Laboratory diagnosis and Treatment of diseases caused by <i>Clostridium sp</i> , <i>Klebsiella</i> , <i>Proteus</i> , <i>Salmonella</i> , <i>Haemophilus influenzae</i> , and. Acid fast bacteria- <i>Mycobacterium leprae</i> and <i>M. tuberculosis</i>					
Unit-III	General characteristics, Epidemiology, Pathogenicity, Laboratory diagnosis and treatment of diseases caused by Spirochetes – <i>Borrelia burgdorferi</i> and <i>Leptospira mayottensis</i> , <i>Rickettsiae prowazekii</i> and <i>Chlamydiae trachomatis</i> .					
Unit-IV	Virology: Viral architecture- Capsid, viral genome and envelope. Baltimore Virus classification. Life cycle of virus: Lytic and lysogenic cycle of lambda phage; structure and Lifecycle of TMV; Structure and lifecycle of T4 phage. Viral diseases:- Causative agent, symptoms, pathogenesis, treatment and prevention of Polio, rabies, yellow fever, mumps, influenza, measles, encephalitis, hepatitis and AIDS.					
Unit-V	Cultivation and Diagnosis of viruses: Tissue culture techniques, embryonated egg, chick embryo fibroblast, animal inoculation, CPE, inclusion bodies. Visualization and enumeration of virus particles:- Measurement of infectious units: Plaque assay, Fluorescent focus assay, Infectious center assay, Transformation assay, Endpoint dilution assay. Measurement of virus particles and their components by haemagglutination.					
Reference and Textbooks:-						
Benjamin, A. P. (2008). Genetics a conceptual approach (3rd ed). W.H. Freeman and company.						
Edward, A. (2000). Principles of Virology.						
Greenwood, D., Slack, R., & Peutherer, J. F. (2002). <i>Medical Microbiology</i> (16 th edition). London: Churchill Livingstone.						
Jawetz & Melnick, (2004). <i>Review of Medical Microbiology</i> . New York: Lange.						
Timbury, M. C. (2002). <i>Notes on Medical Microbiology and Immunology</i> (3 rd edition). London: Churchill Livingstone.						
Outcomes	<p>After completion of the course students are expected to be able to:</p> <ul style="list-style-type: none"> ➤ Acquire information about the concepts of systematic bacteriology and gain knowledge on medically important micro-organisms. ➤ Attain knowledge of morphology, cultural characteristics, biochemical tests, epidemiology, laboratory diagnosis etc of pathogenic organisms. ➤ Understand the concepts involved in the cultivation and diagnosis of viruses. 					

Semester - V					
Course code: 22BMC5C2	Core Course VIII		T/P	C	H/W
	Clinical Immunology		T	4	4
Objectives	<ul style="list-style-type: none"> ➤ Provide knowledge on the human immune system and immune response. ➤ Understand the mechanism of antigen- antibody interaction ➤ Inculcate recent clinical immunodiagnostic methods and monoclonal antibodies production for treating most of the human diseases. 				
Unit-I	Introduction to Immune System: - History and scope of Immunology. Micro flora of normal human body. Lymphoid organs: - Primary and Secondary lymphoid organs. Immune Cells - Lymphoid cells (B-lymphocytes, T-lymphocytes and Null cells), Mononuclear cells (Phagocytic cells and their killing mechanisms), granulocytic cells (neutrophils, eosinophils and basophils), mast cells and dendritic cells.				
Unit-II	Antigen: - Types and properties, haptens, adjuvants, antigenicity and immunogenicity. Immunity: -Types of immunity- Innate immunity and Acquired immunity, immunization. Immune response- Humoral and cell mediated immunity and their interaction. MHC: - properties, class I and class II. Antigen processing and presentation				
Unit-III	Immunoglobulins: - Structure, types, properties and biological functions. Antigen-Antibody interactions: - Precipitation, agglutination and complement fixation. Hybridoma Technology: - monoclonal antibody production. Vaccines: - types and principles in vaccine development- DNA vaccines, subunit vaccines- Recombinant vaccines.				
Unit-IV	Immunity to infection: - Hypersensitivity reactions:- causes, mechanism and types of hypersensitivity reactions. Transplantation – Immunologic response graft rejection mechanism and prevention of graft rejection.				
Unit-V	Immunochemical Techniques:- Immunodiffusion- Radial and Ouchterlony double immunodiffusion, Immuno-electrophoresis, Immunofluorescence:- principle, types, uses and limitations. Principle, technique and applications of RIA and ELISA.				
Reference and Textbooks:-					
<p>Abbas, A. K., Lichtman, A. H., & Pillai, S. (2015). <i>Basic Immunology, Functions and Disorders of the Immune System</i> (5th ed). Elsevier.</p> <p>Delves, P. J., Martin, S. J., Burton, D. R., & Roitt, I. M. (2017). <i>Roitt's Essential Immunology</i> (13th ed). John Wiley & Sons, Ltd.</p> <p>Joseph, A. B (2016). <i>Immunology IV: Clinical Applications in Health and Disease</i>. Washington, DC: Georgetown University School of Medicine.</p> <p>Owen, J. A., Punt, J., Stranford, S. A. (2013). <i>Kuby Immunology</i> (7th ed). W.H. Freeman And Company.</p> <p>Rich, R. R., Fleisher, T. A., Shearer, W.T., Schroeder, H., Frew, A., & Weyand, C.M. (2013). <i>"Clinical Immunology-Principles and Practice"</i> (5th ed) Elsevier.</p> <p>Wen, E. P., Ellis, R., & Pujar, N.S. (2014). <i>"Vaccine Development and Manufacturing"</i> (1st ed), Wiley.</p>					
Outcomes	<ul style="list-style-type: none"> ➤ The students after completing the course would be aware of structure and functions of immune system. ➤ Aware of immunity to various pathogens ➤ Able to understand the concepts and mechanism behind antigen-antibody interactions, hypersensitivity reactions and immunochemical reactions. 				

Semester - V					
Course code 22BMC5C3	Core Course IX		T/P	C	H/W
	Recombinant DNA Technology and Molecular Diagnostics		T	4	4
Objectives	<ul style="list-style-type: none"> ➤ Endow with knowledge on the role of enzymes in rDNA technology. ➤ Know the gene cloning strategies and construction of DNA libraries ➤ Make acquainted with the synthesis of recombinant products and molecular diagnostic methods ➤ Understand the concepts of polymerase chain reaction in diagnostics. 				
Unit-I	Introduction to rDNA technology: - History of rDNA technology. Tools used in rDNA technology:- Enzymes : - Ribonuclease-H (RNase-H), Klenow enzymes or klenow Fragment, SI Nuclease, Taq DNA Polymearse, Restriction Endonucleases, Terminal Nucleotidyl Transferase, Alkaline Phosphatase, Polynucleotide Kinase, DNA ligase, T4 DNA ligase and Methyl transferase. Ligation: - definition and process. Coupling Tools – Linkers and Adaptors.				
Unit-II	Gene cloning: - Strategies in gene cloning. Plasmids – Introduction and classification. Gene cloning vectors: - pBR322, pUC, ColE1 plasmid. Cosmids and phagemid as vectors. Shuttle vectors, Expression vectors. Application and limitations of vectors.				
Unit-III	Direct Gene transfer techniques: - Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication and Liposome fusion. <i>Agrobacterium</i> mediated gene transfer. Selection of recombinant Bacteria: - Direct selection, Insertional inactivation, Blue-white colony selection and colony hybridization. Genetically Engineered Microorganisms (GEMOs). Production of Healthcare products from GEMOs- Insulin, Human growth hormone, Interferons, Blood products and Vaccines.				
Unit-IV	Polymerase Chain Reaction (PCR): History, definition, types and applications. DNA sequencing: -Maxam-Gilbert's and Sanger's method, Automated sequencing. Construction of DNA libraries: Genomic and cDNA libraries: Preparation and uses. Screening of libraries by colony hybridization and colony PCR. Chromosome walking and jumping.				
Unit-V	Molecular diagnostic methods: RAPD, RFLP techniques, DNA Finger Printing and DNA Foot Printing techniques, Fluorescence In-Situ Hybridization (FISH), Molecular beacons and Real Time PCR.				
Reference and Textbooks:- Brown, T. A. (2006). <i>Gene Cloning and DNA Analysis</i> (5 th ed). U.K: Blackwell Publishing, Oxford. Dubey, R.C. (2001). <i>A Text Book of Biotechnology</i> . NewDelhi: S. Chand & Company Ltd (1 st ed). Ramnagar. Primrose, S.B., & Twyman, R. M. (2006). <i>Principles of Gene Manipulation and Genomics</i> (7 th ed). U.K: Blackwell Publishing, Oxford. Sambrook, J., Fritsch, E.F., & Maniatis, T. (2001). <i>Molecular Cloning-A Laboratory Manual</i> (3 rd ed). Cold Spring Harbor Laboratory Press. Satyanarayana. U, (2008). <i>Biotechnology</i> . Books and Allied (p)Ltd. Verma, P. S., & Agrawal, V. K. (2006). <i>Cell Biology, Genetics, Molecular Biology, Evolution & Ecology</i> (1 st ed.). S .Chand and companyLtd.					

Watson, J.D., Gilman, M., & Zoller, M. (2001). *Recombinant DNA* (2nd ed). New York: W.H. Freeman and Company.

Outcomes	<ul style="list-style-type: none">➤ The students are be able to understand the concepts and methods in rDNA technology➤ Enable the students to know about cloning vectors.➤ Acquire knowledge on the construction of DNA libraries and DNA sequencing and an applications of rDNA technology➤ The students are being able to diagnose the genetic diversity and genepattern by molecular methods.
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Semester - V						
Course code: 22BMC5C4	Core Course X			T/P	C	H/W
	Clinical Bioinstrumentation and Diagnostics			T	4	4
Objectives	To impart knowledge on <ul style="list-style-type: none"> ➤ Fundamentals of medical instruments based on physiological parameter and biological system ➤ Concepts of ECG and EEG ➤ Various medical instruments for biomedical applications. 					
Unit-I	Fundamental of medical instrumentation: Sources of biomedical Signals: Generalized medical instrumentation block diagram. Classification of medical instruments based on different principles: Based on application (diagnostic, therapeutic, Imaging, analytical), Based on physiological parameter and bio-potential, Based on Biological system, Based on different departments in the hospital.					
Unit-II	Electrocardiograph: ECG-Block diagram, working principle; Electroencephalograph- EEG - Block diagram, working principle; Electromyograph - EMG -Block diagram, working principle. Techniques of heart rate measurement: Average heart rate meter, Instantaneous heart rate meter; Measurement of pulse rate; Blood Pressure measurement - Direct method & Indirect method (Sphygmomanometer), Manual & automatic BP Instrument; Measurement of respiration rate.					
Unit-III	Pneumography : Impedance pneumography - Apnoea monitor. Oxygen Saturation measurement (Oxymetry) - Ear oxymeter & Pulse oxymeter. Spirogram: Lung volumes and capacities (Respiratory volumes), Spirometry-Basics Spirometer, Wedge Spirometer, Ultrasonic Spirometer. Audiometers: Hearing transducers, Types of audiometers, Hearing aid-Conventional & Digital					
Unit-IV	Spectroscopy-Basic principles, Instrumentation and application of Visible, ultraviolet (UV) and Infrared (IR). Centrifugation-Basic Principle of Centrifugation, Types of centrifuge and rotors. Instrumentation of Ultracentrifuge (Preparative, Analytical) and Rate-Zonal centrifugation.					
Unit-V	Chromatography: Basic principles, Instrumentation and application of Paper Chromatography, Adsorption Chromatography, TLC, GC, Ion Exchange Chromatography, Gel Chromatography, HPLC, Affinity Chromatography.					
Reference and Textbooks:-						
Carr, J. J., & Brown, J. M. (2004). <i>Introduction to Biomedical Equipment Technology</i> . Delhi: Pearson Education India.						
Cromwell, (2007). <i>Biomedical Instrumentation and Measurements</i> . New Delhi: Prentice Hall of India.						
Guyton, A. C. (2012). <i>Textbook of Medical Physiology</i> (12th edition). Prism Books (Pvt) Ltd & W.B. Saunders Company.						
Jacobson, B., & Webster, J. G. (1999) <i>Medical and Clinical Engineering</i> . New Delhi: Prentice Hall of India.						
Khandpur, R. S. (2004). <i>Handbook of Biomedical Instrumentation</i> . New Delhi: Prentice Hall of India.						
Webster, J. G. (2011). <i>Medical Instrumentation, Application and Design</i> Fourth Edition. New York: Wiley & sons, Inc.						
Outcomes	After completion of the course, students are expected to be able to:					

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| | <ul style="list-style-type: none">➤ Identify the need of understanding human anatomy and physiologysystem➤ Select the suitable acquisition method for analysing biomedical signal and vital parameter measurement.➤ Apply the knowledge of biomedical instruments to practical applications➤ Categorize the parameter monitoring techniques based on the application and relevance. |
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Semester –V					
Course code: 22BMC5P1	Core Practical V		T/P	C	H/W
	Lab in Bacteriology, Virology, Clinical Bioinstrumentation and Diagnostics		P	4	6
Objectives	<ul style="list-style-type: none"> ➤ Familiarize with microbiological techniques applied in the clinical laboratories ➤ Perform the basic techniques to identify the antibiotic sensitivity ➤ Understand about effect of environmental condition on microbes 				
	<ol style="list-style-type: none"> 1. Collection, coding and transport of clinical specimens for microbiological Examinations 2. Study of bacterial flora of skin by swab method 3. Preparation of media for culturing autotrophic and heterotrophic microorganisms – algal medium, mineral salts medium , nutrient agar medium, MacConkey agar and Bloodagar. 4. Biochemical tests: IMViC, TSI, Urease, Catalase, Oxidase, Hydrogen sulphide, Starch hydrolysis, coagulase, nitrate reduction tests and sugar fermentation test. 5. Isolation and identification of upper respiratory tract bacterial pathogen – <i>Streptococcus pyogenes</i>, <i>Staphylococcus aureus</i>, <i>Salmonella</i>, <i>Shigella</i>, <i>Klebsiella</i>, <i>E.coli</i>, <i>Pseudomonas</i>, <i>Vibrio</i>. 6. Isolation and identification of clinically important yeast and molds – <i>Candida albicans</i>, <i>Cryptococcus neoformans</i>, <i>Fusarium</i> spp. and <i>Aspergillus</i> spp. 7. Perform antibacterial sensitivity by Kirby-Bauer method. 8. Determination of minimal inhibitory concentration (MIC) of an antibiotic. 9. Turbidometric measurement of bacterial growth. 10. Separation of amino acids and sugar by paper chromatography. 11. Demonstration <ul style="list-style-type: none"> (a) Cultivation of virus in chick embryo method. (b) Cultivation of virus in cell culture (c) Plaque assay 				
Reference and Textbooks:-	<p>Shimeld, L.S., & Delmar, (1999). New York: Essential of Diagnostic Microbiology.</p> <p>Greenwood, D., Slack, R., & Peutherer, J. F. (2002). Medical Microbiology (16th edition). London: Churchill, Livingstone.</p> <p>Jawetz, & Melnick. (2002). <i>Review of Medical Microbiology</i>. New York: Lange.</p> <p>Timbury, M. C. (2002). <i>Notes on Medical Microbiology and Immunology</i>. London: Churchill Livingstone.</p> <p>Mukherjee, K. L. (2010). <i>Medical Laboratory Technology</i>. CBS publishers</p> <p>Rajan, S., & Christy, S. (2012). <i>Experimental Procedures in Life Sciences</i>. Chennai: Anjanaa Book house.</p> <p>Rajan.S.(2012). <i>Manual for Medical Laboratory Technology</i>. Chennai: Anjanaa Book House.</p>				
Outcomes	<p>After completion of the course, students are expected to be able to:</p> <ul style="list-style-type: none"> ➤ Able to isolate and identify the pathogen from the clinical samples. ➤ Knowledge in the analysis of antibiotic sensitivity. ➤ Understand the role of environmental factors affecting bacterial growth. 				

Semester –V				
Course code: 22BMC5P2	Core Practical VI	T/P	C	H/W
	Lab in Clinical Immunology and rDNA Technology	P	4	6
Objectives	<ul style="list-style-type: none"> ➤ Give depth knowledge on the clinical diagnostic methods. ➤ Perform enumeration of blood components ➤ Make familiar with the immune diffusion methods 			
<ol style="list-style-type: none"> 1. Identification of blood group by ABO Blood grouping and Rhtyping. 2. Evaluation of total erythrocyte count(RBC). 3. Evaluation of total WBCcount. 4. Identification of immune cells in a bloodsmear 5. Examination of differential count of bloodcells. 6. Evaluation of erythrocyte Sedimentation Rate(ESR). 7. Haemoglobin estimation Shali's method. 8. Immuno diffusion- radial immune diffusion and ouchterlony double immune diffusion 9. Testing for typhoid antigens by Widaltest 10. Construction of recombinantDNA 11. Protein separation by SDS-PAGE 12. Demonstration of <ol style="list-style-type: none"> a) PCR b) Immunofluorescence c) ELISA 				
Reference and Textbooks:-				
<p>Helen, C., Mansel, H. (1993). <i>Essentials of Clinical Immunology</i> (3rd ed). Blackwell Scientific, London.</p> <p>Janeway, C. A. (2001). <i>Immunobiology</i> (5th ed). London: Churchill living stone.</p> <p>Sambrook, J., Fritsch, E.F., & Maniatis, T. (2001). <i>Molecular Cloning-A Laboratory Manual</i>. (3rd ed). Cold Spring Harbor Laboratory Press.</p> <p>Kaufmann, S.H.E. (2002). <i>Immunology of Infectious Diseases</i>. ASM Press.</p> <p>Roitt, I., Male, D., & Brostoff, J. (2002) <i>Immunology</i>. Mosby Publishers.</p> <p>Rose, N. R. (2002). <i>Manual of Clinical Laboratory and Immunology</i> (6th ed).</p> <p>Murray, P. R. (2003). <i>Manual of Clinical Microbiology</i> (8th ed). Washinton: ASMPress.</p> <p>Brown, T. A. (2006). <i>Gene Cloning and DNA Analysis</i>(5th ed). U.K: Blackwell Publishing, Oxford.</p>				
Outcomes	<ul style="list-style-type: none"> ➤ The students will be able to enumerate the RBC and WBC and also identify the blood cells based on their color and shape. ➤ The students can identify the blood grouping and also diagnose the infectious agents by performing immunological techniques. ➤ The students will have technical knowledge of immunological /clinical tests. ➤ The students are able to construct Rdna. 			

Semester - VI						
Course code: 22BMC6E1	DSE-I			T/P	C	H/W
	Basics of Bioinformatics			T	6	6
Objectives	<ul style="list-style-type: none"> ➤ To provide an- in depth study on Bioinformatics ➤ To create the students to understand sequence alignments, genome analysis, sequence analysis and protein analysis ➤ To familiarize the tools used in Bioinformatics. 					
Unit-I	Introduction to Genes and Proteins: Genome Sequences-ORFs, Genes, Introns, Exons, Splice Variants. DNA Structure: Watson & Crick Model. Amino acid: Definition and Structure, Triplet Codon; Protein Structure: Secondary, Tertiary, Quaternary					
Unit-II	Introduction to Bioinformatics and Biological Databases: Definition and scope of Computational Biology and Bioinformatics. DNA and protein databases – preliminary level analysis of DNA and protein sequences using bioinformatics tools. Examples of related tools (FASTA, BLAST), databases (GENBANK, PUBMED, PDB) and softwares (RASMOL, LigandXplorer). Applications of Bioinformatics.					
Unit-III	Pairwise sequence alignments: Sequence similarity, identity, and homology. Global and local alignment, Dot plots for sequence comparison, Dynamic programming, BLAST and PSI-Blast, Application of Blast tool, Concept of coring matrix (PAM and BLOSUM).					
Unit-IV	Multiple sequence alignments: Progressive Alignment Algorithm (ClustalW), Application of multiple sequence alignment. Phylogenetic analysis: Definition and description of phylogenetic trees, a primer on computation phylogenetic analysis. Visualization of protein structure: Protein Data Bank. Ramachandran plot.					
Unit-V	Structural Bioinformatics: Tertiary structure Prediction methods (Homology modeling, Fold recognition and ab-initio method). Molecular dynamics and simulation study of protein, Force field concepts. Molecular Docking (Basic concepts). Drug target identification and Drug design.					
Reference and Textbooks:-						
Andrew, L. (2001). <i>Molecular Modelling: Principles and Applications</i> (2 nd ed). Prentice Hall.						
Bourne, P. E., & Weissig, H. (2009) <i>Structural Bioinformatics</i> , Wiley-Blackwell						
Claverie, J. M. & Notredame, C. (2003). <i>Bioinformatics for Dummies</i> . Wiley Editor.						
Durbin, R., Eddy, S., Krogh, A., & Mitchison, G. (2007). <i>Biological Sequence Analysis</i> . Cambridge University Press.						
Lesk, A. M. (2005). <i>Introduction to Bioinformatics</i> . Oxford University Press.						
Mount, D.W. (2004). <i>Bioinformatics: Sequence and Genome Analysis</i> . CSHL Press. 8. Phil.						
Primrose, S. B., & Twyman, R. (2009). <i>Principles of Genome Analysis & Genomics</i> . Blackwell						
Rastogi, S.C., Mendiratta, N., & Rastogi, P. (2005). <i>Bioinformatics: Methods and Applications, Genomics, Proteomics and Drug Discovery</i> . New Delhi: Prentice Hall India Publication.						
Sinha, P.K., & Sinha, P. <i>Foundations of Computing</i> . BPB publications						
Outcomes	<p>After completion of the course students are expected to be able to:</p> <ul style="list-style-type: none"> ➤ Understand the different tools for data analysis and apply the appropriate tool for data processing. ➤ Know the whole genome analysis methods and the computational tools used for sequence analysis. ➤ Acquire knowledge on Homology modeling of protein. 					

Semester - VI					
Course code: 22BMC6E2	DSE-II		T/P	C	H/W
	Food and Dairy Microbiology		T	6	6
Objectives	<ul style="list-style-type: none"> ➤ To transmit information on the scope and development of food microbiology ➤ To make awareness among the students about the food quality analysis and the role of government organizations involved in food quality control. ➤ To provide an overview on food spoilage organisms- Food borne diseases- to understand infection process and food-borne outbreaks. 				
Unit-I	Microbiology of foods:- Role, and Significance of Microorganisms in Foods- Microbial flora of fresh foods, grains, fruits, vegetables, milk, meat, eggs and fish and their infestation by bacteria, fungi & viruses. Factors affecting the growth of microorganisms:- Intrinsic factors (Nutrient Content, Redox Potential, pH and Buffering Capacity), water activity and Extrinsic factors (Relative Humidity and Temperature) influence the growth and survival of microorganisms in foods.				
Unit-II	Microbial spoilage of food: - Fruit and vegetables. Spoilage of meat and meat products – Bacon and Ham. Spoilage of milk and milk products – butter and canned foods. Food- intoxications:- <i>Staphylococcus aureus</i> , <i>Clostridium botulinum</i> and mycotoxins. Food infection: - <i>Bacillus cereus</i> , <i>Vibrio parahaemolyticus</i> , <i>Escherichia coli</i> , Salmonellosis, Shigellosis, <i>Yersinia enterocolitica</i> , <i>Listeria monocytogenes</i> and <i>Camphylobacter jejuni</i> .				
Unit-III	Principles of food preservation: - general principles and application methods – asepsis, removal of microorganisms, anaerobic conditions, high temperature, low temperature, osmotic pressure, drying and food additives. Chemicals- organic acids. Radiation –UV light, irradiation. Advanced microbiological method for examination of foods				
Unit-IV	Microbial Fermentation:- Bread making, Alcoholic Beverages. Production of fermented dairy products: Cheese, yoghurt, butter milk, sour cream. Fermented vegetables; Sauerkraut, pickles, olives and soy sauce. Microorganisms as food- single cell protein.				
Unit-V	Quality and safety assurance:- Quality and safety assurance in food and dairy industry Good manufacturing practice, hazard analysis and critical control point (HACCP) concept. FDA, AGMARK, Bureau of Indian Standards(BIS).				
Reference and Textbooks:- Adams, M. R., & Moss, M.O. (1995). <i>Food Microbiology</i> (4th ed). New York: McGraw Hill. Frazier, W.C. (1978). <i>Food Microbiology</i> (3 rd ed). McGrawHill Jay, J.M. (2000). <i>Modern Food Microbiology</i> (6th ed). USA: Aspen Publication. Joshi, V. K & Pandey, A. (1999). <i>Biotechnology: Food Fermentation Microbiology</i> (Vol III). Biochemistry and Technology. Prescott, L.M., Harley, J. P., & Helin, D.A. (2008). <i>Microbiology</i> (5th ed). New York: McGraw Hill. Robinson, R.K. (2002). <i>Dairy Microbiology: Milk and Milk Products</i> (3 rd Ed). Wiley Publishers. Sivasankar, B. (2010). <i>Food Processing and Preservation</i> . New Delhi: PHL Learning Pvt. Ltd. Wood, B. J. (1985). <i>Microbiology of Fermented Foods</i> (Volume I and II). London: Elsevier Applied Science Publication.					
Outcomes	<ul style="list-style-type: none"> ➤ The students are able to know the role of microorganisms in food (beneficial as well as harmful) and also the factors influencing their growth. 				

	<ul style="list-style-type: none">➤ The students can be easily understood in depth the techniques/process involved in the production of microbial products in food and dairy industries.➤ Able to identify the key problems and prospects in food processing and preservation of perishable food products and also understand the microbial hazards involved in food spoilage.
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Semester - VI						
Course code: 22BMC6E3	DSE-III			T/P	C	H/W
	Agricultural Microbiology			T	6	6
Objectives	<ul style="list-style-type: none"> ➤ Make the students understand the role of microbes in agriculture ➤ Give an overview on plant microbe interaction. ➤ Understand infection process and control measures. ➤ Know the importance and applications of biofertilizers and biopesticides. 					
Unit-I	Soil Microbiology:- Physio-chemical properties of soil. Microbial interactions- mutualism, commensalism, amensalism, synergism, parasitism, predation and competition. Microbial interactions between plants – phyllosphere, mycorrhizae, rhizosphere and rhizoplane organisms.					
Unit-II	Plant pathogenic microorganisms:- pathogens, symptoms and control measures Algal, fungal, bacterial, viral, mycoplasma, Nematode diseases and symptoms. Phenolic compounds. Interaction of plant pathogens with host. Definition and History of Biopesticides – Viral (NPV, CPV & GV), bacterial (Bacillus thuringiensis & Pseudomonas sp.), Fungal (Entomophthora mucosa & Verticillium sp.), Protozoan (Mattersia sp & Lambornella sp).					
Unit-III	Non Leguminous associations:- Azotobacter sp and Azospirillum sp and their functions - Cyanobacteria (BGA) and their associations in Nitrogen fixation. Phosphate solubilizing microbes. Mycorrhizae and plant growth promoting rhizobacteria (PGPR). Biofertilizer production:- Role of biofertilizers. Quality control (BIS specification), marketing, Evaluation of field performance and economics of production. Role of biofertilizer in integrated nutrient management. Regulation and standards, Marketing and Monitoring field performance.					
Unit-IV	Biological Nitrogen fixation:- Nitrogen fixers- free living nitrogen fixing bacteria and cyanobacteria, symbiotic nitrogen fixing bacteria and cyanobacteria. Symbiotic nitrogen fixation:- nodule formation and mechanism of nitrogen fixation. Assimilation of Ammonia: reductive amination, catalytic amination and transamination. Nitrate Assimilation:- reduction of nitrate to nitrite.					
Unit-V	Microbial transformations of minerals:- Phosphorous, sulphur, iron and other elements - Chemistry, cycles, mineralization and immobilization and oxidation/reduction.					
Reference and Textbooks:- Atlas, R. M., & Bartha, R. (1992). <i>Microbial Ecology: Fundamentals and Applications</i> (III Ed). Redwood City, CA: Benjamin Cummings. Gaur, A.C., (1999). <i>Microbial Technology for Composting of Agricultural Residues By Improved Methods</i> . New Delhi: 1st print, ICAR. Glick, B. R. & Pasternak, J.J (1994). <i>Molecular Biotechnology</i> . Washington DC: ASM Press. Gupta, S.K. (2014). <i>Approaches and Trends in Plant Disease Management</i> . India: Scientific publishers, Jodhpur. Subba Rao, N. S. (1995). <i>Soil Microbiology</i> (IV Ed). New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd. Subba Rao, N.S. (1997). <i>Biofertilizers in Agriculture and Forestry</i> (III Ed.). New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd. Wheelis, M. (2010). <i>Principles of Modern Microbiology</i> . New Delhi: Jones & Bartlett India Pvt. Ltd.						

Outcomes	After completion of the course, students are expected to be able to: <ul style="list-style-type: none">➤ Understand the role of microbes in the different cycles and their role in agriculture➤ Be familiar with biological nitrogen fixation in symbiotic and non symbiotic associations with plants.➤ Know the value, production, application in pest control and crop response of biofertilizers and biopesticides.
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Semester - VI					
Course code: 22BMC6E4	DSE-IV		T/P	C	H/W
	Environmental Microbiology		T	6	6
Objectives	<ul style="list-style-type: none"> ➤ Provide the student with an understanding of the current views of microbial association in various environments. ➤ Evaluate the continuing roles played by microbes in the environment. ➤ Recognize microorganisms as indicators of alteration of an ecosystem. ➤ Understand microbial processes aimed to solve environmental problems. 				
Unit-I	<p>Soil characteristics:- Composition of Lithosphere, Soil Microbes, Factors influencing soil microbial population. The soil environment-Distribution and abundance, generic groups and nutrition of bacteria, actinomycetes, fungi, algae, protozoa and viruses.</p> <p>Biogeochemical cycling:-Carbon cycling, nitrogen cycling, Phosphorus cycling and sulphur cycling. Ecological groups based on oxygen requirement, nutrition, temperature, habitat (soil, water & air).</p>				
Unit-II	<p>Microbial analysis of drinking water:- Tests for coliforms (presumptive, confirmed and completed tests). Purification of water: Sedimentation, Filtration (slow and rapid sand filters) and Disinfection. Aeromicrobiology:- Phylloplane microflora (morphological, physiological characters: nutrition, radiation, relative humidity and temperature) – Air Pollution – aerosol, droplet nuclei and infectious dust. Examination of air microflora.</p>				
Unit-III	<p>Waste management:- Utilization of solid and liquid waste pollutants for production of Single- Cell protein. Sewage Treatment:- Nature of sewage and its composition. Physical, chemical and biological properties of sewage (BOD, COD etc). Sewage systems and types. Sewage Treatment: Single Dwelling Unit, municipal sewage treatment - primary, secondary and tertiary treatments (Trickling filters, activated sludge process and Oxidation lagoons.</p>				
Unit-IV	<p>Bioremediation & Microbial leaching:- Polluted heterogeneous environment. Indicator organisms for pollution and abatement of pollution. Bioremediation – Types and uses - Genetically Engineered microbes for Bioremediation. Microbial leaching:- In situ & Ex situ methods –copper and uranium mining.</p>				
Unit-V	<p>Biosafety & Environmental monitoring:- Environmental regulations - Biohazards - Types of hazardous emission – Biosafety measures - Biomonitority of waste water toxics - Monitoring of Genetically Engineered Microbes in the Environment.</p>				
<p>Reference and Textbooks:-</p> <p>Brock, T.D., Smith, D.W., &Madigan, M.T (1984). <i>Biology of Microorganisms</i>(4th ed). London : Prentice Hall Int.Inc.</p> <p>Atlas, R. M., &Bartha, R. (1992). <i>Microbial Ecology: Fundamentals and Applications</i> (III Ed). RedwoodCity.CA: BenjaminCummings.</p> <p>Subba Rao, N. S. (1995). <i>Soil Microbiology</i> (IV Ed). New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.</p> <p>Clescri, L.S., Greenberk, A. E., & Eaton, A.D. (1998). <i>Standard Methods for Examination ofWater and WasteWater</i>(20th Edition). American Public HealthAssociation.</p> <p>Maier, R. M., Pepper, I. L, & Gerba, C.P. (2000). <i>EnvironmentalMicrobiology</i>. NewYork:Academic Press.</p> <p>Mara, D., &Horan. N.(2003). <i>The Handbook of Water and Waste Water Microbiology</i>. California: Academic. Press.</p>					

Outcomes	After completion of the course, students are expected to be able to: <ul style="list-style-type: none">➤ Understand on soil characteristics and biogeochemical cycling➤ Be familiar with the microbial analysis of drinking water and Aeromicrobiology➤ Know the different aspects of waste management and sewage Treatment systems➤ Acquire knowledge on bioremediation and microbial leaching.
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Semester - VI					
Course code: 22BMC6E5		DSE-V	T/P	C	H/W
		Medical Microbiology	T	6	6
Objectives	<ul style="list-style-type: none"> ➤ Identify common infectious agents and the diseases that they cause. ➤ Evaluate methods used to identify infectious agents in the clinical microbiology lab. ➤ Recognize and diagnose common infectious diseases from the clinical presentation and associated microbiology. 				
Unit-I	Introduction to Medical Microbiology: Normal microflora of the human body: Importance of normal microflora, normal microflora of skin, throat, gastrointestinal tract, urogenital tract. Antibacterial substance: Lysozyme, Complement, Properdin, Antiviral substances, Phagocytosis. Hostpathogeninteraction: Definitions-Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Carriers and their types, Opportunistic infections.				
Unit-II	Diagnostic and Therapeutical Microbiology: Collections, transport & processing of clinical samples. General methods of lab diagnosis- cultural, biochemical, serological & molecular methods. Test for antimicrobial susceptibility. Elements of chemotherapy- Therapeutic drugs, Mode of action of Pencillin & sulphur drugs & their clinical use. Drug resistance. Antiviral agents- Interferon, Base analogues. Preventive control of diseases- active & passive immunization.				
Unit-III	Medical Bacteriology: Causative agent, symptoms, pathogenesis, treatment and prevention of the following diseases: Air borne diseases- Tuberculosis. Food & water borne diseases- Cholera, Typhoid. Contact diseases- Syphilis, Gonorrhoea. Zoonotic diseases - Anthrax. General account of Nosocomial infections				
Unit-IV	Medical Virology and Parasitology: Causative agent, symptoms, pathogenesis, treatment and prevention of the following diseases: Air borne diseases- Influenza. Food & water borne diseases- Hepatitis-A, Poliomyelitis, Amoebiosis. Insect borne diseases- Malaria, Filariasis, Dengue fever. Zoonotic diseases - Rabies. Blood borne diseases- Serum hepatitis, AIDS.				
Unit-V	Antibacterial agents: Mechanism of action of Penicillins, Tetracyclines, Cephalosporins, Macrolides. Antifungal agents: Mechanism of action of Amphotericin B, Griseofulvin, Nystatin. Antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine				
Reference and Textbooks:- Baron, S. (1996). <i>Medical Microbiology</i> (4 th ed.). Texas: University of Texas medical branch at Galveston. Pelczar, M.J., Chan, E.C. S. & Krieg, N.R. (2002). <i>Microbiology</i> (5 th ed.). New York : McGraw Hill Book Company. Goering, R., Dockrell, H., Zuckerman M., & Wakelin, D. (2007) <i>Mims' Medical Microbiology</i> (4 th ed.). Elsevier Ananthanarayan, R., & Paniker C.K.J. (2009) <i>Textbook of Microbiology</i> (8 th ed.). University Press Publication Brooks, G.F., Carroll, K. C., Butel, J.S., Morse, S. A., & Mietzner, T.A. (2013) <i>Jawetz, Melnick and Adelberg's Medical Microbiology</i> (26 th ed.). McGraw Hill Publication.					

Willey, J. M., Sherwood, L.M., & Woolverton, C. J.(2013) *Prescott, Harley and Klein's Microbiology* (9thed.). McGraw Hill Higher Education.

Madigan, M. T., Martinko, J. M., Dunlap, P.V., &Clark, D. P. (2014). *Brock Biology Of Microorganisms*(14thed.). Pearson International Edition.

Outcomes

- The student will be able to explain general and specific mechanisms by which an infectious agent causes disease.
- The student will be able to describe the epidemiology of infectious agents including how infectious diseases are transmitted.

Semester - VI					
Course code: 22BMC6E6	DSE-VI		T/P	C	H/W
	Microbial Physiology and Metabolism		T	6	6
Objectives	<ul style="list-style-type: none"> ➤ Build up a sufficient background to students about the growth of Microbes ➤ Study the microbial metabolism and nutrition ➤ Attain knowledge on mechanism of photosynthesis. 				
Unit-I	Microbial Growth: Definitions of growth, measurement of microbial growth, Batch culture, Continuous culture, synchronous growth, diauxic growth curve. Microbial growth in response to environment -Temperature, pH. Microbial growth in response to nutrition and energy – Autotroph, heterotrophy, Mixotrophs , Methylophils. Survival at extreme environments – starvation – adaptative mechanisms in thermophilic, alkalophilic, osmophilic and psychrophilic.				
Unit-II	Microbial Nutrition: Microbial Nutrition–Nutritional Requirement, Uptake of nutrients by cell, Transport of nutrients: Passive and facilitated diffusion, Primary and secondary active transport (uniport, symport and antiport) Group translocation, Ironuptake..				
Unit-III	Structure of photosynthetic pigments: chlorophylls, bacteriochlorophyll, carotenoids and phycobilins. Mechanism of photosynthesis - non-cyclic and cyclic electron transport. Photophosphorylation. Photosynthetic Apparatus in Prokaryotes. Outline of oxygenic and Anoxygenic photosynthesis in bacteria				
Unit-IV	Aerobic Respiration: Sugar degradation pathways (EMP, ED, Pentose phosphate pathwayTCACycle).Electrontransportchain:componentsofrespiratorychain, comparison of mitochondrial and bacterial ETC, electron transport phosphorylation. Gluconeogenesis.				
Unit-V	Nitrogen Metabolism: Introduction to biological nitrogen fixation, Ammonia assimilation (glutamate dehydrogenase pathway),Assimilatory nitrate reduction, Dissimilatory nitrate reduction, Denitrification.				
Reference and Textbooks:- Gottschalk, G. (1986). <i>Bacterial Metabolism</i> . New-York: Springer-Verlag. Lehninger, A.L., Nelson, D. L., &Cox, M.M. (1993). <i>Principles of Biochemistry</i> (2 nd ed.). NewDelhi: CBS Publishers and Distributors. Caldwell, D.R. (1995). <i>Microbial Physiology and Metabolism</i> . USA: W.C. Brown Publications, Iowa. Moat, A. G., &Foster, J.W. (1995). <i>Microbial Physiology</i> . NewYork: John-Wiley. White, D. (1995). <i>The Physiology and Biochemistry of Prokaryotes</i> . New York: Oxford University Press. Elliot, W.H.,&Elliot, D.C. (2001). <i>Biochemistry and Molecular Biology</i> (2 nd ed.).U.S.A: Oxford University Press. Reddy,S.R.,&Reddy,S.M.(2004). <i>Microbial Physiology</i> . Scientific Publishers, India: Jodhpur. Srivastava, M.L. (2008). <i>Microbial Biochemistry</i> . NewDelhi: Narosa Publishing House. Nelson, D.L., &Cox,M.M.(2012). <i>Lehingers's Principles of Biochemistry</i> (6 th ed.).New Delhi: MacMillanworth Publishers. Satyanarayana,U., &Chakrapani,U.(2013). <i>Biochemistry</i> (4 th ed).Kolkata: Book and Allied Pvt.Ltd.					

Outcomes	<ul style="list-style-type: none">➤ Know the various phases involved in the microbial growth➤ Understand the general concepts of pathways in microbial metabolism➤ Acquire a clear idea of the role of photosynthetic pigments and the mechanism of photosynthesis.
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Semester - VI						
Course code 22BMC6E7	DSE-VII			T/P	C	H/W
	Communicable and Non- Communicable Diseases			T	6	6
Objectives	<ul style="list-style-type: none"> ➤ Enable students to identify issues specifically related to infectious disease epidemiology. ➤ Evaluate the contributions of various environmental factors to non-communicable diseases. ➤ Impart knowledge on diseases transmitted through air, water, food, vectors and pollution sources as well as major components of health services. ➤ Help the students to apply these understandings to infectious disease prevention and control. 					
Unit-I	Diseases: - Definition, causes of diseases, acute and chronic diseases. Environmental factors that contribute to non-communicable diseases: - Outdoor air pollution, householdairpollution,impurewater,toxicchemicals,radiation,moldandothernatural toxins. Differences between communicable and non-communicable diseases.					
Unit-II	Communicable Diseases- Causative agent, symptoms, preventive measures and treatment of Tuberculosis, Measels, COVID,Post COVID fungal infections, H1N1, Typhoid,Rabies, Chikungunia and Respiratory tract Infections. Reservoirs of infection agents, Chain of transmission in communicable disease.					
Unit-III	Non-Communicable Diseases- Cardiovascular Diseases, Cancer, diabetes, hypertension, obesity and stroke.					
Unit-IV	Chronic diseases transmitted through blood transfusions- Viral disease- Dengue fever, Hepatitis and AIDS; Parasitic disease- Chagas disease, Malaria, Amoebiasis and Leishmaniasis.					
Unit-V	Vaccine Preventable Diseases:- Role of vaccineinglobal health maintenance. Specific vaccines of use in the developing world. Next generation of vaccine prevention, Types of Vaccine. Hospital acquired infection (Nosocomial)					
Reference and Textbooks:-						
Garrett, L. (1994) . <i>The Coming Plague: Newly Emerging Diseases in a World Out of Balance.</i> Penguin Books.						
Park, J. E., & Park, K. (1989). “Text Book of Preventive and Social Medicine”(10 th ed).						
Godkar, P. B., &Godkar, D. P. (2014). Textbook of Medical Laboratory Technology (3 rd ed). Bhalani publishers.						
Abbas, A. K.,Lichtman A.H., &ShivPillai, S.(2015). <i>Basic Immunology, Functions and Disorders of the Immune System</i> (5 th ed).Elsevier						
Delves,P. J., Martin,S. J., Burton, D. R., &Roitt, I. M. (2017). <i>Roitt’s Essential Immunology</i> (13 th ed). John Wiley & Sons, Ltd.						
Outcomes	<ul style="list-style-type: none"> ➤ The students are able to know the risk factors for the communicable and non-communicable diseases. ➤ The students can take preventive measures to avoid severe diseases. ➤ Understand the role of vaccines in the global health maintenance. 					