

YEAR – I	RESEARCH METHODOLOGY (For those students admitted in the year 2021 – 22 and onwards)	21EPM25A
SEMESTER - II		HRS / WK - 3
Elective – III A		CREDIT - 2

Objective: To make the students understand the concept behind designing the research, data collection and data analysis using statistical methods.

Course Outcomes:

Upon successful completion of the course, the student:

CO1: Acquires knowledge about Research and Experimental designs

CO2: Becomes familiar with Citation and Impact factor

CO3: Learns about preparing Research Report

CO4: Understands the role of committees in biological research

CO5: Gains knowledge about General Laboratory Procedures

SEMESTER : II	COURSE CODE: 21EPM25A				COURSE TITLE: RESEARCH METHODOLOGY				HOURS : 3	CREDITS : 2
COURSE OUTCOMES	PROGRAMME OUTCOMES (PO)				PROGRAMME SPECIFIC OUTCOMES (PSO)				MEAN SCORE OF COs	
	PO 1	PO 2	PO 3	PO 4	PSO 1	PSO 2	PSO 3	PSO 4		
CO1	4	3.5	4	3.5	4	4	4	4	3.87	
CO2	3.5	3.5	4	4	4	3.5	3.5	4	3.75	
CO3	4	3.5	4	4	3.5	4	4	4	3.56	
CO4	3	3.5	3.5	4	4	3	3	3.5	3.87	
CO5	3.5	3.5	3.5	3.5	4	3.5	3	3.5	3.50	
Mean Overall Score									3.71	

Result: The score of this course is 3.71 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit 1

(9 Hrs)

Research – Definition – Experimental designs - Identification, Selection and formulation of research problem – Research questions – Research Hypothesis.

Unit 2

(9 Hrs)

Literature Collection – Literature Citation - Major search engines - Major Websites, book and scientific information – Journals – Impact factor.

Unit 3

(9 Hrs)

Research Report – Components of a Research Report – Authors and Addresses – Abstract – Synopsis – Key words – Introduction – Materials and Methods – Results – Discussion – Acknowledgements – Summary and Conclusions – Appendixes – References - Title – Tables – Figures – Formatting and Typing.

Unit 4

(9 Hrs)

Biological research - Institutional Ethical committee – Animal ethical committee – Use of laboratory animals in research - Laboratory animal management.

Unit 5

(9 Hrs)

General Laboratory Procedures – pH, Buffers, Electrodes and Biosensors – Estimation of Carbohydrates (Bradford Method) – Protein (Lowry Method) – Lipid (Soxlet Method) – Nucleic Acid (Spectrophotometry) – Techniques for Sample Preparation.

Text Books

- Research Methodology: For Biological Sciences. Dr. N. Gurumani. 2006, MJP Publishers.
- Biophysical Chemistry Principles and Techniques. Upadhyay, Upadhyay and Nath. 1997. Himalaya Publications.

Reference Books

- Y. K. Singh and R. B. Bajpai, Research Methodology Data Presentation, 2008. APH Publishing Corporation, New Delhi.
- Modern Experimental Biochemistry. 3rd Edition, 2000. Rodney Boyer. Addison Wesley Longman, Inc.
- A Biologists guide to Principles and Techniques of Practical Biochemistry. 5th Edition, 2000. Wilson and Walker. Cambridge University Press.
- Physical Biochemistry. 2nd Edition, 1982. David Freifelder. W. H. Freeman and Company, New York.

YEAR – I	METHODS IN BIOLOGY (For those students admitted in the year 2021 – 22 and onwards)	21EPM26A
SEMESTER - II		HRS / WK - 3
ELECTIVE – IV A		CREDIT - 2

Objective:

To make the students familiar with techniques routinely used in bio sciences

Course Outcomes:

Upon successful completion of the course, the student:

CO1: acquires the knowledge about the study of advanced techniques in biology

CO2: gains the knowledge about the biophysical techniques used to detect functional structure of biological samples

CO3: gets insight knowledge about radioisotopes and its application

CO4: gets depth insights about the electrophysiological methods.

CO5: acquires the knowledge about the animal population and migration through remote sensor technique.

SEMESTER : II	COURSE CODE: 21EPM26A				COURSE TITLE: METHODS IN BIOLOGY				HOURS : 3	CREDITS : 2
COURSE OUTCOME S	PROGRAMME OUTCOMES (PO)				PROGRAMME SPECIFIC OUTCOMES (PSO)				MEAN SCORE OF COs	
	PO 1	PO 2	PO 3	PO 4	PSO 1	PSO 2	PSO 3	PSO 4		
CO1	4	3.5	4	3.5	4	4	4	4	3.87	
CO2	3.5	3.5	4	4	4	3.5	3.5	4	3.75	
CO3	4	3.5	4	4	3.5	4	4	4	3.56	
CO4	3	3.5	3.5	4	4	3	3	3.5	3.87	
CO5	3.5	3.5	3.5	3.5	4	3.5	3	3.5	3.50	
Mean Overall Score									3.71	

Result: The score of this course is 3.71 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0 ≤ rating ≤ 1	1.1 ≤ rating ≤ 2	2.1 ≤ rating ≤ 3	3.1 ≤ rating ≤ 4	4.1 ≤ rating ≤ 5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit 1

(9 Hrs)

Biophysical methods: Analysis of biomolecules using UV/visible, fluorescence, atomic force microscope, circular dichroism, NMR and ESR spectroscopy

Unit 2

(9 Hrs)

Biophysical methods: structure determination using X-ray diffraction, X-ray photoelectron spectroscopy; analysis using light scattering, different types of mass spectrometry, Optical Tweezers

Unit 3 **(9 Hrs)**

Radiolabeling techniques: Properties of radioisotopes, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, **safety guidelines for removal of radioactive wastes.**

Unit 4 **(9 Hrs)**

Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT

Unit 5 **(9 Hrs)**

Methods in field biology: Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behavior, habitat characterization-ground and remote sensing methods.

Text Book

- Biophysical Chemistry Principles and Techniques, (4th Edition) Upadhyay, Upadhyay and Nath, 2009, Himalaya Publications, India

Reference Book

- A Biologists guide to Principles and Techniques of Practical Biochemistry, (8th Edition), Wilson and Walker, 2018, Cambridge University Press.
- Physical Biochemistry, (2nd Edition) David Freifelder, 1982, W. H. Freeman and Company, New York.
- Modern Experimental Biochemistry (3rd Edition) Boyer, R. 2000, Addison Wesley Longman.
- Fundamentals and Techniques of Biophysics and Molecular Biology, (1st edition), Pranavkumar, 2016, Pathfinder Publication, New Delhi.
- Biophysics Tools and Techniques, (1st edition), Mark C. Leake, 2016, CRC press. UK

YEAR – I	MEDICAL LAB TECHNOLOGY (For those students admitted in the year 2021 – 22 and onwards)	21EPM26B
SEMESTER - II		HRS/WK - 3
ELECTIVE – IV B		CREDIT - 2

Objective: To orient students towards diagnosis of diseases in hospital setting.

Course Outcomes:

Upon successful completion of the course, the student:

CO1: gains knowledge on basic hematology and blood disorders

CO2: gets detailed information about the blood banking systems and preservation process

CO3: gets information on the setup of modern clinical laboratories

CO4: understands the preparation of reagents and buffer solutions in the laboratories

CO5: understands the methods of isolating and identification of bacterial pathogens in the clinical labs

SEMESTER : II	COURSE CODE: 21EPM26B				COURSE TITLE: MEDICAL LAB TECHNOLOGY				HOURS : 3	CREDITS : 2
COURSE OUTCOMES	PROGRAMME OUTCOMES (PO)				PROGRAMME SPECIFIC OUTCOMES (PSO)				MEAN SCORE OF COs	
	PO 1	PO 2	PO 3	PO 4	PSO 1	PSO 2	PSO 3	PSO 4		
CO1	4	3.5	4	3.5	4	4	4	4	3.87	
CO2	3.5	3.5	4	4	4	3.5	3.5	4	3.75	
CO3	4	3.5	4	4	3.5	4	4	4	3.56	
CO4	3	3.5	3.5	4	4	3	3	3.5	3.87	
CO5	3.5	3.5	3.5	4	4	3.5	3	4	3.62	
Mean Overall Score									3.73	

Result: The score of this course is 3.73 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit-1

(9 Hrs)

Basic Haematology: Composition of blood and its functions, Origin, Development, and morphology of Blood cells, Basic concepts of Anaemia, Leukaemia, and hemorrhagic disorder; Haematocrit, ESR, blood volume measurements. RBC, WBC & platelet counts, Functions of WBC and platelets. Basis of blood coagulation; Blood groups – ABO & Rh.

Unit-2

(9 Hrs)

Blood banking & Immunohaematology: Methods of estimation of Haemoglobin, Methods of determination of PCV, Blood transfusion and hazards; Requirement of Blood Collection -

Blood collection - Phlebotomy - Sampling errors - Collection and preservation of biological fluids - Anticoagulants - Preservation of samples - Chemical preservatives - Process of analysing the specimens - The laboratory report.

Unit-3 (9 Hrs)

Introduction to Clinical laboratory: The use of the laboratory - Basic laboratory principles - Code of conduct of medical laboratory personnel -Organization of clinical laboratory and role of medical laboratory technician - Safety measures - Medical laboratory professional and professionalism in laboratory workers - clinic borne infection and personnel hygiene.

Unit-4 (9 Hrs)

Preparation of Reagents & Quality control: Buffer and pH- Preparation of reagents : Normal, per cent and Molar solution - normal saline - Methods of measuring liquids - Clinical Laboratory records; Modern Laboratory set up; Quality control: Accuracy, Precision, and Reference values.

Unit-5 (9 Hrs)

Approaches to diagnosis of infectious diseases: Isolation of bacteria from mixed culture. Study of morphological, cultural, biochemical characteristics of common bacterial pathogen; Composition and use of important differential media for identification of pathogenic bacteria EMB agar, McConkey agar, TCBS agar and *Salmonella* - *Shigella* agar and blood culture media.

Text Book

- Textbook of Medical Lab Technology. 3rd Edition, 2016. Praful B. Godkar and Darshan B. Godkar.

Reference Books

- Medical Laboratory Technology Methods and Interpretations. Volume 1 & 2, 6thedition. 2009. RamnikSood. Jaypee Brothers Medical Publishers.
- Bailey and Scott's Diagnostic Microbiology, 12thedition 2007. Betty A. Forbes, Daniel F. Sahm and Alice S. Weissfeld. Mosby Elsevier Publishers, ISBN-13: 978-0808923640.
- Medical Laboratory Technology, Vol.1-3. 3rd Edition, 2017. Mukherjee L. K. Tata Mcgraw Hill.
- Microbiology: A Laboratory Manual. 10th Edition, 2013. James Cappuccino and Natalie Sherman, Benjamin Cummings.
- Wintrobe's Clinical Haematology. 13thedition, 2014. Lippincott Williams & Wilkins.

YEAR - I	PROBIOTICS FOR HUMAN HEALTH (For those students admitted in the year 2021 – 22 and onwards)	21SPMB2B
SEMESTER - II		SELF STUDY COURSE
ELECTIVE – V B		CREDITS - 2

Objective:

To make the students understand the importance of probiotics in human health.

Course Outcomes:

Upon successful completion of the course, the student:

CO1: will understand the sources and uses of probiotics

CO2: will know the characteristics of probiotics

CO3: will be able to describe probiotic organisms

CO4: will be able to appreciate the applications of probiotics

CO5: will become familiar with the safety regulations of probiotic products

SEMESTER : II	COURSE CODE: 21SPMB2B				COURSE TITLE: PROBIOTICS FOR HUMAN HEALTH				HOURS :-	CREDITS : 2
COURSE OUTCOME S	PROGRAMME OUTCOMES (PO)				PROGRAMME SPECIFIC OUTCOMES (PSO)				MEAN SCORE OF COs	
	PO 1	PO 2	PO 3	PO 4	PSO 1	PSO 2	PSO 3	PSO 4		
CO1	4	4	3.5	3.5	4	4	4	4	3.87	
CO2	3.5	3.5	3	4	4	3.5	3.5	4	3.62	
CO3	3.5	3.5	3	4	4	3.5	3.5	4	3.62	
CO4	4	4	3.5	3.5	4	4	4	4	3.87	
CO5	3.5	3.5	3	4	4	3.5	3.5	4	3.62	
Mean Overall Score									3.72	

Result: The score of this course is 3.72 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit - 1

(9 Hrs)

Probiotics: Definition, History, Role of probiotics in human health, Probiotic sources – dairy products, vegetables, fruits, egg, meat, fish, beverages, sugar products, dietary supplements - uses of probiotics.

Unit - 2

(9 Hrs)

Characteristics of probiotics: Tolerance to additives, stability during storage, stability during passage to intestinal sites, minimum effective dose, maintenance of probiotic microorganisms- enzyme production – antagonistic activity.

Unit - 3

(9 Hrs)

Probiotic organisms - *Lactobacillus*, *Bifidobacteria*, *Enterococcus*; production of specific substance (organic acid and bacteriocins); Modulation of immune system -reduction of inflammation; Modification of microbial population.

Unit - 4

(9 Hrs)

Applications of probiotics: stimulation of immune system; prevention and reduction of constipation; prevention of diarrhea; reduction of colon cancer; reduction of cholesterol level; lactose intolerance; Gastrointestinal infection; Urinary tract infection.

Unit - 5

(9 Hrs)

Probiotic products Safety and regulations: Food and Drug Administration, USA (FDA) – FAO/WHO Guidelines on probiotics – Animal testing – Dosage of probiotics (Pregnant women, Children, Adult)

Text Book

- Probiotics. 1st Edition, 2012. Rigobelo E.C. InTech Publishers, Rijeka, Croatia, European Union.

Reference Books

- Probiotics and Prebiotics: Current Research and Future Trends. 1st Edition, 2015. Venema K. and Carmo AP do. Caister Academic Press, Brazil.
- Interactive Probiotics. 1st Edition, 2014. Pessione E. CRC Press, New York, USA.
- Handbook of Probiotics and Prebiotics. 2009. Lee Y. K. and Salminen S. A. John Willey and Sons Inc. Publications.
- Intestinal Microbiota, Probiotics and Prebiotics. 1st Edition, 2014. Orel R. Institute for Probiotics and Functional Foods Ltd., Ljubljana, Slovenia.

YEAR - I	PHARMACEUTICAL MICROBIOLOGY (For those students admitted in the year 2021 – 22 and onwards)	21SPMB2C
SEMESTER - II		SELF STUDY COURSE
ELECTIVE – V C		CREDITS – 2

Objective: To study the role of microbes in the production of pharmaceutically active compounds, development of new drugs and to understand the regulatory aspects in pharmaceuticals.

Course Outcomes:

Upon successful completion of the course, the student:

CO1: Understands the basic concepts of Pharmacological Microbiology and the role of microbiologist in pharmacology.

CO2: Grasps knowledge on pharmaceutical microbiology laboratory and management.

CO3: Gains knowledge on drug discovery and development, clinical and preclinical trials.

CO4: Grasps information on pharmaceutical applications.

CO5: Understands regulatory aspects in Pharmaceuticals.

SEMESTER : II	COURSE CODE: 21SPMB2C				COURSE TITLE: PHARMACEUTICAL MICROBIOLOGY				HOURS :-	CREDITS : 2
COURSE OUTCOMES	PROGRAMME OUTCOMES (PO)				PROGRAMME SPECIFIC OUTCOMES (PSO)				MEAN SCORE OF COs	
	PO 1	PO 2	PO 3	PO 4	PSO 1	PSO 2	PSO 3	PSO 4		
CO1	3	4	4	3	3	3	3	4	3.3	
CO2	3	3	3	4	3	3	3	5	3.2	
CO3	3	3	3	4	3	3	4	5	3.5	
CO4	3	3	3	3	3	3	4	5	3.3	
CO5	3	4	3	3	5	3	3	5	3.6	
Mean Overall Score									3.4	

Result: The score of this course is 3.4 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit - 1

(9 hours)

Introduction and Overview of Pharmaceutical Microbiology – Microbiological test methods — Basics of pharmaceutical sector – Role of the microbiologist– Importance of medicine in public health – Role and development of pharmacopoeias – Importance of

inspections in the life cycle of medicines. Biology of pharmaceutically important microorganism: Bacteria and Fungi (Yeast and Molds).

Unit - 2 **(9 hours)**

Microbial products and pharmaceutical laboratory management: Microbial products in pharmaceutical industry: antibiotics, antifungal agents, antiviral agents, small molecules, growth factors, hormones, vitamins, therapeutic enzymes, recombinant proteins and vaccines. Pharmaceutical microbiology laboratory –Laboratory management and design.

Unit - 3 **(9 hours)**

Drug Discovery and Development: Microbial, Recombinant, Biochemical and Molecular level screening systems and their construction/ design strategies. Conventional Process; Bio-prospecting. Search of database/data mining for Drug designing; Preclinical and Clinical trials; Estimation of toxicity: LD50 and ED50; Rational Drug Design – Principle (Structure activity relationship -SAR) and Tools (applications of High throughput Screening - Combinatorial synthesis - Pharmacogenomics).

Unit - 4 **(9 hours)**

Pharmaceutical Applications: Immobilisation procedure for pharmaceutical applications (liposomes), biosensors in pharmaceuticals - Applications of microbial enzymes in pharmaceuticals; Phage therapy: Introduction to phages, lytic cycle, types of phages involved in phage therapy; Plant based therapeutic agents.

Unit – 5 **(9 hours)**

Regulatory aspects in pharmaceuticals: Regulatory aspects of quality control - Sterilisation, control and sterility testing (Heat sterilization, D-value, Z-value, radiation, Gaseous and filter sterilization), chemical and biological indicators used; Government regulatory practices and policies for pharmaceutical industry: Food and Drug Administration (FDA), The Central Drugs Standard Control Organization (CDSCO), The Drug Controller General of India (DCGI); Patenting of pharmaceutical products; GMP in pharmaceuticals.

Text Book

- Pharmaceutical Microbiology. 2007 (6th Edition, 2007). Ed. by W. B. Hugo and A.D. Russell. Blackwell scientific Publications.

Reference Books

- Pharmaceutical Microbiology. Essentials for Quality assurance and quality control. 2015. Tim Sandle. Woodhead publishing series biomedicine.
- Quality control in pharmaceutical industry, Vol. 2. 2001. Murray. S. Cooper. Academic press, New York.
- Pharmaceutical Biotechnology. 2004. S.P. Vyas, V.K. Dixit. CBS publishers and Distributors, New Delhi.
- Textbook of Drug Design and Discovery. 2004. Krogsgaard L, Lilliefors T. and Madsen, U. Taylor and Francis, London.

YEAR - II	r-DNA TECHNOLOGY (For those students admitted in the year 2021 – 22 and onwards)	21PMB32
SEMESTER - III		HRS/WK - 4
CORE - 10		CREDITS - 4

Objective: To make the students familiar with techniques in recombination technology.

Course Outcomes:

Upon successful completion of the course, the student:

CO1: Learns the available genetic engineering tools & molecular techniques

CO2: Learns the importance of Cloning vectors

CO3: Acquires knowledge about Cloning strategies

CO4: Understands the expression of cloned DNA molecules

CO5: Learns the importance of Genome Editing using r-DNA technology.

SEMESTER : III	COURSE CODE: 21PMB32				COURSE TITLE: r-DNA TECHNOLOGY				HOURS : 4	CREDITS : 4
COURSE OUTCOMES	PROGRAMME OUTCOMES (PO)				PROGRAMME SPECIFIC OUTCOMES (PSO)				MEAN SCORE OF COs	
	PO1	PO2	PO3	PO4	PSO 1	PSO 2	PSO 3	PSO 4		
CO1	3.5	3.5	4	3.5	4	3	4	3	3.56	
CO2	4	4	3.5	4	3	3.5	3.5	4	3.69	
CO3	3.5	3.5	4	3	4	3.5	4	3.5	3.63	
CO4	4	4	3.5	3	3.5	4	3	3	3.50	
CO5	4	3.5	4	3	4	3.5	4	3	3.63	
Mean Overall Score									3.60	

Result: The score of this course is 3.60 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	$0 \leq \text{rating} \leq 1$	$1.1 \leq \text{rating} \leq 2$	$2.1 \leq \text{rating} \leq 3$	$3.1 \leq \text{rating} \leq 4$	$4.1 \leq \text{rating} \leq 5$
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit 1

(12 Hrs)

Molecular Techniques: Agarose gel electrophoresis, Nucleic acid blotting, Southern blotting, Northern blotting, Western blotting, Transformation of *E. coli* - **Cutting and Joining DNA molecules** - Host-controlled restriction and modification, Restriction Endonucleases, Nomenclature, Mechanical shearing of DNA, Joining DNA molecules (DNA ligase, Double linkers, Adaptors, Homopolymer tailing)

Unit 2

(12 Hrs)

Cloning vehicles for use in *E. coli*: Construction and characterization of a new cloning vehicle: pBR322, Improved vectors derived from pBR322, Direct selection vectors, Low-copy-number plasmid vectors, Runway plasmid vectors - **Bacteriophage and cosmid vectors for *E. coli*** - Bacteriophage λ , Vector DNA, Improved phage λ vectors, Packaging phage λ DNA in vitro, Cosmid vectors, Phasmid vectors.

Unit 3 (12Hrs)

Cloning Strategies, Gene Libraries and cDNA Cloning: Cloning strategies, Chromosome walking, cDNA cloning, Full-length cDNA cloning, Genomic and cDNA libraries; Recombinant Selection and Screening - South-Western screening for DNA-binding proteins, Nucleic acid hybridization methods.

Unit 4 (12 Hrs)

Expression of Cloned DNA molecules in *E. coli*: Expression of fusion proteins, Manipulation of cloned genes to achieve expression of native proteins, Secretion of proteins, Detecting expression of cloned genes, Maximizing the expression of cloned genes, Constructing the optimal promoter, The effect of plasmid copy number.

Unit 5 (12Hrs)

Genome Editing Technology: DNA finger printing and Foot printing, Restriction fragment Length Polymorphism (RFLP) analysis, RAPD, Genome Editing: ZFN, TALENS, CRISPR. Applications of recombinant DNA technology - Production of Recombinant and Synthetic Vaccines; Genetically modified microorganisms; Recombinant proteins as therapeutic agents; **Ethical and legal issues in rDNA technology.**

Text Book

- Principles of Gene manipulation. 5th Edition, 1994. Old, R.W. and S.B. Primrose. Blackwell Science, Oxford.

Reference Books

- Molecular Biology of the Gene. 5th Edition, 2004. James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick. Pearson Education. Inc.
- Recombinant DNA and Biotechnology: Guide for Teachers. 2nd Edition, 2001. Helen Kruez. ASM publications.
- From Genes to Clones. 2003. Ernst-L. Winnacker. Panima Publishing Corporation, New Delhi.
- Genetics - A Molecular Approach. 2004. Brown, T.A. Chapman Hall. London.
- Molecular Biotechnology - Principles and Applications of Recombinant DNA technology. 2006. Glick, B.R. and J.J. Pasternak. ASM press, Washington.

YEAR - II	FOOD MICROBIOLOGY (For those students admitted in the year 2021 – 22 and onwards)	21PMB33
SEMESTER - III		HRS/WK - 4
CORE - 11		CREDITS - 4

Objective: To make the students understand the importance of microbiology in the field of food industry.

Course Outcomes:

Upon successful completion of the course, the student:

CO1: Recognizes the principles of food preservation and the factors that influence growth and survival of microorganisms in food.

CO2: Understands the importance of fermented dairy and nondairy foods and probiotics.

CO3: Acquires knowledge on food spoilage and foodborne diseases.

CO4: Comprehends and applies the standard methods for microbiological analysis of foods.

CO5: Gains knowledge on food regulatory agencies and policies related to food safety and quality.

SEMESTER : III	COURSE CODE: 21PMB33				COURSE TITLE: FOOD MICROBIOLOGY				HOURS : 4	CREDITS : 4
COURSE OUTCOMES	PROGRAMME OUTCOMES (PO)				PROGRAMME SPECIFIC OUTCOMES (PSO)				MEAN SCORE OF COs	
	PO 1	PO 2	PO 3	PO 4	PSO 1	PSO 2	PSO 3	PSO 4		
CO1	4	4	4.5	4	4	4	3.5	4	4.0	
CO2	4	4	4	3.5	4	3.5	2.5	3	3.6	
CO3	4	3.5	3.5	3.5	4	4	3	4	3.7	
CO4	3.5	4	3	3.5	4	3.5	3	3	3.4	
CO5	4	3.5	4	4	4	4	3	3.5	3.8	
Mean Overall Score									3.7	

Result: The score of this course is 3.7 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	0<=rating<=1	1.1<=rating<=2	2.1<=rating<=3	3.1<=rating<=4	4.1<=rating<=5
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit - 1

(12 Hrs)

Importance of studying food and dairy microbiology; Microorganisms important in food microbiology; Food as a substrate for microorganisms, Extrinsic and Intrinsic factors; Food preservation methods with principles - physical irradiation, drying, heat processing - high temperature, low temperature; modification of atmosphere; Food additives – sodium chloride, sugar, vinegar, class I and class II preservatives.

Unit - 2 (12 Hrs)

Food fermentations – Meat Products, Fish Products, Idly, Breads, Sauerkraut, Pickles; therapeutic and nutritional value of fermented foods; Milk and milk products - fermented dairy products - butter, cheese, yogurt, acidophilus milk; Spoilage and defects of fermented dairy products; Milk preservation methods – pasteurization, sterilization; Probiotics, Prebiotics and Synbiotics - Definition and Health benefits.

Unit - 3 (12 Hrs)

Contamination and spoilage: vegetables, fruits, cereals, meat products, fish and sea foods, Poultry and egg; Food poisoning and food borne infections by bacteria such as *Brucella*, *Bacillus*, *Clostridium*, *Escherichia*, *Salmonella*, *Shigella*, *Staphylococcus*, *Vibrio*, fungi and viruses; bacterial and fungal exo- and endo- toxins; Food borne disease outbreaks.

Unit – 4 (12 Hrs)

Detection of food borne microorganisms: Culture, Microscopic and sampling methods – Chemical methods (Thermostable nuclease, Limulus lysate for endotoxin, Adenosine triphosphate measurement), Immunological Methods (Serotyping, Fluorescent Antibody, Enrichment serology, Radioimmunoassay and ELISA), Molecular Genetic methods (Nucleic acid probe, PCR), Fingerprinting methods (AFLP, Ribotyping, Microarrays) and Physical methods (Biosensor, Flow Cytometry).

Unit – 5 (12 Hrs)

Food safety and Quality control: Principles of quality control and microbiology criteria, Indicators of product quality, Indicators of food safety, Predictive Microbiology, Hazard analysis Critical Control Point (HACCP), Good Manufacturing process (GMP) - Food control agencies and its regulations (Codex Alimentarius, NABL, FDA, EPA and ISI).

Text Book

- Modern food microbiology. 7th Edition, 2005. James M. Jay, Martin J. Loessner, David A. Golden. Springer Science & Business.

Reference Books

- Food Microbiology. 5th Edition, 2013. William C. Frazier, Dennis C. Westhoff, N. M. Vanitha. McGraw-Hill Education (India).
- Food Microbiology, 1st Edition, 2016. Foster, W. M. CBS Publishers and Distributors Pvt. Ltd., New Delhi.
- Food Microbiology, 4th Edition, 2015. Adams, M.R., Moss, M.O and McClure, P. J. RSC Publication, CPI Group (UK) Ltd., Croydon, UK.
- Food Microbiology - Fundamentals and Frontiers. 2nd Edition, 2001. Doyle, M. P., L. R. Beuchat and T. J. Montville. ASM Press. Washington, D.C.
- The Microbiological Safety and Quality of Food. 2000. Barbara M. Lund, Baird-Parker, Gould G.W. An Aspen publication, Maryland, U.S.A.

YEAR – II	BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS (For those students admitted in the year 2021 – 22 and onwards)	21EPM35A
SEMESTER - III		HRS / WK - 3
Elective – VII A		CREDIT - 2

Objective: To make the students completely equipped with strategies of patent rights

Course Outcomes:

Upon successful completion of the course, the student:

CO1: Acquires knowledge about concept of bioethics

CO2: Learns about Ethics committees

CO3: Attains knowledge about intellectual property

CO4: Understands the Patents, Copy rights and related rights

CO5: Gains knowledge about Indian IPR legislations

SEMESTER : III	COURSE CODE: 21EPM35A				COURSE TITLE: BIOETHICS AND INTELLECTUAL PROPERTY RIGHTS				HOURS : 3	CREDITS : 2
COURSE OUTCOME S	PROGRAMME OUTCOMES (PO)				PROGRAMME SPECIFIC OUTCOMES (PSO)				MEAN SCORE OF COs	
	PO1	PO2	PO3	PO4	PSO 1	PSO 2	PSO 3	PSO 4		
CO1	3	4	4	3	3	3	3	4	3.3	
CO2	3	3	3	4	3	3	3	5	3.2	
CO3	3	3	3	4	3	3	4	5	3.5	
CO4	3	3	3	3	3	3	4	5	3.3	
CO5	3	4	3	3	5	3	3	5	3.6	
Mean Overall Score									3.4	

Result: The score of this course is 3.4 (High)

Association	1%-20%	21%-40%	41%-60%	61%-80%	81%-100%
Scale	1	2	3	4	5
Interval	$0 \leq \text{rating} \leq 1$	$1.1 \leq \text{rating} \leq 2$	$2.1 \leq \text{rating} \leq 3$	$3.1 \leq \text{rating} \leq 4$	$4.1 \leq \text{rating} \leq 5$
Rating	Very Poor	Poor	Moderate	High	Very High

This Course is having **HIGH** association with Programme Outcomes and Programme Specific Outcomes.

Unit - 1

(9 Hrs)

Bioethics – definition - The birth of the concept of ‘bioethics’ - History of Bioethics as a Discipline - Bioethics as bridge between facts and values - Bioethics versus medical ethics - Health and disease as values - Principles of bioethics - Health care decisions include facts and values, Universal Declaration on Bioethics and Human Rights.

Unit- 2

(9 Hrs)

Ethics committees – Need, Types, Composition, Function - Human dignity and human rights
- Benefit and harm – Definitions, comparing harms and benefits; Autonomy and individual responsibility, health care provider-patient relationship; ‘informed consent’ – Animal Ethics Committee.

Unit- 3

(9 Hrs)

Introduction – Invention and Creativity, intellectual property (IP) – Importance; Protection of IPR – Basic types of property (i) Movable property (ii) Immovable property and (iii) Intellectual property; International convention relating to intellectual property - Establishment of WIPO, Mission and Activities: General Agreement on Trade and Tariff (GATT).

Unit- 4

(9 Hrs)

Patents, Copy rights and related rights, Trade Marks and rights arising from trade mark registration, Industrial designs, Protection of Geographical Indications at national and international levels - application procedures.

Unit – 5

(9 Hrs)

Indian IPR legislations; Patent Ordinance and the Bill; National Intellectual property policy; Case studies on patents - Basmati rice, Turmeric, Neem.

Text book

- Bioethics for Scientists. 2002. John A. Bryant, Linda Baggott la Velle, John F. Searle. Wiley.
- Biotechnology and Intellectual Property Rights. 2014. Kshitij Kumar Singh. Springer India.

Reference Books

- An Introduction to Bioethics. 4th Edition, 2009. Thomas A. Shannon and Nicholas J. Kockler. Paulist Press.
- Contemporary issues in Bioethics. 2013. Tom L Beauchamp. Jeffrey Khan, LeRoy Walters, Anna C Mastroanni.
- Intellectual Property in Asia. 2009. Paul Goldstein and Joseph Straus Springer Science & Business Media.
- Law Relating to Intellectual Property Rights. 2nd Edition, 2007. Ahuja. V.K. LexisNexis.
- Hand book of Indian Patent Law and Practice. 1998. Subbarab, N. R. Viswanathan Printers and Publishers Pvt. Ltd.