



TECHNO INDIA UNIVERSITY
WESTBENGAL

Proposed Syllabus for 4-year B.Sc (Honours with or without research) (NEP)

2023

MICROBIOLOGY



Department of Microbiology

**Techno India University, West Bengal
EM-4, EM Block, Sector V, Bidhannagar,
Kolkata, West Bengal 700091**



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Credit Requirements for obtained different degree		
Degree	Year	Total Credit
Certificate in Microbiology	1	38
Diploma in Microbiology	2	80
B.Sc (Three Years) in Microbiology	3	120
B.Sc (Hons.) in Microbiology (with research)	4	160
B.Sc (Hons.) in Microbiology (without research)	4	160

B.Sc Microbiology
Course Curriculum for All Semesters

Semester V

Sl. No.	Course Code	Course Title	Contact Hrs. / Week			Credit	Page No.
			L	T	P		
Theory							
1.		Major: Recombinant DNA Technology	2	1		3	
2.		Major: Food and Dairy Microbiology	2	1		3	
3.		Major: Industrial Microbiology	2	1		3	
4.		Minor:	2	1		3	
5.		Minor:	2	1		3	
Practical							
6.		Major: Recombinant DNA Technology			1	1	
7.		Major: Food and Dairy Microbiology			1	1	
8.		Major: Industrial Microbiology			1	1	
9.		Minor:			1	1	
10.		Minor:			1	1	
Total Credit						20	



Semester V

Course Name : RECOMBINANT DNA TECHNOLOGY

Course Code:

Course Details:

Unit 1: Molecular Cloning: Tools and Strategies

Cloning Tools; Restriction modification systems: Types I, II and III. Mode of action, nomenclature, applications of Type II restriction enzymes in genetic engineering DNA modifying enzymes and their applications: DNA polymerases. Terminal deoxynucleotidyl transferase, kinases and phosphatases, and DNA ligases Cloning Vectors: Definition and Properties Plasmid vectors: pBR and pUC series Bacteriophage lambda and M13 based vectors Cosmids, BACs, YACs, Use of linkers and adaptors Expression vectors: E.coli lac and T7 promoter-based vectors, yeast YIp, YEp and YCp vectors, Baculovirus based vectors, mammalian SV40-based expression vectors

Unit 2: Methods in Molecular Cloning

Transformation of DNA: Chemical method, Electroporation Gene delivery: Microinjection, electroporation, biolistic method (gene gun), liposome and viral mediated delivery, Agrobacterium - mediated delivery DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern - blotting techniques, dot blot, DNA microarray analysis, SDS-PAGE and Western blotting.

Unit 3 DNA Amplification and DNA sequencing

PCR: Basics of PCR, Types of PCR: Nested PCR Inverse PCR, Multiplex PCR, RT-PCR, Errorprone PCR, Real-Time PCR, Sanger's method of DNA Sequencing: traditional and automated sequencing, Primer walking and shotgun sequencing

Unit 4 Construction and Screening of Genomic and cDNA libraries

Genomic and cDNA libraries: Preparation and uses, Screening of libraries: Colony hybridization and colony PCR, Chromosome walking and chromosome jumping

Unit 5 Applications of Recombinant DNA Technology

Products of recombinant DNA technology: Products of human therapeutic interest - insulin, hGH, DNA fingerprinting- RAPD, VNTR Typing, site directed mutagenesis, phage Display

SUGGESTED READING

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
3. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7 th edition. Blackwell Publishing, Oxford, U.K.
4. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
5. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education



6. Brown TA. (2007). Genomes-3. Garland Science Publishers
7. Primrose SB and Twyman RM. (2008). Genomics: Applications in human biology. Blackwell Publishing, Oxford, U.K.

Course Name : RECOMBINANT DNA TECHNOLOGY (Practical)

Course Code:

Course Details:

1. Bacterial Transformation and calculation of transformation efficiency
2. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis
3. Interpretation of sequencing gel electropherograms
4. Designing of primers for DNA amplification
5. Amplification of DNA by PCR

Course Name : FOOD AND DIARY MICROBIOLOGY (Theory)

Course Code:

Course Details:

Unit 1: Food as a substrate for microorganisms

Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.

Unit 2: Microbial spoilage of various foods

Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods.

Unit 3 Principles and methods of 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, SO₂, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins.

Unit 4 Fermented dairy products

Dairy starter cultures, yogurt, dahi, acidophilus milk.

Unit 5 Prebiotics and Probiotics

Prebiotics: definition, types, microorganisms, benefits, Fructo-oligosaccharides (FOS) from GRAS organisms (commercial prebiotic). Probiotics: definition, essential features of a probiotic, types of microorganisms used, health benefits, probiotic foods available in market.

Unit 6 Food borne diseases (causative agents, foods involved, symptoms and preventive measures)

Food intoxications: Staphylococcus aureus, Clostridium botulinum and mycotoxins; Food infections: Bacillus cereus, Vibrio parahaemolyticus, Escherichia coli, Salmonellosis, Shigellosis, Yersinia enterocolitica, Listeria monocytogenes and Campylobacter jejuni.

Unit 7 Cultural and rapid detection methods of food borne pathogens in foods and introduction



to predictive microbiology

Culture and microscope methods – standard plate count, microscopic counts Molecular methods: PCR based detection. Biosensor based methods: optical biosensor, electrochemical biosensor, mass-based biosensor Immunological based methods: ELISA.

SUGGESTED READING

1. Adams MR and Moss MO. (1995) Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987) Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
3. Davidson PM and Brannen AL. (1993) Antimicrobials in Foods. Marcel Dekker, New York. Publishing, Oxford, U.K.
4. Dillion VM and Board RG. (1996) Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.
5. Frazier WC and Westhoff DC. (1992) Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.
7. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
8. Lund BM, Baird Parker AC, and Gould GW. (2000). The Microbiological Safety and Quality of Foods. Vol. 1-2, ASPEN Publication, Gaithersberg, MD.
9. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition, Pearson Education.

Course Name :FOOD AND DIARY MICROBIOLOGY (Practical)

Course Code:

Course Details:

1. MBRT of milk samples and their standard plate count.
2. Isolation of spoilage microorganisms from spoiled vegetables/fruits.
3. Isolation of spoilage microorganisms from bread.
4. Preparation of Yoghurt/Dahi.

Course Name : INDUSTRIAL MICROBIOLOGY

Course Code:

Course Details:

Unit 1: Introduction to Industrial microbiology

Brief history and developments in industrial microbiology

Unit 2: Isolation of Industrial Strains and Fermentation

Sources of industrially important microbes and methods for their isolation, preservation and maintenance of industrial strains, strain improvement, Crude and synthetic media; molasses, corn-steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates

Unit 3 Types of fermentation processes, bio-reactors and measurement of fermentation



Types of fermentation processes - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (eg. baker's yeast) and continuous fermentations. Components of a typical bio-reactor, Types of bioreactors-Laboratory, pilot- scale and production fermenters, constantly stirred tank and air-lift fermenters, Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration

Unit 4 Down-stream processing

Cell disruption, filtration, centrifugation, solvent extraction, precipitation, lyophilization and spray drying

Unit 5 Microbial production of industrial products (micro-organisms involved, media, fermentation conditions, downstream processing and uses)

Citric acid, ethanol, penicillin, glutamic acid, Vitamin B12 Enzymes (amylase, protease, lipase), wine, beer

Unit 6 Enzyme immobilization

Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase)

SUGGESTED READING

1. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited
2. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology. 1st edition. Bios Scientific Publishers Limited. USA
3. Waites M.J., Morgan N.L., Rockey J.S. and Higton G. (2001). Industrial Microbiology: An Introduction. 1st edition. Wiley – Blackwell
4. Glaze A.N. and Nikaido H. (1995). Microbial Biotechnology: Fundamentals of Applied Microbiology. 1st edition. W.H. Freeman and Company
5. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
6. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2 nd edition. Panima Publishing Co. New Delhi.

Course Name : INDUSTRIAL MICROBIOLOGY (Practical)

Course Code:

Course Details:

1. Study different parts of fermenter
2. Microbial fermentations for the production and estimation of Enzymes: Amylase (Both qualitative and quantitative only) and Protease (Qualitative only)
3. Whole cell immobilization and detection through any one enzyme assay (Qualitative only)
4. A visit to any educational institute/industry to see the operation of instruments and other downstream processing operations.