Rayat Shikshan Sanstha's

YASHAVANTRAO CHAVAN INSTITUTE OF SCIENCE, SATARA

(AUTONOMOUS)

Reaccredited by NAAC with 'A+' Grade

Proposed Syllabus For

Bachelor of Science

Part - III

MICROBIOLOGY

Syllabus to be implemented w .e. f. June, 2023

REVISED SYLLABUS FOR BACHELOR OF SCIENCE PART - III: MICROBIOLOGY

1 TITLE: Microbiology

2. YEAROF IMPLEMENTATION: Revised Syllabus will be implemented from June 2023 onwards.

3. PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of Microbiology to undergraduate students at first year of three years of B.Sc. degree course. Students learn Microbiology as a separate subject from B.Sc. I. The goal of the syllabus is to make the study of Microbiology popular, interesting, and encouraging to the students for higher studies including research. The new and updated syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable tothe syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. GENERAL OBJECTIVES OF THE PROGRAMME:

1) To make the students knowledgeable with respect to the subject and its practicable applicability.
2) To promote understanding of basic and advanced concepts in microbiology.
3) To expose the students to various emerging areas of Microbiology.
4) To prepare students for further studies helping in their bright career in the subject
5) To expose the students to different processes used in industries and in research field
6) To develop their ability to apply the knowledge of microbiology in day-to-day life.
7) To prepare the students to accept the challenges in life sciences.
8) To develop skills required in various industries, research labs and in the field of human health.

7. **DURATION:** The course shall be a full-time course.

8. **PATTERN:** Pattern of Examination will be Semester.

9. **MEDIUM OF INSTRUCTION:** The medium of instruction shall be in English.

8. COURSESTRUCTURE OF B. Sc. III -

1) B. Sc. III : Total Number of Courses - **10**

B. Sc. III		**SEMESTER V**				
Sr. No	**Subject Title**	**Course No**	**Theory**		**Practical**	
			No of lectures	**Credits**	**No of lectures**	**Credits**
1	**Virology (Comp) and Immunology (Comp) and Food and Industrial microbiology (Comp)**	**IX, X and XI**	**6**	**4**	**10**	**4**
2	**Agricultural microbiology-I** **Cell biology-I (prokaryotes)** **Medical Microbiology-I**	**(Any one among three)** **XII**	**6**	**4**	**10**	**4**
3	**Mathematical models to understand microbiology**	**I**	**1**	**1**	**3**	**1**
4	**AECC**	**III**	**2**	**2**	**--**	**--**
5	**Total of Semester V**	**-**	**15**	**11**	**23**	**09**

B. Sc. III		SEMESTER VI				
Sr. No	Subject Title	Course No	Theory		Practical	
			No of lectures	Credits	No of lectures	Credits
1	Genetics (Comp), Microbial biochemistry (Comp) and Environmental microbiology (Comp)	XIII, XIV and XV	6	4	10	4
2	Agricultural microbiology-II Cell biology-II (eukaryotes) Medical Microbiology-II	(Any one among three) XVI	6	4	10	4
3	Entrepreneurship Development	II	1	1	3	1
4	AECC	IV	2	2	--	--
5	Total of Semester VI	-	15	11	23	09
6	Total of Semester V and VI	-	30	22	46	18

- AECC – Ability Enhancement Compulsory Course
- Skill Enhancement Course for each subject

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- Total marks of B. Sc. Part III including Skill and AECC = 800
- Total marks of B. Sc. Part III **Semester V and VI = 40**

9. Evaluation structure Class B. Sc. III

SEMESTER- V

Course No	ESE	Internal exam		Practical			Submission		Total
		ISE I	ISE II	Practical Course	Exam	Journal	Student Performance	Seminar	
IX	40	5	5	V	40	5	5	-	300
X	40	5	5						
XI	40	5	5	VI	40	5	-	5	
XII	40	5	5						
SECC	20	--	--		30				50

Evaluation structure Class B. Sc. III

SEMESTER- VI

Course No	ESE	Internal exam		Practical			Submission		Total
		ISE I	ISE II	Practical Course	Exam/ Report	Journal	Student Performance	Seminar	
XIII	40	5	5	VII	40	5	5	-	300
XIV	40	5	5						
XV	40	5	5	VIII	40= (Lab work -20 and Literature Survey/ Industrial training/ Project	5	-	5	
XVI	40	5	5						
SECC	20	--	--		30				50

10 SCHEMES OF EXAMINATION:

- The examination shall be conducted at the end of each semester of academic year.
- Each theory paper shall carry 40 marks.
- The evaluation of the performance of the students in theory papers shall be on the basis of Semester Examination and skill-based course of 800 marks.
- Question Paper will be set in view of the / in accordance with the entire Syllabus and preferably covering each unit of syllabi.

OTHER FEATURES

A. **LIBRARY:** Reference and Text Books, Journals and Periodicals, Reference Books
for Advanced studies. - List Attached

B. **SPECIFIC EQUIPMENTS:** Necessary to run the Course - OHP, Computer, L.C.D., Projector

C. LABORATORY SAFETY EQUIPMENTS:

- Fire extinguisher
- First aid kit
- Fumigation chamber
- Stabilized power supply
- Insulated wiring for electric supply.
- Good valves, distribution pipes & regulators for gas supply.
- Operational manuals for instruments.
- Emergency exits.

Nature of Question papers (Theory)

As per Guidelines of examination cell .

SEMESTER V

COURSE IX- BMiT- 501: VIROLOGY

(TOTAL LECTURES-45)

Course objectives-

The students will be able to

1. Understand the basics of Virology regarding- ubiquitous nature of viruses, their harmful and beneficial nature, discovery, and properties of viruses.
2. Understand structural properties of viruses with some examples.
3. Study of isolation, cultivation, purification, and enumeration of viruses
4. Understand the reproduction of plant, animal, and bacterial viruses (with respect to lytic cycle and lysogeny

Credits=4	SEMESTER-V COURSE IX- BMiT- 501: VIROLOGY	No. of hours per unit/ Credits
UNIT I	**Basic concept of virology**	**(12)**
	1) a] General properties and Ubiquitous nature of viruses b] Beneficial and harmful nature of viruses. c] History and Discovery of viruses **2] Morphology and ultra structure of viruses:** a]Capsids, b]Nucleic acids c]envelope d]Glycoprotein, matrix protein, & lipid e]Virus related agent: Viroids and prions **3] Structure and Reproduction:** a]Animal Virus- HIV b]Plant Virus- TMV c] Bacteriophage: Structure and Reproduction of T4 phage One step growth experiment	

UNIT II	**Classification ,isolation, cultivation and Purification of viruses**	**(11)**
	1]Classification and Nomenclature of viruses: a] ICTV recommendation b] Baltimore classification system 2] Isolation and cultivation of viruses. a] Animal virus-Tissue culture, chick embryo and live animals. b] Plant virus – Whole plant, Protoplasts, Insect cell culture. c] Bacteriophages- Plaque method. 2] Purification of viruses based on physicochemical properties: a] Density gradient centrifugation. b] Precipitation. 3] Methods of Enumeration of viruses. a] Latex droplet method (Direct electron microscopic count). b] Plaque and pock method	
UNIT III	**Lysogeny and reproduction of virus**	**(11)**
	1] Lysogeny : a] Introduction. b] Definition of lysogeny. c] Temperate phages. d] Lysogeny by lambda phage. 2] Events of lysogeny: a] Adsorption and penetration of λ phage. b] Integration of λ genome into host genome. c] Genetic map for lysogenic interaction. d] Expression of λ genes. e] Establishment of repression. f] Maintenance of repression 3] Reproduction of animal virus-Adenovirus. 4] Reproduction of plant virus - TMV	

UNIT IV	**Oncogenesis and emerging new viruses**	**(11)**
	1] Oncogenesis a] Definition of Oncogenesis. b] Type of cancers. c] Characteristics of cancer cells. d] Hypothesis about cancer. i] Somatic mutation hypothesis. ii] Defective immunity hypothesis. iii] Viral gene hypothesis. **2] Oncogenic Viruses**: a]Role of DNA viruses in cancer : i) Popova viruses ii) Herpes b] Role of RNA tumour viruses : i] Retrovirus ii] Hepatitis c) Provirus theory d) Proto virus theory e) Oncogene theory **3] Emerging New Viruses**: a] Filoviruses b] SARS Coronavirus c] Influenza virus A	

Course outcomes:

The students should be able to

1. Understand the basics of Virology regarding- ubiquitous nature of viruses, their harmfuland beneficial nature, discovery, and properties of viruses
2. Understand the structural properties of viruses with some examples
3. Perform isolation, cultivation, purification, and enumeration of viruses
4. Understand reproduction of plant, animal, and bacterial viruses (with respect to lytic cycle and lysogeny)

Books Recommended:

1. Principles of Virology- S.Jane Flint, LynnW. Enquist,RM,Racaniello, VR, Skalka, AM published by ASM press Washington DC 4 th edition Vol. 2 (2004).
2. Virology: Principles and Applications John Carter, Venetia Saunders published by Wiley2 nd Edition (May 6,2013)
3. *Basic Virology* , Edward K. Wagner, Martinez J. Hewlett, David C. Bloom , and David Camerini 3rd edition (2008)
4. Fields – Virology, Bernard N. Fields, Peter M., MD Howley Diane E., Ph.D. Griffin, Robert A., Ph.D. Lamb, Malcolm A., MD Martin, Bernard,4th Edition (August 2001)
5. Introduction to Modern Virology. J. Dimmock, A. J. Easton, and K. N. Leppard,6th Edition (2007).
6. Microbiology - Lansing M. Prescott, Donald A. Klein, published byBrown, 2 nd Edition (1993).
7. Microbiology - Bernard D. Davis published by Lippincott Willams and Wilkins; Subsequent Edition (January1,1990).
8. General Virology- Luria published byJohnWileyand Sons(January1,1978).
9. Genetics of Bacteria and their Viruses- WilliamHayes, published byWiley, New York (1968).
10. General Microbiology Vol. II - Powar and Daginawala, published by Himalaya Publishing House (1 Jan 2010).
11. An introduction to Viruses - S.B. Biswas and Amita Biswas published by Vani EducationalBooks, 3 rd Edition. (1984).
12. Bacterialand PhageGenetics –EdwardA. Birge published bySpringer ScienceNew York, USA4 th Edition (2000).
13. General Microbiology- RogerY. Stanier published byMacmillan (1987).

SEMESTER V

COURSE X- BMiT- 502: IMMUNOLOGY

(TOTAL LECTURES-45)

Course objectives

The students will able to:

1. Understand Classification of immune system, different cells and organs of immune system.
2. Understand Properties, activation and pathways of complement system.
3. Study Molecular mechanism of antibody production.
4. Study monoclonal antibody production and applications.

Credits=4	SEMESTER-V COURSE IX- BMiT- 502: IMMUNOLOGY	No. of hours per unit/ Credits
UNIT I	**Cells and organs of the immune system and complement**	(12)
	Cells and organs of the immune system**:** Cells of the immune system i) Classification of cells of immune system-Lymphoid and myeloid cells ii) Structure and functions of lymphoid cells- T cells and T cell subsets, NK cells, B cells and dendritic cells iii) Structure and functions of myeloid cells – Granulocytes, Monocytes andmacrophages (receptors present on the surface and cytokines produced) b) Organs of the immune system i) Primary and secondary lymphoid organs - Structure and functions of Thymus, bone marrow (hematopoiesis), spleen, lymph node and Mucosa associated lymphoid tissue(MALT) 2) Complement: a) Nature and Properties of complement, Complement activation by classical and alternative and lectin pathway. b) Biological consequences of complement activation c) Principle and technique of complement fixation test	

UNIT II	**Antibody production**	**(11)**
	1] Molecular mechanism of antibody production: a) Processing and presentation of antigen by Antigen presenting cell. b) Interaction of APC with TH cell c) Interaction of B cell and TH cell d) Proliferation and differentiation of activated B cells e) Role of follicular dendritic cells in selection of high affinity B cells 2)Monoclonal antibodies: a) Concepts of Polyclonal and monoclonal antibodies b) Production of mouse monoclonal antibodies by hybridoma technology. c)Types of monoclonal antibodies- Mouse, Chimeric, Humanized and Human antibodies d)Applications of monoclonal antibodies.	
UNIT III	**Cytokines, Immunological tolerance**	**(11)**
	1 Cytokines: a)General characters of cytokines b)Cytokines produced by different TH cells and Macrophages. c)Effects of cytokines d)Interferon–properties- types, inducers of Interferon, Mechanism of action-antiviral and immunoregulatory action 2)Immunological tolerance a)Immunological tolerance b)Natural or self-tolerance and induced tolerance c)Cellular mechanism of immunological tolerance- Central tolerance and peripheral tolerance d)Induction of tolerance using immunosuppressive drugs and monoclonal antibodies and its significance	
UNIT – IV	**Hypersensitivity and Immunotechniques**	**(11)**
	1)Hypersensitivity a) Basic concept, Gell and Coombs classification b) Type I-Anaphylaxis, Mechanism of anaphylaxis, types, hypo sensitization c)Type II-Blood transfusion reactions d)Type III- Arthus reaction and Serum sickness e) Type IV- Delayed type hypersensitivity –Allergy of infection, Allograft rejection. 2)Immunotechniques – a) ELISA – Principle, Procedure types and applications b)Elispot test Principle, Procedure and applications	

	c) Radio immune assay- Principle, Procedure and applications 3)Immunofluorescence test -Principle, Procedure, types and applications	

Course outcomes

The students should be able to

1. Understand the classification of immune system, different cells and organs of immune system.
2. Understand the properties, activation, and pathways of complement system.
3. Understand the molecular mechanism of antibody production.
4. Understand the monoclonal antibody production and applications.

Books Recommended:

1) Immunology - 6th edition - Kuby ,Kindt, Goldsby & Osborne.
2) Essential Immunology - 11th edition - Delves, Martin, Burton and Roitt.
3) Immunology - An Introduction, 4th edition – Tizzard.
4) Basic and Clinical Immunology 5th edition- Stites, Stobo, H. H. Fudenberg.
5) Essentials of Immunology - S. K. Gupta
6) Immunology – M. P. Arora
7) Textbook of Basic and clinical Immunology- Sudha Gangal, Shubhangi Sontakke University Press
8) The elements of Immunology- Fahim Khan, Pearson Publication 2009
9) Immunology Second Edition- Vaman Rao.

SEMESTER V

COURSE XI-BMiT- 503: FOOD AND INDUSTRIAL MICROBIOLOGY

(TOTAL LECTURES-45)

Course objectives

The students will be able to :

1. Understand the source of microorganisms to food
2. Study the role of microorganisms in food poisoning
3. Study the methods & Culture collection centers.
4. Understand the industrial Production of Alcohol, antibiotics, organic acid and enzyme.

Credits=4	SEMESTER-V BMiT- 503: FOOD AND INDUSTRIAL MICROBIOLOGY	No. of hours per unit/ Credits
UNIT I	**Food Microbiology and Probiotics**	(12)
	1)Food Microbiology a)Introduction b)Food as a substrate for microorganisms: Intrinsic and extrinsic factors c)General Principles and methods of food preservation d)Food poisoning: i) Staphylococcal ii) Clostridium iii) Fungal (aflatoxin) e)Food infections: i)Salmonellosis. ii) Shigellosis 2)Probiotics: Concept and applications	
UNIT II	**Industrial Microbiology**	(11)
	1. Strain Improvement 2. Scale up of fermentations 3. Microbiological assays 4. Preservation of industrially important microorganisms: Methods & Culturecollection centers. .	

UNIT III	**Industrial Fermentation**	**(11)**
	1)Industrial Production of a) Alcohol: - Organisms used inoculum preparation, Fermentation media, Fermentation conditions, Extraction and Recovery. b) Grape wine: - Definition, types, production of table wine (Red and White) and microbial defects of wine c) Penicillin: - Organisms used Inoculum preparation, Fermentation media, Fermentation conditions, Extraction and Recovery. Concept of semi synthetic penicillin d)Citric acid production-organism used, substrates, production processes, product recovery. e)Amylase production-organism used, production processes, purification of amylase, application	
UNIT – IV	**Downstream processes**	**(11)**
	Downstream processes 1) Recovery Techniques and testing- a) Downstream` processing & product recovery : Centrifugation, flocculation, filtration, solvent extraction, distillation, precipitation, crystallization and chromatography. b) Testing of final product for :sterility, pyrogen, carcinogenicity, toxicity and allergens	

Course Outcomes:-

Students should be able to

1. Understand the role of microorganism in food poisoning.
2. Understand the industrial Production of antibiotic, alcohol, organic acid and enzyme.
3. Understand the downstream processing & product recovery of different industrialproducts.
4. Perform sterility testing of products, carcinogenicity and toxicity testing

Books Recommended:

1. Principles of fermentation technology- Peter F. Stanbury & Allan Whitaker(Pergamon Press).
2. Principles of Microbial technology - Peppler, Vol. I & II.
3. Industrial Microbiology - Casida
4. Industrial Microbiology - A. H. Patel
5. Industrial Microbiology - Prescott & Dnn
6. Industrial Microbiology - Miller
7. Pharmaceutical Microbiology - Huggo & Russel
8. Modern food Microbiology - Jay & Jay
9. Food Microbiology - Frazier
10. Industrial Microbiology- Cruger.
11. Fermentation Technology- A.H.Modi - Vol. I and II

SEMESTER V

COURSE XII-BMiT- 504: AGRICULTURAL MICROBIOLOGY-I

(TOTAL LECTURES-45)

Course objectives-

The students will be able to:

1. Study the physical, Chemical characteristics of soil
2. Study about types of microorganisms in soil
3. Understand about Biodegradation of hydrocarbon, pesticide and Plant pathology.
4. Understand the basic principle and application of bio-analytical techniques.

Credits=4	SEMESTER-V BMiT- 504: AGRICULTURAL MICROBIOLOGY-I	No. of hours per unit/ Credits
UNIT I	**Basics of soil Microbiology**	(12)
	1) Soil Microbiology. a) Physical characters. b) Chemical characters. c) Types of microorganisms in soil and their role in soil fertility. 2) Role of microorganisms in elemental cycle a) Carbon cycle. b) Nitrogen cycle c) Phosphorous cycle	
UNIT II	**Role of Microorganisms in reclamation of soil and composting**	(11)
	1) Role of Microorganisms in reclamation of soil 2) Manure and Compost a) Methods of Production - i) Green manure and farm yard manure ii) City compost- Windrow and pit method. iii) Vermicompost iv) Optimal conditions for composting with reference to - Composition of organicwaste, Availability of microorganisms, Aeration, C:N:P ratio, Moisture content, Temperature, pH, Time.	

UNIT III	**Biodegradation and plant pathology**	**(11)**
	1) Biodegradation of - a) Pesticides b) Hydrocarbon 2) Plant Pathology A)Common symptoms produced by plant pathogens B) Modes of transmission of plant diseases. C) Plant diseases - i) Citrus Canker ii) Tikka disease of groundnut iii)Bacterial Blight of Pomegranate	
UNIT – IV	**Instrumentation-principle, working and application of-**	**(11)**
	a) Electrophoresis b) Chromatography c) U. V. Visible spectroscopy d) Atomic absorption spectroscopy	

Course outcomes-

The students should be able to -

1. Understand physical, Chemical characteristics of soil
2. understand types of microorganisms in soil
3. understand the biodegradation of hydrocarbon, pesticide and Plant pathology.
4. Understand the basic principle and application of bio-analytical techniques.

Books Recommended:

1. Soil Microbiology - An exploratory approach - Mark Coyne.
2. Agricultural Microbiology - N. Mukherjee and J. Ghosh.
3. Introduction to Soil Microbiology - Martin Alexander IInd Edition.
4. Agricultural Microbiology - Rangaswamy and Bhagyaraj IInd Edition
5. Plant diseases - R. S. Singh.
6. Plant pathology - R. S. Mehrotra.
7. Diseases of crop plants in India - G. Rangaswamy.
8. Principles of Soil Science - M. M. Rai.
9. Soils and Soils Fertility- 6th edition-Frederick R.Troeh (Blackwell publishingCo.)
10. Soil Microbiology- Singh, Purohit, Parihar. (Agrobios India , 2010)
11. Soil Microbiology and Biochemistry – Ghulam Hassan Dar (New IndiaPublishing Agency, 2010)

12. Principles and Techniques of Biochemistry and Molecular Biology by Wilsonand Walker
13. Bioinstrumentation by L. Veera Kumari, MIP Publishers Chennai.

SEMESTER V

COURSE XII- BMiT- 505: CELL BIOLOGY-I (TOTAL LECTURES-45)

Course Objectives:

The students will be able to

1. Study the variations in Gram positive and Gram-negative bacterial cell wall
2. study the Archeal cell walls
3 Understand in detail different structures and functions of cell organelles and cytoplasmic inclusions
4 Study signaling mechanism in prokaryotes

Credits=4	SEMESTER-V BMiT- 505: CELL BIOLOGY-I	No. of hours per unit/ Credits
UNIT I	**Bacterial cell structure**	(11)
	Structures of components of Gram positive and Gram-negative bacterial cell wall withtheir variations. a) Archeal cell wall,structure, chemical composition and functions of Archeal cellmembrane b) Bacterial cell membrane-Structure, chemical composition and functions c) Bacterial Endospore - Ultrastructure, Sporulation and Germination d) Flagella – Structure, Mechanism of movement, tactic behavior	

UNIT II	**Cytoplasmic inclusions**	**(11)**
	Cytoplasmic inclusions- Chlorobium vesicles, Gas vesicles, Magnetosomes,Carboxysomes. a) Reserve food materials –i) Nitrogen ii) non nitrogenous Carbon (Glycogen ,PHB),Sulphur, Phosphorus b) Cell division and differentiation	
UNIT III	**prokaryotic intercellular signaling**	**(11)**
	a) Diffusible and cell-associated signal b) Examples of intercellular signalling by bacteria c) Quorum sensing and autoinduction d) Diversity in prokaryotic diffusible molecules e) Specific Signalling Systems i) peptide pheromones: Location of Peptide Pheromone Receptors ii) Intracellular Targets of signalling iii) Two component phosphorelay system iv) Pheromones that initiate two component signaling cascades v) Mechanism of quorum sensing i) competence in Streptococcus pneumoniae ii) bacteriocin production in Lactococcus lactis iii) sporulation	
UNIT – IV	**Instrumentation-principle, working and application of-**	**(11)**
	a) Electrophoresis b)Chromatography c) U. V. Visible spectroscopy d) Atomic absorption spectroscopy	

Course outcomes

Student should be able to

1. Understand structure and functions of different organelles and cytoplasmic inclusions of bacteria.
2. Understand in detail different structures and functions of cell organelles and cytoplasmic inclusions
3. Understand the signaling mechanism in prokaryotes
4. Understand the basic principle and application of bio-analytical techniques

Books Recommended

1. Microbiology-Michael J. Pelczar, Chan and krieg ,fifth edition, Tata McGraw-Hill
2. Prescott's Principles of Microbiology ,Willey, Sherwood, Woolverton, fifth edition, McGraw-Hill
3. Cell signaling in prokaryotes and lower metazoan edited by Ian Fairweather, Spriner-science+ Business media, B.V.
4. The microbial world, Roger Y. Stanier, Mcmillan 1987
5. Principles and Techniques of Biochemistry and Molecular Biology by Wilson and Walker
6. Bioinstrumentation by L. Veera Kumari, MIP Publishers Chennai.

SEMESTER V

COURSE XII- BMiT- 506: MEDICAL MICROBIOLOGY (TOTAL LECTURES- 45)

Course Objectives:

Students will be able to:

1. understand the cultural and biochemical characteristics, antigenic structure of mode of spread , prevention and control of selected human pathogens.
2. Understand the techniques used for diagnosis of the diseases caused by protozoa, nematodes,bacteria, fungi and viruses
3. understand the emerging diseases in India in future.
4. Understand basic principle and application of bio-analytical techniques

Credits=4	SEMESTER-V **BMiT- 506: MEDICAL MICROBIOLOGY**	No. of hours per unit/ Credits
UNIT I	**Parasitology**	**(12)**
	Habitat, life cycle, pathogenicity, laboratory diagnosis, prevention, control and treatment of the diseases caused by a)Protozoa: *Plasmodium vivax , Entamoeba histolytica , Leishmania donovani* b)Nematodes: *Ascaris lumbricoides, Wuchereria bancrofti*	
UNIT II	**Fungal diseases**	**(11)**
	Habitat, pathogenicity, laboratory diagnosis, prevention ,control and treatment of thediseases caused by a) *Aspergillus flavus* *b) Cryptococcus neoformans* *c) Candida albicans* *d) Trichophyton rubrum*	
UNIT III	**Emerging Microbial Diseases in India**	**(11)**
	Antigenic structure, modes of transmission, pathogenesis, symptoms, laboratory diagnosis,prevention, control and treatment of diseases caused by- *a) Treponema pallidum* *b) Neisseria gonorrhoeae* c) Ebola virus, d) New Corona 19 virus e) Nipah virus f) Avian influenza(H7N9)	

UNIT – IV	**Instrumentation-principle, working and application of-**	**(11)**
	a) Electrophoresis b) Chromatography c)U. V. Visible spectroscopy d)Atomic absorption spectroscopy	

Course Outcomes:

Students should be able to

1. Understand preventive measures about spread and control ofmode of spread, prevention and control of human pathogens.
2. Understand methods of diagnosis of the diseases caused by protozoa, nematodes, bacteria, fungi and viruses
3. understand the emerging diseases in India in future.
4. understand basic principle and application of bio-analytical techniques

Books Recommended:

1. Medical Parasitology : Chatergi
2. Medical Parasitology : Arora and Arora
3. Text book of Medical Lab. Technology Vol I & II : Dr. K. Mukhargi
4. Principles of Virology : S.J. Flint
5. Text book of Microbiology-Ananthnarayan R and C.E. Jayaram Panikar 5th edition, 1996, Orient Longman
6. Medical Bacteriology-Dey N.C. &Dey T.K. 17 th edition 1988, Allied Agency, Calcutta
7. Medical Laboratory Technology;Vol.I, II & III,-Mukharjee K.L. ,10th edition. Tata Mc Graw-Hill Pub Co.
8. Principles and Techniques of Biochemistry and Molecular Biology by Wilson and Walker
9. Bioinstrumentation by L. Veera Kumari, MIP Publishers Chennai.

SEMESTER V
SKILL BASED COURSE

SECCMIT-507 - MATHEMATICAL MODELS TO UNDERSTAND MICROBIOLOGY

Course objectives

Students will be able to

1. Understand the characteristics of Central Tendency
2. Study of common measures of central tendency-Mean, Mode, Median.
3. Study of measures of dispersion
4. Study of mathematical Concept of Growth and Growth rate

Credits=4	**SEMESTER-V** **SECCMIT-507 - MATHEMATICAL MODELS TO UNDERSTAND MICROBIOLOGY**	**No. of hours per unit/ Credits**
UNIT I	**Measures of Central Tendency**	**(10)**
	1) Measures of Central Tendency-Averages a) Definition b) Characteristics of Central Tendency c) Common measures of central tendency-Mean, Mode, Median. **2)**Measures of dispersion a) Definition b) Different measures of dispersion- Range, Quartile deviation, Decile range,Mean deviation, Standard deviation.	
UNIT II	**The Mathematics in microbiology**	**(10)**
	a) Measurement of Growth. b) Determination of growth rate. c) Determination of mutation rate	

Course outcomes

Students should be able to,

1. understand measures of dispersion
2. determine common measures of central tendency-Mean, Mode, Median.
3. measure mutation rate in bacteria
4. measure growth rate in bacteria

Books Recommended:

1) Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics. 3rd Ed. Ukaaz, Publications, Hyderabad - UNIT III, IV.
2) P.N. Arora, P.K.Malhan (2006) Biostatistics, Himalaya Publishing House, Mumbai
3) Robert R. Sokal and F. James Rohlf (1969) Introduction to Biostatistics, 2ndEd, Dover Publications, INC. Mineola, New York
4) S. Chand Introduction to biostatistics-A textbook of biostatistics, S. Chand and Company LTD.

Practical Course Semester V

BMiP- 508

Course objectives:

Students will be able to :

1.isolate the pathogens from clinical samples and coliphage from sewage
2**.** Perform total leukocyte count of the given blood sample.
3.Perform differential leukocyte count of the given blood sample
4.Determine hemoglobin content of given blood sample.

Credits=4	**SEMESTER-V** **BMiP- 508 Practical Course**	**No. of hours per unit/ Credits**
	1. Isolation of following pathogens from clinical samples (wherever possible) and identification ofthe same by morphological, cultural and biochemical characteristics- A. *Klebsiella pneumoniae* *B. Staphylococcus aureus* 2.Isolation of coliphages from sewage. 3.Demonstration of viruses inoculation by chick embryo technique 4.Perform total leukocyte count of the given blood sample. 5.Perform differential leukocyte count of the given blood sample. 6.Widal test – Quantitative 7.Demonstration of Rocket immunoelectrophoresis. 8.Demonstration of ELISA test 9.Haematology: a)Estimation of haemoglobin by Sahli's method b)Determination of ESR of the blood sample (Wintrobemethod) c)Determination of PCV d)Total and differential blood cells count.	

Course outcomes:

Students should be able to :

1.Isolate the pathogens from clinical samples and coliphage from sewage
2**.** Perform total leukocyte count of the given blood sample.
3.Perform differential leukocyte count of the given blood sample
4.Determine haemoglobin content of given blood sample

BMiP- 509

Course objectives:

Students will be able to :

1.carry out microbiological assay of penicillin and Vit B12.

2**.** Isolate Isolation and identification of Xanthomonas from infected citrus fruit

3. Isolate pesticide degrading bacteria from soil

4.Determine SPC of soft drink.

Credits=4	**SEMESTER-V** **BMiP- 509 Practical Course**	**No. of hours per unit/ Credits**
	1.Microbiological assay of penicillin 2.Microbiological assay of Vit B12. 3.Production of citric acid and estimation of citric acid. 4.Production of amylase and detection of amylase produced 5.SPC of soft drink. 6.Isolation and identification of Xanthomonas from infected citrus fruit. 7.Isolation of pesticide degrading bacteria from soil. 8. Isolation of following pathogens from clinical samples (wherever possible) and identification of the same by morphological, cultural and biochemical characteristics. a)*Candida albicans* b) *Aspergillus flavus*	

Course outcomes:

Students should be able to :

1.Perform production and estimation of citric acid .

2**.** Isolate Isolation and identification of Xanthomonas from infected citrus fruit

3.Isolate pesticide degrading bacteria from soil

4.Determine SPC of soft drink

SECCMiP- 510

Course objectives:

Students will be able to :

1.Determine measures of central tendency

2**.** Determine of mean deviation and standard deviation

3. Determine Growth rate of *E. Coli*

4.Determine mutation rate of *E.coli*.

Credits=4	**SEMESTER-V** **SECCMiP- 510 Practical Course**	**No. of hours per unit/ Credits**
	1) Determination of central tendency--Arithmetic mean 2) Determination of central tendency—Median 3) Determination of central tendency—Mode 4) Determination of measures of Dispersion--Mean deviation 5) Determination of measures of Dispersion --Standard deviation 6) Determination of measures of Dispersion--coefficient of variation 7) Determination of measures of Dispersion--Quartile deviation 8) Determine Growth rate of *E. Coli* at 37^{o}C 9) Determine mutation rate of *E. Coli*.	

Course outcomes:

Students should be able to :

1.Determine measures of central tendency

2**.** Determine measures of dispersion

3. Determine Growth rate of *E. Coli*

4.Determine mutation rate of *E.coli.*

Books Recommended:

1. Dixit J. V. (1996) Principles and Practicals of biostatistics , first edition .
2. T. Bhaskarrao (1995), Methods of biostatistics, Paras publications.
3. T. K. Saha, Biostatistics in theory and practicals, Emkkay Publication, New Delhi.
4. Stanier, General Microbiology
5. Rose, Chemical Microbiology

SEMESTER VI

COURSE XIII BMiT- 601: MICROBIAL GENETICS (TOTAL LECTURES-45)

Course objectives:

Students will be able to ,

1. Understand the basic concepts of bacterial and yeast chromosome
2. Understamd gene regulation regarding transcription and translation
3. Understand various techniques in molecular biology
4. Understand the concept of genetic engineering and various techniques used in that field.

Credits=4	SEMESTER-V BMiT- 601: MICROBIAL GENETICS	No. of hours per unit/ Credits
UNIT I	**Genome and its regulation**	**(12)**
	1)Basic concepts of bacterial genome - a) Structural organization of *E. coli* chromosome - Folded Fiber model. b) Structure of yeast chromosome 2) Regulation of gene expression a) Regulation of transcription elongation – Attenuation, Riboswitches b) Regulation at the level of translation – Role of antisense RNAs and riboswitch c) Tryptophan operon 3) Global regulatory system	
UNIT II	**Mutations and detection of mutants**	**(11)**
	1) Mutations A)Expression of mutations - a) Time course of phenotypic expression. b) Conditional expression of mutation. B) Suppressor mutations (with examples) - Genetic and non-genetic. C) Types of bacterial and viral mutant phenotypes 2) Methods of isolation and detection of bacterial and viral mutants based on - a) Relative survival b) Relative growth c) Visual detection	

UNIT III	**Advanced genetics**	**(11)**
	1] Genetic complementation a]Cis- trans test b]Concept of cistron , one cistron one polypeptide theory 2] Extra chromosomal inheritance : Kappa particles 3] Transposable elements- general properties and types. 4] Techniques in Molecular Biology a]DNA sequencing (Sanger's method, Maxam and Gilbert) b]Southern blot technique c] D) PCR	
UNIT – IV	**Genetic engineering**	**(12)**
	1) Introduction 2) Tools of genetic engineering – a)Enzymes- Restriction endonucleases, DNA ligase, Terminal deoxynucleotidyl transferase, Alkaline phosphatase- b)Vectors- Properties of ideal vectors , types of selectable markers Examples - phage, plasmid and cosmid, YAC and BAC c)Cloning organisms –Properties of ideal cloning organism (Bacteria and Yeasts) 3)Techniques – a)Isolation of desired DNA segment- Shotgun Method, cDNA synthesis, Chemical Synthesis using PCR b)Construction of r-DNA using appropriate vector- Use of restriction enzymes, Linkers, Adaptors, Homopolymer tails c)Transfer of r DNA into cloning organisms by physical , chemical and biological methods d)Selection of recombinant bacteria and yeasts – Blue and white screening, Colony hybridization technique. 4)Construction of genomic and cDNA library 5)Application of genetic engineering in – a)Medicine- b)Agriculture c)Industry d)Environment	

Course outcomes

Students should be able to,

1. Understand about chromosome and its gene regulation
2. Familiar with concept of mutation
3. Understand the methods of isolation and detection of mutants
4. Understand various techniques in genetic engineering.

Books Recommended:

1. Genetics - Stickberger.
2. Microbiology - Prescott
3. Genes - Benjamin Lewin IX ed.
4. Principles of gene manipulation - Primrose and Old
5. Genetic Engineering - Second Ed. Desmond S. T. Nicholl
6. Recombinant DNA - J. D. Watson
7. Biochemistry - Lehninger
8. Molecular Biology of Gene - J. D. Watson
9. Principles of Genetics - Herskowitz
10. General Microbiology – Stanier

SEMESTER VI

COURSE XIV- BMiT- 602: - MICROBIAL BIOCHEMISTRY (TOTAL LECTURES-45)

Course objectives-

Student will be able to

1. Understand the properties, lock and key and induced fit hypothesis, explaining mechanism ofenzyme action
2. Understand the concept of Allosteric enzymes, Ribozymes and Isozymes
3. Understand the Significance of Km and V max and able to derive MM equation
4. Understand the methods of extraction and purification of enzymes

Credits=4	SEMESTER-VI BMiT- 602: - MICROBIAL BIOCHEMISTRY	No. of hours per unit/ Credits
UNIT I	**Basics of enzyme**	(11)
	1] Properties, structure of active site, specificity, mechanism of action (Lock & Key, Induced fit hypothesis) 2] Allosteric enzymes- Definition, properties, models explaining mechanism of action. 3] Ribozymes and Isozymes. 4] Enzyme kinetics- Derivation of Michaelis- Menten equation, Lineweaver Burk Plot, Significance of Km and V max. 5] Regulation of enzyme synthesis. a] Positive control-Ara operon b] Negative control- Lac operon c] Catabolite repression.	

UNIT II	**Extraction, purification and Immobilization of enzymes**	**(12)**
	1) Extraction & purification of enzymes. a) Methods of extraction of intracellular and extracellular enzymes. i) Choice of source and biomass development i) Methods of homogenization - cell disruption methods ii) Purification of enzymes on the basis of - b) Molecular size c) Solubility differences d) Electrical charge e) Adsorption characteristic differences f) Differences in biological activity 2) Assay of enzymes - Based on substrate and product estimation. 3) Immobilization of enzymes - Methods & applications	
UNIT III	**Catabolic reactions in bacteria**	**(11)**
	1) Basic concepts of - a) Glyoxylate bypass, regulation of TCA cycle b) PP pathway, ED pathway, Phosphoketolase pathway c) Pyruvate as a key intermediate 2) Modes of ATP generation- a) Oxidative phosphorylation- chemo-osmotic model b) Photophosphorylation in Cyanobacteria- photosynthetic pigments and mechanism c) Substrate level phosphorylation 3) Bioluminescence – Occurrence, mechanism & applications. 4) Assimilation of - a) Carbon b) Nitrogen with respect to N2 and NH3 (GOGAT) c) Sulphur	
UNIT – IV	**Anabolic reactions in bacteria**	**(11)**
	1) Biosynthesis of - a) RNA- Transcription and Post Transcriptional modifications b) DNA- Important features of Replication, process of Replication- role of different proteins and enzymes c) Proteins- Translation and Post- Translational modifications d) Peptidoglycan e) Lipopolysaccharide	

Course outcomes-

Students should be able to

1. understand properties, lock and key and induced fit hypothesis, explaining mechanism ofenzyme action
2. understand allosteric enzymes, ribozymes and Isozymes
3. understand significance of Km and V max and able to derive MM equation
4. understand the methods of extraction and purification of enzymes

Books Recommended:

1. Enzymology - Prise & Stevens
2. Enzymes - Biochemistry, Biotechnology, clinical chemistry - Trevor Palmer.
3. Enzymes - Dixon and Webb
4. Nature of Enzymology - R. L. Foster,
5. Lehnigers Principles of Biochemistry by David Nelson & Michale Cox, Fifth edition.
6. General Microbiology - Stanier
7. Principles & techniques of Biochemistry - Wilson & Walker,6th edition.
8. Biochemistry - Lubert Stryer

SEMESTER VI

COURSE XV- BMiT- 603: - ENVIRONMENTAL MICROBIOLOGY (TOTAL LECTURES-45)

Course objectives-

Students will be able to

1) Understand general characteristics of solid and liquid waste
2) Understand biological safety in laboratory and pharmaceutical industry
3) Understand classification of lakes, sources, consequences and control of eutrophication
4) Understand Microbial interactions

Credits=4	**SEMESTER-VI** **BMiT- 603: - ENVIRONMENTAL MICROBIOLOGY**	**No. of hours per unit/ Credits**
UNIT I	**Characteristics of waste and Eutrophication**	**(11)**
	1.General characteristics of waste a) Liquid waste - pH, electrical conductivity, COD, BOD, total solids, total dissolved solids, total suspended solids, total volatile solids, chlorides, sulphates, oil& grease. b) Solid waste- pH, electrical conductivity, total volatile solids, ash. c) Standards as per MPCB. 2. Eutrophication - a. Classification of lakes b. Sources c. Consequences d. Control	
UNIT II	**Microbial Interactions**	**(12)**
	1) Types of interactions: Mutualism, synergism, commensalism, competition,amensalism, parasitism, predation 2) Microbe-Plant interaction: Symbiotic and non-symbiotic interaction 3) Microbe-animal interaction: Microbes in ruminants, nematophagus fungi andsymbiotic luminescent bacteria	

UNIT III	**Environmental monitoring and Bioremediation**	**(11)**
	1) Environmental monitoring- a) Cleanroom classification b) Routine EM programmed in pharmaceutical industries c) Microbial Control in Cleanrooms d) Bioburden considerations in equipment- biocontamination control. 2) Bioremediation - Approaches, types and applications. 3) Environmental Impact assessment –Concept and Brief introduction.	
UNIT – IV	**Characteristics of waste and Bioleaching**	**(12)**
	1) Characteristics and treatment of waste generated by a) Sugar Industry. b) Distillery c) Dairy Industry d) Hospital 2) Bioleaching a) Introduction b) Microorganisms involved c) Chemistry of Microbial leaching d) Laboratory scale and pilot scale leaching e) In situ leaching - Slope, heap f) Leaching of Copper and Uranium	

Course outcomes-

Students should be able to-

1) Understand general characteristics of solid and liquid waste
2) Learn about biological safety in laboratory and pharmaceutical industry
3) Understand classification of lakes, sources, consequences and control of Eutrophication
4) Understand Environmental monitoring and bioremediation

Books Recommended:

1. Environmental Pollution by Chemicals - Walker, Hulchiason.
2. Biochemistry and Microbiology of Pollution - Higgins and Burns.
3. Environmental Pollution - Laurent Hodge, Holt.
4. Waste Water Treatment - Datta and Rao (Oxford and IBH)
5. Sewage and waste treatment - Hammer
6. Pollution - Kudesia, Pragati Prakashan Meerat.
7. Environment Chemical Hazards - Ram Kumar (Swarup and Sons, New Delhi).
8. Environment and Metal Pollution - Khan (ABD Pub. Jaipur).
9. Environment Pollution - Timmy Katyal (Satke Anmol Pub. New Delhi).
10. Ecology of Polluted Water - Vol. II - Anand Kumar (Aph Pub. Co. New Delhi).
11. Environment Pollution and Management of waste waters by Microbial Techniques -
Pathade and Goel (ABD Pub. Jaipur).
12. Current Topics in Environmental Sciences - Tripathi and Pandey (ABD Pub. Jaipur).
13. Environmental Impact Assessment - R. K. Trivedy
14. Microbial Limit and Bioburden Tests, 2nd edition - Lucia Clontz (CRC Press)

SEMESTER VI
COURSE XVI- BMiT- 604: AGRICULTURAL MICROBIOLOGY- II
(TOTAL LECTURES-45)

Course objectives-

Students will be able to:

1. Understand about biofertilizer and bio pesticide production
2. Understand the types, production, methods of application and uses of biofertilizers and GM crops.
3. Understand the plant diseases and its control.
4. Understand molecular biology techniques.

Credits=4	SEMESTER-VI BMiT- 604: AGRICULTURAL MICROBIOLOGY- II	No. of hours per unit/ Credits
UNIT I	**Types, production, methods of application and uses of**	(11)
	1) Biofertilizer i) Nitrogen fixing - Azotobacter, Rhizobium, and Azospirillum. ii)Phosphate Solubilizing Microorganisms. **2)** Bio pesticide- *Bacills thuriengenesis*, Trichoderma sp	
UNIT II	**Plant diseases**	(12)
	1) Microbial Control of Soil Borne Plant Pathogens a) Bio- control mechanisms and ways b) Microorganisms used as bio controlagents against- Microbial plant pathogens, Insects, Weeds 2) Plant diseases- a) Black rust of wheat b) Bacterial leaf blight c) Blast disease of rice	
UNIT III	**Agriculture Biotechnology**	(11)
	Secondary Agriculture Biotechnology 1) Biotech feed, Silage, biogas, biofuels – advantages and processing parameters	

	2) GM crops - Advantages, social and environmental aspects, Bt crops, golden rice, transgenic animals.	
UNIT – IV	**Instrumentation**	**(12)**
	Principle, Technique, types, advantages, and disadvantages of- ELISA FISH Technique Microarray technique.	

Course outcomes-

Students should be able to -

1. understand biofertilizer and bio pesticide production
2. understand types, production, methods of application and uses of biofertilizers and GM crops.
3. Understand Plant diseases and its control.
4. Understand techniques in molecular biology

Books Recommended:

1. Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,
2. Singh RS. (1998). Plant Diseases Management. 7th edition. Oxford & IBH, New Delhi.
3. Glick BR, Pasternak JJ, and Patten CL (2010) Molecular Biotechnology 4th edition, ASM Press,
4. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
5. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
6. Barton LL & Northup DE (2011). Microbial Ecology. 1st edition, Wiley Blackwell, USA
7. Campbell RE. (1983). Microbial Ecology. Blackwell Scientific Publication, Oxford, England.
8. Coyne MS. (2001). Soil Microbiology: An Exploratory Approach. Delmar Thomson Learning.
9. Altman A (1998). Agriculture Biotechnology, Ist edition, Marcel decker Inc.
10. Mahendra K. Rai (2005). Hand Book of Microbial Biofertilizers, The Haworth Press, Inc. New York.
11. Reddy, S.M. et. al. (2002). Bioinoculants for Sustainable Agriculture and Forestry, Scientific Publishers.
12. Saleem F and Shakoori AR (2012) Development of Bioinsecticide, Lap Lambert Academic Publishing GmbH KG

SEMESTER VI

COURSE XVI- BMiT- 605: CELL BIOLOGY II (EUKARYOTIC) (TOTAL LECTURES-45)

Course objectives:

Students will be able to

1. Understand the structure of eukaryotic cell wall, cell membrane
2. Understand cell- cell interactions and adhesion molecules
2. Understand in detail different structures and functions of cell organelles and know about signaling mechanism in eukaryotes
3. understand the principle, technique, types of ELISA, FISH and microarray techniques

Credits=4	**SEMESTER-VI** **BMiT- 605: CELL BIOLOGY II (EUKARYOTIC)**	**No. of hours per unit/ Credits**
UNIT I	**Structure of Cell**	**(12)**
	a) Structure of Cell- plant cell, animal cell b) Plasma membrane: Structure and transport of small molecules Fluid mosaic modeland details c)Cell Wall: plant cell, d)Extra cellular matrix and cell matrix interactions Cell- Cell Interactions - adhesion junctions, tight junctions, gap junctions, and plasmodesmata (only structural aspects)	
UNIT II	**Cell organelles**	**(11)**
	a) Ribosomes, Chloroplast and peroxisomes b) Cytoskeleton: Structure and organization of actin filaments, association of actinfilaments with plasma membrane, cell surface protrusions, intermediate filaments,microtubules	
UNIT III	**Cell signaling**	**(11)**
	a) Signaling molecules and their receptors b) Function of cell surface receptors c) Pathways of intra-cellular receptors – Cyclic AMP pathway, cyclic GMP and MAP kinase pathway	

UNIT – IV	**Principle and practices of microbial techniques**	**(11)**
	Principle, Technique, types, advantages, and disadvantages of- ELISA FISH Technique Microarray technique.	

Course Outcomes:

Students should be able to

1. understand structure of eukaryotic cell wall, cell membrane
2. Understand cell- cell interactions and adhesion molecules
2. Understand in detail different structures and functions of cell organelles and know about signaling mechanism in eukaryotes
3. Understand the principle, technique, types of ELISA, FISH and microarray techniques

Books Recommended

1. The Cell: A Molecular Approach-**Geoffrey M. Cooper Sixth edition**

2. Cell Biology by Gerald Karp, International students version,**seventh edition**

3. Molecular Biology of the Cell (Sixth Edition) Sixth Edition
by Bruce Alberts , Alexander D. Johnson, Julian Lewis

4.Principles of microbiology – Ronald M. Atlas, Mosby publications 1995

5.Molecular Cell Biology 2007 , Harvey Lodish , Arnold Berk,**Sixth edition**

SEMESTER VI

COURSE XVI- BMiT- 606: MEDICAL MICROBIOLOGY

(TOTAL LECTURES- 45)

Course objectives:

Students will be able to

1. Study the cultural and biochemical characteristics, antigenic structure of mode of spread, prevention and control of selected human pathogens.
2. Understand the principle, technique, types of ELISA, FISH and microarray techniques
3. Understand the basic concept of Chemotherapy, Drug resistance
4. Understand the concept of Immunoprophylaxis

Credits=4	**SEMESTER-VI** **BMiT- 606: MEDICAL MICROBIOLOGY**	**No. of hours per unit/ Credits**
UNIT I	**Bacterial Diseases**	**(12)**
	Cultural and biochemical characteristics, antigenic structure, modes of transmission,pathogenesis, symptoms, laboratory diagnosis, prevention and control of diseases caused by *i)Mycobacterium tuberculosis* *ii)Clostridium perfringens* *iii)Pseudomonas aeruginosa* *iv)Vibrio cholerae* *v)Leptospira interrogans* *vi) Streptococcus mutans*	
UNIT II	**Viral diseases**	**(11)**
	Cultural and biochemical characteristics, antigenic structure, modes of transmission and pathogenesis, symptoms, laboratory diagnosis, prevention and control of diseases caused by Viruses: i] Hepatitis A & B virus, ii] Rabies virus iii] Dengue virus iv] Influenza virus	
UNIT III	**Chemotherapy**	**(11)**
	Chemoprophylaxis 1] General principles of chemotherapy	

	2] Mode of action of antimicrobial agents: a] Antibacterial drugs Penicillin, Bacitracin, Piperacillin, Murepavadin, cycloserine, Streptomycin, Tetracycline, Trimethoprim, Sulphonamides and Quinolones.\ b] Antiviraldrug: AZT. c] Antifungal drugs : Ketoconazole, Griseofulvin, Nystatin. d]Anti protozoal drugs: Metronidazole, Mepacrine, Quinone. 4] Drug resistance :Mechanism of drug resistance and way out to drug resistance. 5] Immuno prophylaxis: Vaccines and Immune Sera. a] Vaccines-live attenuated, inactive, subunit, conjugate and DNA vaccines. b] Immune Sera-examples with applications	
UNIT – IV	**Principle and practices of microbial techniques**	**(11)**
	Principle, Technique, types, advantages, and disadvantages of- FISH Technique Microarray technique.	

Course outcomes:

Student should be able to

1. Understand the morphology, cultural and biochemical characteristics, antigenic structure ofmode of spread, prevention, and control of selected human pathogens.
2. understand the principle, technique, types of ELISA, FISH and microarray techniques
3. understand the basic concept of Chemotherapy, Drug resistance and immunoprophylaxis
4. Understand the concept of immunoprophylaxis

Books Recommended:

1. Microbiology–Davis B.D, Delbacco, 4th edition,1990 ,J.B.Lippincott Co. NY
2. Text book of Microbiology-Ananthnarayan R and C.E. Jayaram Panikar 5th edition, 1996, Orient Longman
3. Medical Bacteriology-Dey N .C. &Dey T.K. 17 th edition 1988, Allied Agency, Calcutta
4. Medical Bacteriology including Medical Mycology &AIDS–T. K. Dey, D. Sinha &N. C. Dey,New Central Book Agency (Kolkata)
5. Principals and Practice of Clinical Bacteriology–A.M.Emmerson
6. Antimicrobial chemotherapy- David Greenwood, 5th edition, Oxford university press
7. Medical Laboratory Technology;Vol. III,-Mukharjee K.L. ,10th edition. Tata Mc Graw-Hill Pub Co.
8. Ananthnarayan and Paniker's Textbook of Microbiology –9th edition , Editor Arati Kapil 2013, University Press

SEMESTER V

SKILL BASED COURSE

SECCMIP-607-THEORY PAPER II (SECC II) ENTREPRENEURSHIP DEVELOPMENT

Course objectives

Students will be able to

1. understand classification & Characteristics of Entrepreneur
2. understand business idea and techniques to generate business idea.
3. understand components of project report
4. understand accounting principles and concept of audit

Credits=4	**SEMESTER-VI** **(SECC II) ENTREPRENEURSHIP DEVELOPMENT**	**No. of hours per unit/ Credits**
UNIT I	**Entrepreneurship, Creativity & Opportunities**	**(5)**
	Concept, Classification & Characteristics of Entrepreneur, Creativity and Risk taking, Risk Situation, Types of risk & risk takers, Business Idea Methods and techniques to generate business idea, Transforming Ideas in to opportunities -transformation involves, Assessment of idea &Feasibility of opportunity SWOT Analysis Market Assessment: Concept and Importance Market Identification, Survey Key components Market Assessment Types of business/ownership,	
UNIT II	**Business Finance & Accounts**	**(5)**
	Project Report: Meaning and Importance, Components of project report, Project Appraisal: Meaning and definition Technical, Economic feasibility, Cost benefit Analysis **Business Finance:** sources-government and nongovernment agencies. **Business Account:** Accounting Principles, Book Keeping Financial Statements Concept of Audit	

Unit III	**Enterprise Management and Modern Trends:**	**(5)**
	Enterprise Management: Essential roles of Entrepreneur in managing enterprise Features of small business firms, Process of management of small business. E-Commerce: Concept and Process, types-B2B, B2C, C2B, C2C	
Unit IV	**Entrepreneurship opportunities in Microbiology**	**(5)**
	Introduction and scope of microbiology-based entrepreneurship development in India. Types of industries in Microbiology. Case studies	

Course outcomes:

Students should be able to

1. Understand classification & Characteristics of Entrepreneur
1. Understand business idea and techniques to generate business idea.
2. Understand the components of project report
3. Understand the accounting principles and concept of audit

Practical Course Semester VI

BMiP- 608

Course objectives:

Students will be able to

1. Isolate auxotrophic mutants by replica plate technique.
2. Isolate streptomycin - resistant mutants by gradient plate technique
3. Perform agarose Gel Electrophoresis of DNA
4. Isolate chromosomal DNA from bacteria.

Credits=4	SEMESTER-VI **BMiP- 608 Practical Course**	No. of hours per unit/ Credits
	1. U. V. lethal curve of E. Coli. 2.Isolation of auxotrophic mutants by replica plate technique. 3.Isolation of streptomycin - resistant mutants (gradient plate technique) 4.Isolation of chromosomal DNA from bacteria (J. Marmurs method) 5.Agarose Gel Electrophoresis of DNA 6.Assay of Amylase by DNSA method (Graphical estimation) 7.Study of enzyme immobilization by sodium alginate method 8.β Galactosidase induction in E. coli 9.Study yeast cell immobilization in calcium alginate gel 10.Study of different phases of mitosis by using onion root tip.	

Course outcomes:

Students should be able to :

1. Isolate auxotrophic mutants by replica plate technique.
2. Isolate streptomycin - resistant mutants by gradient plate technique
3. Perform agarose Gel Electrophoresis of DNA
4. Isolate chromosomal DNA from bacteria.

BMiP- 609

Course objectives:

Students will be able to

1. Determine BOD and COD of sewage sample.
2. Isolate *Azotobactor* and *Rhizobium* from soil
3. Determine MIC of streptomycin against *E.coli* by broth method.
4. Isolate pathogens from clinical samples

Credits=4	SEMESTER-V **BMiP- 609 Practical Course**	No. of hours per unit/ Credits
	1. Determination of BOD of sewage 2. Determination of COD of sewage. 3. Isolation of Azotobacter from soil. 4. Isolation of Rhizobium from root nodules. 5. Isolation of phosphate solubilizing bacteria from soil 6. Isolation of following pathogens from clinical samples (wherever possible) and identification of the same by morphological,cultural and biochemical characteristics. a) *Pseudomonas aeruginosa* b) *Streptococcus mutans* 7. Determination of MIC of streptomycin against *E.coli* by broth method. 8. Determination of sensitivity of common pathogens to antibiotics by paper disc method. 9. Urine analysis: Physical and chemical examination of urine. a) Microscopic examination of urine-crystals, RBCs, pus cells and bacteria. b)Test for protein (Acetic acid test) c)Test for ketone bodies (Rothra'stest) d)Test for bile salt and bile pigments. e)Test for sugar (Benedict's method)	

Course outcomes:

Students should be able to

1. Determine BOD and COD of sewage sample.
2. Isolate *Azotobactor* and *Rhizobium* from soil
3. Determine MIC of streptomycin against *E.coli* by broth method.
4. Isolate pathogens from clinical samples

SECC Practical course

Credits=4	SECC Practical course	No. of hours per unit/ Credits
	Case study /project report writing	

Books Recommended:

1. Stanier, General Microbiology
2. Rose, Chemical Microbiology
3. Laboratory exercise in microbiology, Harley Prescott fifth edition, McGraw Hill companies,200
4. Experimental microbiology by Rakesh J.Patel, Kiran J.Patel, Aditya publications, volume I
5. Experimental microbiology by Rakesh J.Patel, Kiran J.Patel, Aditya publications, volume II