

Syllabus

B.Sc Microbiology (FAHS)

(CBCS Semester System)

2019

PROPOSED SCHEME FOR CHOICE BASED CREDIT

SYSTEM IN B. Sc. MICROBIOLOGY

	CORE COURSES (12)	ABILITY ENHANCEMENT ELECTIVE COURSE (AEEC) (2)	ABILITY SKILL ENHANCEMENT COURSES (ASEC)(4)	ELECTIVE DISCIPLINE SPECIFIC (DSE) (6)	ELECTIVE GENERIC Interdisciplinary/ Open Elective (GE)
Semester-I					
1	C-MB-01 Introduction to Microbial World (Theory+Practical)				
2	C-MB-02 Mycology and Phycology (Theory+Practical)				
3	C-MB-03 Chemistry (Theory+Practical)				
4		AEEC- MB-01 Communication skill and personality development (Theory)			
Semester-II					
1	C-MB-04 Bacteriology (Theory+Practical)				
2	C-MB-05 Virology (Theory+Practical)				
3	C-MB-06 Cell biology (Theory)				
4		AEEC-MB-02 Environmental Science(Theory)			
Semester-III					
1	C-MB-07 Microbial ecology (Theory+Practical)				
2	C-MB-08 Molecular biology - I (Theory+Practical)				

3	C-MB-09 Microbial physiology and metabolism - I (Theory)				
4			ASEC-MB-01 Fundamentals of Computer Science (Theory)		
Semester-IV					
1	C-MB-10 Plant pathology (Theory+Practical)				
2	C-MB-11 Molecular biology II (Theory+Practical)				
3	C-MB-12 Microbial physiology and metabolism – II (Theory+Tutorial)				
			ASEC-MB-02 Genetics and genomics – I (Theory)		
Semester-V					
			ASEC-MB-03 Genetics and genomics – II (Theory)		
				DSE-MB-1 Immunology (Theory+Practical)	
				DSE-MB-02 Food and dairy microbiology (Theory+Practical)	
				DSE-MB-03 Biotechnology (Theory+ Practical)	
Semester-VI					
			ASEC-MB-04 Research methodology &		

			Biostatistics (Theory)		
				DSE-MB-04 Medical microbiology (Theory+Practical)	
				DSE-MB- 05 Industrial microbiology (Theory+Practical)	
				DSE-MB-06 Recombinant DNA Technology (Theory+ Practical)	

Scheme of examination

Semester I								
Paper	Subject	Paper Code	Theory Examination		Practical Examination		Total Marks	Credits
			Univ. Exam.	Int. Assessment	Univ. Exam.	Int. Assessment		
1	Introduction to microbial world		60	40	30	20	150	4 + 2
2	Mycology and Phycology		60	40	30	20	150	4 + 2
4	Chemistry		60	40	30	20	150	4 + 2
5	Communication skill and personality development		60	40	-	-	100	4
	TOTAL		240	160	90	60	550	22
Semester II								
1	Bacteriology		60	40	30	20	150	4+ 2
2	Virology		60	40	30	20	150	4+ 2
3	Cell biology		60	40	-	-	150	6
4	Environmental Science		60	40	-	-	100	4
	TOTAL		240	160	60	40	550	22
Semester III								
1	Microbial ecology		60	40	30	20	150	4+ 2
2	Molecular Biology - I		60	40	30	20	150	4+ 2
4	Microbial physiology and metabolism - I		90	60	-	-	150	6
5	Fundamentals of Computer Science		60	40	-	-	100	4
	TOTAL		270	180	60	40	550	22
Semester IV								
1	Plant pathology		60	40	30	20	150	4 + 2
2	Molecular Biology - II		60	40	30	20	150	4 + 2
3	Genetics and genomics - I		60	40	-	-	100	4

4	Microbial physiology and metabolism- II		90	60	-	-	150	6
	TOTAL		270	180	60	40	550	22
Semester V								
1	Immunology		60	40	30	20	150	4 + 2
2	Food and Dairy Microbiology		60	40	30	20	150	4 + 2
3	Biotechnology		60	40	30	20	150	4 + 2
4	Genetics and genomics - II		60	40	-	-	100	4
	TOTAL		240	160	90	60	550	22
Semester VI								
1	Medical Microbiology		60	40	30	20	150	4 + 2
2	Industrial Microbiology		60	40	30	20	150	4 + 2
3	Recombinant DNA Technology		60	40	30	20	150	4 + 2
4	Research methodology and biostatistics		60	40	-	-	100	4
	TOTAL		240	160	90	60	550	22

Marks Scheme (CBCS)

Semester-I					
S. No.	Course Code	Course Title	Hrs/week	Total Marks	Credit
1.	C-MB-01	Introduction to microbial world (theory)	4	100	4
		Practical	4	50	2
2.	C-MB-02	Mycology and phycology (Theory)	4	100	4
		Practical	4	50	2
3.	C-MB-03	Chemistry (Theory)	4	100	4
		Practical	4	50	2
4.	AEEC- MB-01	English (Theory)	4	100	4
Total			28	550	22

Semester-II					
S. No.	Course Code	Course Title	Hrs/week	Total Marks	Credit
1.	C-MB-04	Bacteriology (Theory)	4	100	4
		Practical	4	50	2
2.	C-MB-05	Virology (Theory)	4	100	4
		Practical	4	50	2
3.	C-MB-06	Cell biology (Theory)	6	150	6
4	AEEC-MB-02	Environmental Science (Theory)	4	100	4
Total			26	550	22

Semester-III					
S. No.	Course Code	Course Title	Hrs/week	Total Marks	Credit
1.	C-MB-06	Microbial ecology (Theory)	4	100	4
		Practical	4	50	2

2.	C-MB-07	Molecular biology –I (Theory)	4	100	4
		Practical	4	50	2
3	C-MB-08	Microbial physiology and metabolism-I (Theory)	6	150	6
4.	ASEC-MB-01	Fundamentals of Computer Science(Theory)	4	100	4
Total			26	550	22

Semester IV					
S. No.	Course Code	Course Title	Hrs/week	Total Marks	Credit
1.	C-MB-10	Plant pathology (Theory)	4	100	4
		Practical	4	50	2
2.	C-MB-11	Molecular biology-II (Theory)	4	100	4
		Practical	4	50	2
4.	C-MB-12	Microbial physiology and metabolism-II (Theory)	6	150	6
5.	ASEC-MB-02	Genetics and genomics- I (Theory)	4	100	4
Total			26	550	22

Semester-V					
S. No.	Course Code	Course Title	Hrs/week	Total Marks	Credit
1.	DSE-MB-1	Immunology (theory)	4	100	4
		Practical	4	50	2
2.	DSE-MB-02	Food and dairy microbiology	4	100	4
		Practical	4	50	2
3.	DSE-MB-03	Biotechnology	4	100	4
		Practical	4	50	2

4.	ASEC-MB-03	Genetics and genomics-II (Theory)	4	100	4
Total			28	550	22

Semester-VI					
S. No.	Course Code	Course Title	Hrs/week	Total Marks	Credit
1.	DSE-MB-04	Medical microbiology (Theory)	4	100	4
		Practical	4	50	2
2.	DSE-MB-05	Industrial microbiology (Theory)	4	100	4
		Practical	4	50	2
4.	DSE-MB-06	Recombinant DNA technology	4	100	4
		Practical	4	50	2
5.	ASEC-MB-04	Research & Biostatistics (Theory)	4	100	4
Total			28	550	22

B.Sc MICROBIOLOGY

SEMESTER 1

INTRODUCTION TO MICROBIAL WORLD

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a).Development of microbiology as a discipline, Spontaneous generation vs. biogenesis, development of various microbiological techniques, concept of fermentation	Must to know	(a). 3 hours
	(b).Establishment of fields of medical microbiology, immunology and environmental microbiology with special reference to the work of following scientists : Anton von Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Martinus W. Beijerinck, Sergei N. Winogradsky, Alexander Fleming, Selman A. Waksman, Elie Metchnikoff, Norman Pace, Carl Woese and Ananda M. Chakraborty.	Desirable to know	(b). 5 hours
	(c). Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility.	Must to know	12 hours
	(d). Differences between prokaryotic and eukaryotic microorganisms. Morphology of acellular microorganisms (Viruses, Viroids, Prions) and cellular microorganisms (Bacteria, Algae, Fungi and Protozoa).	Must to know	

<p>2</p>	<p>(a). Brief introduction to eubacteria, archaeobacteria (extremophiles).</p>	<p>Must to know</p>	<p>(a). 8 hours</p>
	<p>(b). General characteristics and structure of the following: TMV, T4 and λ phage, lytic and lysogenic cycles.</p>	<p>Must to know</p>	
	<p>(c).History of phycology. General characteristics of algae including occurrence, thallus organization, pigments, flagella, and vegetative, asexual and sexual reproduction.</p>	<p>Must to know</p>	
	<p>(d). Historical developments in the field of mycology General characteristics of fungi including habitat, distribution, nutritional requirements, fungal cell ultra-structure, thallus organization and aggregation, fungal wall structure and synthesis, asexual reproduction, sexual reproduction, heterokaryosis, heterothallism and parasexual mechanism.</p>	<p>Must to know</p>	<p>(c). 12 hours</p>
	<p>(e). General characteristics of protozoa - <i>Amoeba</i>, <i>Paramecium</i> and <i>Giardia</i></p>	<p>Must to know</p>	<p>(d). 8 hours</p>

SEMESTER 1

MYCOLOGY AND PHYCOLOGY

TIME: 50 HOURS

S.no	Topic	Domain	hours
1	(a). General classification and economic importance of fungi with examples in agriculture, environment, industry, medicine, food, bioremediation (of wood, paper, textile, leather), mycotoxins	Must to know	7 hours
	(b). Life cycle, structure and occurrence – Cellular slime molds , True slime mold	Must to know	
	(c). Oomycetes, Chytridiomycetes , Zygomycetes	Must to know	7 hours
	(d). Ascomycetes, Basidiomycetes , Deuteromycetes	Must to know	10 hours
2	(a). General classification and economic importance of algae with examples in agriculture, environment, industry and food (b). Life cycle, thallus organisation and occurrence -Chlorophyceae ,Charophyceae (c). Diatoms , Xanthophyceae	Must to know	

	(d). Phaeophyceae Rhodophyceae: Cyanobacteria		
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SEMESTER 1

CHEMISTRY

Time: 45 hours

S.no	Topic	Domain	hours
1. Atomic Structure and chemical bonding	Recapitulation of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de-Broglie's relation, Heisenberg Uncertainty principle. Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.	Must to know	4 hrs
		Desirable to know	
		Desirable to know	
		Must to know	4 hrs
2. Ionic Bonding	General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.	Must to know	3hrs
3. Covalent bonding	VB Approach Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of, linear, trigonal planar, square planar,	Must to know	
4. Periodic Properties.			

	<p>tetrahedral, trigonal bipyramidal and octahedral arrangements. Hydrogen bonding and its effect of physical and chemical properties.</p> <p>Introduction & properties of s, p, d, block elements in periodic table..</p>	Desirable to know	3hrs
<p>Unit:2 Physical Chemistry</p> <p>1.Acids-Bases and ionic equilibria</p> <p>2. Chemicals Kinetics:</p>	<p>Modern concepts of acids and bases: Arrhenius theory, Bronsted and Lowry's concept, Lewis concept with typical examples, applications and limitations.</p> <p>Strengths of acids and bases (elementary idea). Ionization of weak acids and bases in aqueous solution, ionization constants, ionic product of water, Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization. pH scale, common ion effect, Buffer solutions. Solubility and solubility product of sparingly soluble salts - applications of solubility product principle.</p> <p>Rate, order and molecularity of a reaction, rate constants of first and second order reactions, half -life period, influence of temperature on reaction rate, activation energy, determination of order of a reaction.</p>	<p>Desirable to know</p> <p>Must to know</p> <p>Must to know</p>	<p>3hrs</p> <p>4 hrs</p>
<p>Unit 3 : Fundamentals of Organic Chemistry</p>	<p>(a). Concept of hybridization of carbon. Cleavage of a covalent bond: homolysis and heterolysis. Electronic effects and their applications (inductive, electromeric,</p>	Must to know	3 hours

<p>Basic organic chemistry</p>	<p>hyperconjugation and resonance). Structure and stability of reactive intermediates (carbocations, carbanions and free radicals).</p> <p>(b). Relative strength of carboxylic acids (aliphatic, aromatic and halo-substituted aliphatic), alcohols, phenols and nitro-phenols. Relative basic strength of amines (aliphatic and aromatic)</p>	<p>Must to know</p>	<p>3 hours</p>
<p>Stereochemistry</p>	<p>(c). Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds)</p> <p>(d). Threo and erythro; D and L; <i>cis-trans</i> nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).</p>	<p>Must to know</p>	<p>3 hours</p> <p>3 hours</p>

		Must to know	
Unit 4: Chemistry of Biomolecules Carbohydrates	<p>(a). Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.</p>	Must to know	6 hours
Amino Acids, Peptides and Proteins	<p>(b). Classification, and General Properties of amino acids, <i>Preparation of Amino Acids</i>: Strecker synthesis, using Gabriel's phthalimide 20 synthesis. Zwitter ion, Isoelectric point and Electrophoresis. ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C-terminal (thiohydantoin and with carboxypeptidase enzyme).</p>	Must to know	6 hours

SEMESTER 1

COMMUNICATION SKILL AND PERSONALITY DEVELOPMENT

Sl. No	TOPICS TO BE COVERED	Domain	Teaching Hours
Unit-I	Listening Comprehension <ul style="list-style-type: none"> • Speeches • Interviews • audio-video clippings followed by exercises • Introduction to Communication • Importance of Communication • Barriers to Communication and ways to overcome them 	Desirable to know Must Know Nice to know	10 hours
Unit-II	Conversation Skills <ul style="list-style-type: none"> • Greetings and Introducing oneself • Framing questions and answers • Role play • Buying: asking details etc • Word formation strategies • Vocabulary building: Antonyms, Synonyms, Affixation, Suffixation, One word substitution 	Must Know Desirable to know	8 Hours
Unit-III	Reading Comprehension <ul style="list-style-type: none"> • Simple narration and Stories • Newspaper and articles clippings • Sentence types • Note Making • Paragraph Writing • Comprehension • Report Writing: types, characteristics 	Must Know	12 Hours
Unit-IV	Pronunciation <ul style="list-style-type: none"> • Pronunciation • Syllable and Stress • Intonation and Modulation 	Must Know	10 Hours

Unit-V	<p>Writing Comprehension</p> <ul style="list-style-type: none"> • Letters: types, format, style • Précis Writing • Paragraph: Order, Topic sentence, consistency, coherence • Report and Proposal • Project Writing: Features, Structure 	Must Know	20 Hours
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2nd SEMESTER

BACTERIOLOGY

Time: 50 hours

S.no (Theory 2)	Topic	Domain	Hours
1	<p>(a). Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae and pili. Composition and detailed structure of gram positive and gram-negative cell walls, Archaeobacterial cell wall, Gram and acid fast staining mechanisms, lipopolysaccharide (LPS), sphaeroplasts, protoplasts, and L-forms.</p>	Must to know	3
	<p>(b). Effect of antibiotics and enzymes on the cell wall. Ribosomes, mesosomes, inclusion bodies, nucleoid, chromosome and plasmids and endospore: structure, formation, stages of sporulation.</p>	Must to know	7
	<p>(c). Nutritional requirements in bacteria and nutritional categories; Culture media: components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media</p>	Must to know	7
	<p>(d). Sterilization and Disinfection: Physical methods of microbial control: heat, low temperature, high pressure, filtration, desiccation, osmotic pressure, radiation Chemical methods of microbial control: disinfectants, types and mode of action</p>	Must to know	5
	<p>(e). Asexual methods of reproduction,</p>		5

	logarithmic representation of bacterial populations, phases of growth, calculation of generation time and specific growth rate	Desirable to know	
2	(a). Archaea: General characteristics, phylogenetic overview. Methanogens- <i>Methanobacterium</i> . Thermophiles- <i>Thermococcus</i> , <i>Pyrococcus</i> . Halophiles- <i>Halobacterium</i> , <i>Halococcus</i>	Desirable to know	4
	(b). Eubacteria: Morphology, pathogenesis and economic importance of following groups -	Must to know	4
	Gram negative: Chlamydiae, Spirochetes, Rickettsia, Rhizobium, Agrobacterium, Neisseria, Enterobacteriaceae family, Pseudomonas, Vibrio, Salmonella, Haemophilus, Helicobacter, Campylobacter	Desirable to know	4
	(c). Eubacteria Gram positive: Staphylococcus, Streptococcus, Mycoplasma, Clostridium, Lactobacillus, Bacillus, Corynebacterium, Mycobacterium, Listeria, Actinomyces,	Must to know	6
	(d). Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures; An overview of scope of Microbiology	Must to know	5

SEMESTER 2

VIROLOGY

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a). History of viruses, definition of viruses, general properties of viruses, viroids, virusoids, satellite viruses and prions. Classification and nomenclature of viruses	Must to know	7
	(b). Capsid symmetry, enveloped and non-enveloped viruses. TMV, T4 phage, Hepatitis B virus, Picornavirus, rhabdovirus, Hepatitis B, retrovirus, influenza virus.	Must to know	8
	(c). Isolation, cultivation of viruses	Desirable to know	7
	(d). Applications of virology	Desirable to know	2
2	(a). Definition, structure and cycle of T4 and lambda phage,	Must to know	8
	(b). Viral multiplication Types of oncogenic DNA and RNA viruses. Concepts of oncogenes, proto oncogenes, tumor suppressor genes.	Must to know	9
	(c). Transmission, prevention and control of viral diseases: Persistent and non-persistent mode. Antiviral compounds, interferons and viral vaccines.	Must to know	9

SEMESTER 2

CELL BIOLOGY

Time: 50 hours

S.no	Topic	Domain	hours
1	(a). Prokaryotic and eukaryotic cells, cell size and shape, molecules of cell, cell membranes and cell proteins.	Must to know	3
	(b). Nuclear Envelope- structure of nuclear pore complex, nuclear lamina, transport across nuclear envelope,	Must to know	4
	(c).Chromatin: molecular organization, nucleolus and rRNA processing	Must to know	3
	(d).The endoplasmic reticulum, golgi apparatus, lysosomes, mitochondria, chloroplast, peroxisomes	Must to know	5
2	(a). Structure and organization of actin filaments; actin, myosin and cell movement; intermediate filaments; microtubules	Desirable to know	5
	(b). Mechanism of vesicular transport.	Must to know	1
	(c). The plasma membrane structure; Transport of small molecules, Endocytosis	Must to know	3
	(d). Bacterial and Eukaryotic Cell Wall; the extracellular matrix and cell matrix interactions; cell-cell interactions	Must to know	6
3	(a). Tools and Techniques of cell biology: Microscopic-Principles of Light microscopy; Phase contrast microscopy;	Must to know	3

	<p>Confocal microscopy; Electron microscopy (EM)- scanning EM and scanning transmission EM (STEM); Fluorescence microscopy.</p> <p>(b). Analytical- Flow cytometry- fluorochromes, fluorescent probe and working principle; Spectrophotometry; Mass spectrometry; X-ray diffraction analysis</p> <p>(c). Separation-Sub-cellular fractionation- differential and density gradient centrifugation; Chromatography- paper, thin-layer, gel-filtration, ion-exchange, affinity and High-Performance Liquid Chromatography (HPLC).</p>	<p>Must to know</p> <p>Desirable to know</p>	<p>3</p> <p>3</p>
4	<p>(a). Signaling molecules and their receptor; functions of cell surface receptors; Intracellular signal transduction pathway; signaling networks.</p> <p>(b). Eukaryotic Cell Cycle, Regulation of Cell cycle progression, Events of Mitotic Phase, Meiosis and Fertilization.</p> <p>(c). Programmed Cell Death, Stem Cells and Maintenance of adult tissues, Embryonic Stem Cells and Therapeutic cloning</p> <p>(d). Cancer and mutation: Development and Causes of Cancer, Tumor Viruses, Oncogenes, Tumor Suppressor genes, Cancer Treatment- molecular approach. Mutation, types of mutation.</p>	<p>Must to know</p> <p>Must to know</p> <p>Must to know</p> <p>Must to know</p>	<p>5</p> <p>3</p> <p>1</p> <p>2</p>

SEMESTER 2

ENVIRONMENTAL SCIENCES

S.No.	Topic	Teaching Hours	Domain
1.	The Multidisciplinary nature of environmental studies	2hr.	Must know
2.	<ul style="list-style-type: none">• Definition, scope and importance.• Need for public awareness	2hr.	Must Know
3.	Natural Resources Renewable and non-renewable resources: Natural resources and associated problems	2 hr.	Must Know
4.	Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.	2 hr.	Must Know
5.	Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.	2 hr.	Must Know
6.	Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.	2 hr.	Nice to Know
7.	Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.	2hr.	Must Know
8.	Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.	2 hr.	Must Know
9.	Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.	2 hr.	Good to Know
10.	Unit 2: Ecosystems Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers.	2 hr.	Must Know
11.	Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids.	2 hr.	Good to Know

12.	Biodiversity and its conservation Hot-spots of biodiversity. Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity	4 hr.	Must Know
13.	Unit 3: Environmental Pollution Definition, causes, effects and control measures of-	2hr.	Must Know
14.	a. Air pollution	2hr.	Must Know
15.	b. Water pollution	2hr.	Must Know
16.	c. Soil pollution	2hr.	Good to Know
17.	d. Marine pollution	1hr.	Good to Know
18.	e. Noise pollution	1hr.	Must Know
19.	f. Thermal pollution	1hr.	Nice to Know
20.	g. Nuclear hazards	1hr.	Nice to Know
21.	Solid waste Management: Causes, effects and control measures of urban and industrial wastes.	3hr.	Must Know
22.	Fireworks, their impacts and hazards	2hr.	Must Know
23.	Pollution case studies.	2hr.	Good to Know
24.	Disaster management: floods, earthquake, cyclone and landslides.	3hr.	Good to Know
25.	Unit 4 : Social Issues and the Environment From Unsustainable to Sustainable development	1 hr.	Must Know
26.	Urban problems related to energy Water conservation, rain water harvesting, watershed management	1hr.	Must Know
27.	Resettlement and rehabilitation of people; its problems and concerns. Case studies.	1hr.	Nice to Know
28.	Environmental ethics: Issues and possible solutions. Consumerism and waste products. Environmental Legislation (Acts and Laws)	2hr.	Good to Know
29.	Issues involved in enforcement of environmental legislation Human Population and the Environment	2hr.	Nice to Know
30.	Population growth, variation among nations with case studies Population explosion – Family Welfare Programmes and Family Planning Programmes	2 hr.	Must Know

31.	Human Rights. Value Education. Women and Child Welfare.	2 hr.	Good to know
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SEMESTER 3

MICROBIAL ECOLOGY

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a). Microorganisms habitat and their role in biogeochemical cycles and succession pattern	Must to know	5
	(b). Atmosphere: Stratification of the Atmosphere, Aeromicroflora, Dispersal of Microbes <i>Animal Environment</i> : Microbes in/on human body (Microbiomics) & animal (ruminants) body. <i>Extreme Habitats</i> : Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.	Must to know	11
	(c). <i>Carbon cycle, Nitrogen cycle</i> Ammonification, nitrification, denitrification & nitrate reduction. <i>Phosphorous cycle</i> : Phosphate immobilization and phosphate solubilization. <i>Sulphur Cycle</i> Microbes involved in sulphur cycle.	Must to know	11
	(d). Succession of microbial communities in the decomposition of plant organic matter	Desirable to know	7
2	(a). Microbe–Microbe Interactions	Must to know	7
	(b). Microbe–Plant Interactions	Must to know	7
	(c). Microbe–Animal Interactions	Desirable to know	7

SEMESTER 3

MOLECULAR BIOLOGY I

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a). DNA as the carrier of genetic information, key experiments establishing-The Central Dogma, DNA Double helix, Genetic code, Direction of Protein Synthesis, Genomics. DNA Structure: Miescher to Watson and Crick- historic perspective, DNA structure, salient features of double helix	Must to know	10
	(b). Types of DNA, Types of genetic material, denaturation and renaturation, cot curves. DNA topology - linking number, topoisomerases; Organization of DNA Prokaryotes, Viruses, Eukaryotes.	Must to know	10
	(c). RNA Structure, Organelle DNA - mitochondria and chloroplast DNA. Genome Sequence and Chromosome Diversity, Chromosome Duplication and Segregation, The Nucleosome	Desirable to know	10
	(d). Chromatin structure- Euchromatin, Heterochromatin-	Desirable to know	3
2	(a). Chemistry of DNA synthesis, general principles - bidirectional replication, Semiconservative, Semi discontinuous, RNA priming	Must to know	10
	(b). Various models of DNA replication including rolling	Desirable to know	4

	<p>circle, D-loop (mitochondrial), Θ (theta) mode of replication, replication of linear ds-DNA, replicating the 5' end of linear chromosome.</p> <p>(c). Enzyme involved in DNA replication – DNA polymerases, DNA ligase, Primase, Telomerase and other accessory proteins. Replication Errors, DNA Damage and their repair.</p>	Nice to know	3
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SEMESTER 3 MICROBIAL PHYSIOLOGY AND METABOLISM I

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a). Definition of growth, balanced and unbalanced growth, growth curve, the mathematics of growth-generation time, specific growth rate, batch and continuous culture, synchronous growth, diauxic growth curve	Must to know	5
	(b) Measurement of cell numbers, cell mass and metabolic activity. Temperature -temperature ranges for microbial growth, classification based on temperature ranges and adaptations	Must to know	5
	(c). pH-classification based on pH ranges and adaptations, solutes and water activity, oxygen concentration, radiation and pressure	Desirable to know	5
2	(a). Diffusion - Passive and facilitated, Primary active and secondary active transport, Group translocation (phosphotransferase system), symport,	Must to know	7

	<p>antiport and uniport, electrogenic and electro neutral transport, transport of Iron</p> <p>(b). Chemolithotrophic metabolism- Physiological groups of aerobic and anaerobic chemolithotrophs. Hydrogen oxidizing bacteria and methanogens.</p> <p>(c). Phototrophic metabolism - Historical account of photosynthesis, diversity of phototrophic bacteria, anoxygenic and oxygenic photosynthesis, photosynthetic pigments: action and absorption spectrum, type, structure and location,</p> <p>(d). physiology of bacterial photosynthesis: light reactions, cyclic and non-cyclic photophosphorylation. Carbondioxide fixation: Calvin cycle and reductive TCA cycle.</p>	<p>Desirable to know</p> <p>Nice to know</p> <p>Desirable to know</p>	<p>8</p> <p>10</p> <p>10</p>
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SEMESTER 3

SUBJECT: FUNDAMENTALS OF COMPUTER SCIENCE

S.no	Topic	Domain	Hours
1	Introduction about computers What are Computers? Its various characteristics, applications and limitations. Functional Block Diagram of computer. Computer Architecture: Classification of computer on basis of Purpose, signal and size and portability.	Must know	8
	Evolution of computer from 1 st generation to fourth generation. Some description about fifth generation.	Desirable to know	4
	Data representation in memory.	Nice to know	1
2	Hardware: To study the various input devices used: Keyboard, mouse, OMR, OCR, MICR, BCR, Scanner etc. To study the internal structure of CPU: Registers, ALU, Motherboard, HD, Memory, Cache, and Virtual Memory. TO study the various Secondary storage devices: Magnetic Disk, Optical Disk, Flash memory To cover what are Monitor, Its types, Printer: Dot matrix, Daisy wheel. Line printer, Laser printer, Thermal Printer, Ink Jet printers etc.	Must know	8
3	To cover the types of Software, Languages and their types (High level and low level language.) To cover the definition of operating system, its types and what are the various functions and types of operating system. Basic introduction about Interfaces: its types character user and graphical user interface (DOS and Windows)	Must know	8

	Basic introduction about linux, Unix operating system	Desirable to know	4
	To study the various HTML tags (Bold tags, Italic, Underline, Marquee, Img, anchor etc.)	Nice to know	1
4	<p>Network: Data Communication, Structure of Universal Resource Locator, Domains (.com, .in, .country specific, .org and rationale behind them), HTTP Practicals: TO cover the various MS Excel Formulas and preparation of spreadsheets. Basics of E-mail, Web browsers (IE, Google Chrome, Mozilla),</p> <p>LAN, LAN topologies, WAN, MAN, Internet: Introduction, Internet, extranet and Intranet</p>	Must know	8
	Network devices (Hub, Switches, Modems, Routers etc), DNS, Network Security and Search Engine	Desirable to know	4
	IP address, Structure of IP Address Backbone network, Network connecting devices,	Nice to know	1

SEMESTER 4

GENETICS AND GENOMICS I

S.no	Topic	Domain	Hours
1	(a). Mendel's work on transmission of traits, genetic variation, molecular basis of genetic information. Interrelation between the cell structure and the genetics function. Mitosis, Meiosis (explaining Mendel's ratios).	Must to know	10
	(b). Principles of Inheritance, Chromosome theory of inheritance, Pedigree analysis, Incomplete dominance and codominance. Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex linked inheritance	Must to know	5
	(c). Linkage and crossing over, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping.	Must to know	10
2	(a). Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy. Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations,	Must to know	10
	(b). Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations: CLB method, Attached X method	Desirable to know	7
	(c). DNA repair mechanisms. Chromosomal mechanisms, Environmental factors effecting sex determination, Barr bodies, Dosage compensation	Must to know	8

SEMESTER 4 PLANT PATHOLOGY

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a). Microbial Pathogenicity Virulence factors of pathogens: enzymes, toxins (host specific and non specific) growth regulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development. Effects of pathogens on host physiological processes (photosynthesis, respiration, cell membrane permeability, translocation of water and nutrients, plant growth and reproduction).	Must to know	10
	(b).Genetics of Plant Diseases resistance (R) gene and avirulence (avr) gene; gene for gene hypothesis, types of plant resistance: true resistance– horizontal & vertical, apparent resistance.	Must to know	10
2	(a). Concept of plant disease- microbial plant diseases -, types of plant pathogens, pathogenicity, symptoms, economic losses. Principles & practices involved in the management of plant diseases by different methods., diseases.	Must to know	10
	(b). Important diseases caused by fungi	Desirable to know	5
	(c). Important diseases caused by phytopathogenic bacteria and phytoplasmas	Must to know	10

	(d). Important diseases caused by viruses & viroids	Must to know	10
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SEMESTER 4 MOLECULAR BIOLOGY II

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a). Mechanism of Transcription (Prokaryotes and Eukaryotes) - RNA Polymerase and the transcription unit,	Must to know	5
	(b). Translation (Prokaryotes and Eukaryotes) Assembly line of polypeptide synthesis - ribosome structure and assembly, various steps in protein synthesis. Charging of tRNA, aminoacyl tRNA synthetases.	Must to know	10
	(c).Proteins involved in initiation, elongation and termination of polypeptides. Inhibitors of protein synthesis	Must to know	10
4	(a). Transcription Regulation in Prokaryotes: Principles of transcriptional regulation, regulation at initiation with examples from <i>lac</i> and <i>trp</i> operons.	Must to know	10
	(b).Eukaryotes: Conserved mechanism of regulation, Eukaryotic activators, Signal integration, combinatorial control, transcriptional repressors, signal	Must to know	10

	transduction and control of transcriptional regulator, Gene Silencing (c). Regulation of translation: translation-dependent regulation of mRNA and Protein Stability. Regulatory RNAs: Riboswitches, RNA interference, miRNA, siRNA, Regulatory RNA and X inactivation	Must to know	5
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SEMESTER 4

MICROBIAL PHYSIOLOGY AND METABOLISM II

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a). Enzymes: Importance, structure and classification of enzymes. Apoenzyme and cofactors. Prosthetic group, coenzyme and metal cofactors. Active site and its salient features. Mechanism of enzyme action	Must to know	10
	(b). Activation energy, Lock and key hypothesis, induced fit. Enzyme kinetics and inhibition. Substrate saturation curve, Michaelis-Menten kinetics, Lineweaver-Burke plot.	Must to know	5
	(c). Effect of pH and temperature on enzyme activity. Enzyme unit, specific activity, turnover number. Irreversible and reversible inhibition: competitive and non-competitive inhibition.	Desirable to know	5
	(d). Enzyme regulation. Synthesis: introduction of enzyme induction and repression. Activity: allostery,	Nice to know	5

	covalent modification and feedback inhibition. Multienzyme: pyruvate dehydrogenase complex, isozymes: lactate dehydrogenase		
4	(a). Concept of aerobic respiration, anaerobic respiration and fermentation. Central metabolic pathways: EMP pathway, ED pathway, PP pathway, and TCA cycle	Must to know	5
	(b). Anaplerotic reactions, gluconeogenesis, glyoxylate cycle. Mitochondrial and bacterial electron transport. Oxidation-reduction potential and energetic of electron transport. Components of respiratory chain, and their inhibitors.	Desirable to know	5
	(c). Anaerobic respiration, denitrification, nitrate/nitrite respiration. Oxidative phosphorylation: ATP synthesis and ATP synthase. Uncouplers, inhibitors and ionophores. Chemical coupling, conformational coupling and chemiosmotic hypotheses	Desirable to know	5
	(d). Fermentations: alcohol fermentation, Pasteur effect, lactate and butyrate fermentation, Fermentation balances, branched versus linear fermentation pathways.	Must to know	5
	(e). Nitrogen Fixation - Physiology of nitrogen cycle. Assimilatory and dissimilatory nitrate reduction, biological nitrogen fixation. Nitrogen fixers and mechanism of nitrogen fixation, properties of nitrogenase, and ammonia	Must to know	5

SEMESTER 5

GENETICS AND GENOMICS II

Time: 50 hours

S.no	Topic	Domain	Hours
1	(a). Conjugation; Transformation; Transduction, Recombination.	Must to know	10 hours
	(b). Prokaryotic transposable elements- IS elements, Composite transposons, Uses of transposons	Must to know	10 hours
	(c). Human genome project; Evolution and Comparative Genomics. Introduction to Bioinformatics, Gene and protein databases; Sequence similarity and alignment	Desirable to know	10 hours
4	(a). Genetic analysis using mutations, forward genetics, genomics, reverse genetics, RNAi, functional genomics and system biology	Must to know	10 hours
	(b). Allele frequencies, Genotype frequencies, Hardy-Weinberg Law, role of natural selection, mutation, genetic drift. Genetic variation and Speciation	Desirable to know	10 hours

SEMESTER 5 IMMUNOLOGY

Time: 50 hours

S. no	Topic	Domain	Hours
1	(a). History of immunology contributions of following scientists to the development of field of immunology - Edward Jenner, Karl Landsteiner, Robert Koch, Paul Ehrlich, Elie Metchnikoff, Peter Medawar, MacFarlane Burnet, Neils K Jerne, Rodney Porter and Susumu Tonegawa .	Must to know	5
	(b). Introduction to immune cells and organs concept of Innate and Adaptive immunity; Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT	Must to know	10
	(c).Antigens and antibodies characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Haptens; Epitopes (T & B cell epitopes); T-dependent and T-independent antigens;	Must to know	10

	Adjuvants Structure, Types, Functions and Properties of antibodies; Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic); VDJ rearrangements; Monoclonal and Chimeric antibodies.		
2	<p>(a). Major histocompatibility complex- Organization of MHC locus (Mice & Human); Structure and Functions of MHC I & II molecules; Antigen processing and presentation (Cytosolic and Endocytic pathways)</p> <p>(b). Complement system, immune response Components of the Complement system; Activation pathways (Classical, Alternative and Lectin pathways); Biological consequences of complement activation. Primary and Secondary Immune Response; Generation of Humoral Immune Response (Plasma and Memory cells); Generation of Cell Mediated Immune Response (Self MHC restriction, T cell activation, Co- stimulatory signals); Killing Mechanisms by CTL and NK cells, Introduction to tolerance</p> <p>(c). Immunologica-1 disorders types of autoimmunity and hypersensitivity with examples; Immunodeficiencies - Animal models (Nude and SCID</p>	<p>Desirable to know</p> <p>Must to know</p> <p>Desirable to know</p>	<p>5</p> <p>10</p> <p>4</p>

	<p>mice), SCID, DiGeorge syndrome, Chediak- Higashi syndrome, Leukocyte adhesion deficiency, CGD; Characteristics of tumor antigens.</p> <p>(d).Immunologica-1 techniques principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophoresis, ELISA, ELISPOT, Western blotting, Immunofluorescence, Flow cytometry, Immunoelectron microscopy, RIST, RAST, MLR</p>	Must to know	6
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SEMESTER 5

FOOD AND DAIRY MICROBIOLOGY

Time: 50 hours

S. no	Topic	Domain	Hours
1	(a). Food as a substrate Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora	Must to know	10
	(b). food preservation Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO ₂ , nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins	Must to know	10

	(c). Microbial spoilage Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods. Fermented foods	Must to know	10
2	(a). Food borne diseases Food intoxications: <i>Staphylococcus aureus</i> , <i>Clostridium botulinum</i> and mycotoxins; Food infections: <i>Bacillus cereus</i> , <i>Vibrio parahaemolyticus</i> , <i>Escherichia coli</i> , Salmonellosis, Shigellosis, <i>Yersinia enterocolitica</i> , <i>Listeria monocytogenes</i> and <i>Campylobacter jejuni</i>	Must to know	10
	(b). Food sanitation and water potability Treatment and safety of drinking (potable) water, methods to detect potability of water samples: standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms ; Membrane filter technique and; Presence/absence tests in detail	Must to know	10

SEMESTER 5 BIOTECHNOLOGY

Time: 50 hours

S. no	Topic	Domain	Hours
1	(a). Introduction to biotechnology milestones in genetic engineering and biotechnology	Must to know	5
	(b). Basic DNA cloning Simple cloning of DNA fragments, Vectors: Definition and properties. <i>E. coli</i> expression vectors-lac, tac and T7 promoter based vectors. Yeast expression vectors - pET yeast vectors,	Must to know	15

	<p>YIp, YEplac and YCp vectors. Baculovirus based vectors. Ti based vectors (Binary and Cointegrated vectors) and cloning using linkers and adaptors. Transformation of DNA by chemical method and electroporation in detail</p>		
2	<p>(a). Tools of recombinant DNA technology- Hosts <i>Agrobacterium</i>-mediated delivery <i>E. coli</i> strains; Yeast (<i>Saccharomyces cerevisiae</i>, <i>Pichia pastoris</i>); Fungi (<i>Penicillium</i>, <i>Aspergillus</i>); Mammalian cell lines - names and genotypes.</p>	Desirable to know	10
	<p>(b). Tools of recombinant DNA technology- enzymes Restriction modification systems: Types I, II and III. Mode of action, nomenclature. Application of Type II restriction enzymes in genetic engineering. DNA modifying enzymes and their applications: Terminal deoxynucleotidyl transferase, kinases and phosphatases, DNA ligases and DNA polymerases, reverse transcriptases, bacteriophage RNA polymerases, exonuclease III, BAL31, mung bean nuclease, S1 nuclease</p>	Must to know	10
	<p>Cloning Vectors- Definition and Properties. Plasmid vectors-pBR and pUC series, Bacteriophage lambda and M13 based vectors. Cosmids. Shuttle</p>	Must to know	10

	vectors. BACs, YACs, MACs. <i>Mammalian</i> <i>Expression Vectors</i> - SV40, Vaccinia, Retroviral promoter based vectors.		
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SEMESTER 6

MEDICAL MICROBIOLOGY

TIME: 50 HOURS

S. no	Topic	Domain	Hours
1	(a). Microflora of human body microflora of Skin, throat, gastrointestinal tract, urogenital tract.	Must to know	5
	(b). Host pathogen interaction invasion, pathogen, parasite, pathogenicity, toxigenicity, virulence, carriers and their types, nosocomial infections, opportunistic infections, septicemia, septic shock, transmission and spread of infection	Must to know	10
	(c). Sample processing collection, transport and culturing of clinical samples	Must to know	5
	(d). Diagnostic tools, antimicrobial agents diagnostic tests (ELISA, Immunofluorescence, Agglutination based tests, Complement fixation, PCR, DNA probes). Mechanism of action of important chemotherapeutic agents. Principles of drug resistance in bacteria.	Must to know	5
2	(a). Bacterial Diseases <i>Bacillus anthracis</i> , <i>Corynebacterium diphtheriae</i> , <i>Streptococcus pyogenes</i> , <i>Escherichia coli</i> , <i>Salmonella</i> <i>typhi and paratyphi</i> , <i>Shigella</i> <i>dysenteriae</i> , <i>Helicobacter pylori</i> , <i>Vibrio cholerae</i> , <i>Haemophilus</i>	Must to know	10

	<p><i>influenza, Neisseria gonorrhoeae, Mycobacterium tuberculosis, Treponema pallidum</i></p> <p>(b). Protozoan diseases</p> <p>Malaria, Kala-azar, and Toxoplasmosis</p> <p>(c).Viral diseases Polio, Chicken pox, Herpes, Hepatitis, Rabies, Influenza with brief description of bird and swine flu, Dengue, AIDS, Viral cancers. An overview of emerging viral diseases: Japanese Encephalitis, Ebola, Marburg, SARS, Hanta, Nipah, Chandipura, Chikungunya.</p> <p>(d).Fungal diseases different types of mycoses with particular reference to Dermatormycoses and Opportunistic mycoses</p>	<p>Desirable to know</p> <p>Must to know</p> <p>Must to know</p>	<p>5</p> <p>7</p> <p>3</p>
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SEMESTER 6

INDUSTRIAL MICROBIOLOGY

Time: 50 hours

S. no	Topic	Domain	Hours
1	(a). Introduction, fermentation and fermentors Brief history and developments in industrial microbiology. Solid-state and liquid-state (stationary and submerged) fermentations; Batch, fedbatch and continuous fermentations. Components of a typical bioreactor, types of bioreactors-Laboratory, pilot- scale and production fermenters; constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter.	Must to know	10
	(b). Overview of industrial fermentation-measurement of parameters, isolation of strains, media and ingredients - Brief history and developments in industrial microbiology. Solid-state and liquid-state (stationary and submerged) fermentations; Batch, fedbatch and continuous fermentations. Components of a typical bioreactor, types of bioreactors-Laboratory, pilot- scale and production fermenters; constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter.	Desirable to know	20
2	(a). Downstream processing Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying	Must to know	10
	(b). Microbial production of industrial products citric acid, ethanol, penicillin, glutamic acid, riboflavin, enzymes (amylase, cellulase, protease, lipase, glucose isomerase, glucose oxidase), wine, beer, bioinsecticides (Bt) and Steroid	Desirable to know	10

	transformations		
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SEMESTER 6
RECOMBINANT DNA TECHNOLOGY
TIME: 50 HOURS

S. no	Topic	Domain	Hours
1	(a). Gene delivery Microinjection, biolistic method (gene gun), liposome and viral-mediated delivery, <i>Agrobacterium</i> -mediated delivery in detail	Must to know	5
	(b). Amplification of nucleic acids Polymerase chain reaction - enzymes used, primer design. Cloning PCR products. RT-PCR and principles of real time PCR. Ligation chain reaction	Must to know	10
	(c). Analytical methods Agarose gel electrophoresis, Southern - and Northern - blotting techniques, dot blot and colony hybridizations. Chromosome walking and jumping. DNA fingerprinting by RFLP and RAPD. Gel retardation assays in detail	Must to know	10
	(d). DNA typing DNA footprinting by DNase I, DNA microarray analysis. SDS-PAGE and Western blotting. Phage display with diagrams	Must to know	5
2	(a). Construction of genomic libraries Genomic and cDNA libraries: Preparation and uses. Screening	Must to know	10

	of libraries by colony hybridization and colony PCR		
	(b). DNA sequencing Maxam-Gilbert's and Sanger's method. Automated sequencing	Must to know	5
	(c). Product of DNA technology Human genome sequencing project. Human protein replacements-insulin, hGH and Factor VIII. Human therapies - tPA, interferon, antisense molecules. Bt transgenics-rice, cotton, brinjal	Desirable to know	5

SEMESTER 6

SUBJECT: RESEARCH METHODOLOGY & BIOSTATISTICS

Chapter 1-	Introduction- Definition and characteristics of statistics Importance of the study of statistics	Must Know	2
	Branches of Statistics		2
	Statistics of and health sciences including nursing		2
	Parameters and estimates		2
	Descriptive and inferential statistics	Desirable to Know	2
	Variables and their types Measurement scales		
Chapter 2-	Tabulation of Data Raw Data, the array, frequency distribution	Must Know	2
	Basic principles of graphical representation		
	Types of diagrams – histograms, frequency polygons, smooth frequency polygon, cumulative frequency curve, normal probability curve	Desirable to Know	2
Chapter 3-	Measures of Central Tendency Introduction: Uses, applications and practical approach	Must Know	2
	Definition and calculation of mean for ungrouped and grouped data Meaning, interpretation and calculation of ungrouped and grouped data		2
	Meaning and calculation of mode		2
	Comparison of mean and mode	Nice to know	2

	Guidelines for the use of various measures of central tendency	Must Know	2
Chapter 4-	Measures of Variability Introduction: Uses, applications and practical approach	Must Know	2
	The range, average deviation or mean deviation		2
	The variance and standard variation	Desirable to know	2
	Calculation of Variance and standard variation for ungrouped and grouped data		2
	Properties and uses of variance and standard deviation	Nice to know	2
Chapter 5-	Sampling Techniques Introduction: Uses, applications and practical approach Criteria for good samples	Must Know	2
	Application of Sampling in Community		2
	Sampling Methods, Sampling and Non- Sampling errors Sampling variation and tests of significance	Nice to know	2