TECHNO INDIA UNIVERSITY

WESTBENGAL

3yr B.Sc (HONOURS)

In

MICROBIOLOGY

SYLLABUS

Choice Based Credit System (CBCS)

2019

TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

Semester Wise Microbiology Honours Courses						
	1	**2**	**3**	**4**	**5**	**6**
Core Courses	TIU-HMB-T1C1 TIU-HMB-P1C1 TIU-HMB-T1C3 TIU-HMB-P1C3 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T1C2 TIU-HMB-P1C2 TIU-HMB-T1C4 TIU-HMB-P1C4 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T2C5 TIU-HMB-P2C5 TIU-HMB-T2C7 TIU-HMB-P2C7 TIU-HMB-T2C9 TIU-HMB-P2C9 3T+3P (3X4+3X2=18 Credits)	TIU-HMB-T2C6 TIU-HMB-P2C6 TIU-HMB-T2C8 TIU-HMB-P2C8 TIU-HMB-T2C10 TIU-HMB-P2C10 3T+3P (3X4+3X2=18 Credits)	TIU-HMB-T3C11 TIU-HMB-P3C11 TIU-HMB-T3C13 TIU-HMB-P3C13 2T+2P (2X4+2X2=12 Credits)	TIU-HMB-T3C12 TIU-HMB-P3C12 TIU-HMB-T3C14 TIU-HMB-P3C14 2T+2P (2X4+2X2=12 Credits)
Generic Elective Courses	TIU-UCH-T1G1 TIU-UCH-P1G1 1T+1P (1X4+1X2=6 Credits)	TIU-UCH-T1G2 TIU-UCH-P1G2 1T+1P(1X4+1X2=6 Credits)	TIU-UCS-T2G1 TIU-UCS-P2G1 1T+1P (1X4+1X2=6 Credits)	TIU-UCS-T2G2 TIU-UCS-P2G2 1T+1P (1X4+1X2=6 Credits)		
Discipline Specific Elective Courses					TIU-HMB-T3D1 TIU-HMB-P3D1 TIU-HMB-T3D3 TIU-HMB-P3D3 TIU-HMB-T3D5 TIU-HMB-P3D5 2T+2P Any two: (2X4+2X2=12 Credits)	TIU-HMB-T3D2 TIU-HMB-P3D2 TIU-HMB-T3D4 TIU-HMB-P3D4 TIU-HMB-T3D6 TIU-HMB-P3D6 2T+2P Any two: (2X4+2X2=12 Credits)
Skill Enhancement Elective Courses			TIU-HMB-T2S1 TIU-HMB-P2S1 TIU-HMB-T2S3 TIU-HMB-P2S3 1T+0P (1X2=2 Credits)Any one	TIU-HMB-T2S2 TIU-HMB-P2S2 TIU-HMB-T2S4 TIU-HMB-P2S4 1T+0P(1X2=2 Credits)Any one		
CASD	TIU-UCE-T105 1T+0P (2 Credits) (language)	TIU-UES-T106 1T+0P (2 Credits) (Environmental Science)				
Total = 140 Credits	20 Credits	20 Credits	26 Credits	26 Credits	24 Credits	24 Credits

TECHNO INDIA UNIVERSITY
W E S T B E N G A L

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

Core Courses		
Semester	**Core Courses (Code)**	**Subject**
1	TIU-HMB-T1C1 TIU-HMB-P1C1	Introduction to microbiology and microbial diversity
	TIU-HMB-T1C3 TIU-HMB-P1C3	Bacteriology
2	TIU-HMB-T1C2 TIU-HMB-P1C2	Biochemistry
	TIU-HMB-T1C4 TIU-HMB-P1C4	Cell Biology
3	TIU-HMB-T2C5 TIU-HMB-P2C5	Virology
	TIU-HMB-T2C7 TIU-HMB-P2C7	Microbial physiology and metabolism
	TIU-HMB-T2C9 TIU-HMB-P2C9	Molecular Biology
4	TIU-HMB-T2C6 TIU-HMB-P2C6	Microbial Genetics
	TIU-HMB-T2C8 TIU-HMB-P2C8	Environmental Microbiology
	TIU-HMB-T2C10 TIU-HMB-P2C10	Recombinant DNA Technology
5	TIU-HMB-T3C11 TIU-HMB-P3C11	Food and Dairy Microbiology
	TIU-HMB-T3C13 TIU-HMB-P3C13	Industrial Microbiology
6	TIU-HMB-T3C12 TIU-HMB-P3C13	Immunology
	TIU-HMB-T3C14 TIU-HMB-P3C14	Medical Microbiology

TECHNO INDIA UNIVERSITY
W E S T B E N G A L

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

Skill Enhancement Elective Courses		
Semester	**Core Courses (Code)**	**Subject**
3	TIU-HMB-T2S1 TIU-HMB-P2S1	Bio fertilizer
	TIU-HMB-T2S3 TIU-HMB-P2S3	Microbial quality control in food and pharmaceutical industry
4	TIU-HMB-T2S2 TIU-HMB-P2S2	Food Fermentation Technique
	TIU-HMB-T2S4 TIU-HMB-P2S4	Microbiological analysis of air and water

Discipline Specific Elective Courses		
Semester	**Core Courses (Code)**	**Subject**
5	TIU-HMB-T3D1 TIU-HMB-P3D1	Biostatistics
	TIU-HMB-T3D3 TIU-HMB-P3D3	Medical & Diagnostics Microbiology
	TIU-HMB-T3D5 TIU-HMB-P3D5	Advance Method in Microbiology
6	TIU-HMB-T3D2 TIU-HMB-P3D2	Inheritance Biology
	TIU-HMB-T3D4 TIU-HMB-P3D4	Bioinformatics
	TIU-HMB-T3D6 TIU-HMB-P3D6	Project Work

CORE COURSES

SEMESTER –5

TIU-HMB-T3C11: Food and Dairy Microbiology (THEORY)

TOTAL HOURS: 60 CREDITS: 4 Unit 1 Foods as a substrate for microorganisms No. of Hours: 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 No. of Hours: 10 Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods

Unit 3 Principles and methods of food preservation No. of Hours: 12 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 foods No. of Hours: 10 Dairy starter cultures, fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese, other fermented foods: dosa, sauerkraut, soy sauce and tampeh, Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.

Unit 5 Food borne diseases (causative agents, foods involved, symptoms and preventive measures)
No. of Hours: 10
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 6 Food sanitation and controlNo. of Hours: 5

HACCP, Indices of food sanitary quality and sanitizers

Unit 7 Cultural and rapid detection methods of food borne pathogens in foods and introduction to predictive microbiology.

No. of Hours: 5

GET IT ON
Google Play

WWW.TECHNOINDIAUNIVERSITY.AC.IN

TIU-HMB-P3C11: Food and Dairy Microbiology (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 21. MBRT of milk samples and their standard plate count.

2. Alkaline phosphatase test to check the efficiency of pasteurization of milk.

3. Isolation of any food borne bacteria from food products.

4. Isolation of spoilage microorganisms from spoiled vegetables/fruits.

5. Isolation of spoilage microorganisms from bread.

6. Preparation of Yogurt/Dahi.

SUGGESTED READINGS

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.

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 McGrawHill 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.

TIU-HMB-T3C13:INDUSTRIAL MICROBIOLOGY (THEORY)

TOTAL HOURS: 60 CREDITS: 4Unit 1 Introduction to industrial microbiologyNo. of Hours: 2

Brief history and developments in industrial microbiology

Unit 2 Isolation of industrially important microbial strains and fermentation media

No. of Hours: 10

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 parameters
No. of Hours: 12
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 No. of Hours: 6 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)
No. of Hours: 18
Citric acid, ethanol, penicillin, glutamic acid, Vitamin B12 Enzymes (amylase, protease, lipase) Wine, beer

Unit 6 Enzyme immobilization No. of Hours: 4 Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase)

TIU-HMB-P3C13:INDUSTRIAL MICROBIOLOGY (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 2 1. Study different parts of fermenter

2. Microbial fermentations for the production and estimation (qualitative and quantitative) of: (a) Enzymes: Amylase and Protease (b) Amino acid: Glutamic acid (c) Organic acid: Citric acid (d) Alcohol: Ethanol

TECHNO INDIA UNIVERSITY
WESTBENGAL

EM 4, Sector V, Salt Lake, Kolkata-700091, West Bengal, India
Phone: +91 9836544416/17/18/19, Fax: +91 33 2357 1097

3. A visit to any educational institute/industry to see an industrial fermenter, and other downstream processing operations.

SUGGESTED READINGS

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. 2nd edition.Panima Publishing Co. New Delhi.

7. Stanbury PF, Whitaker A and Hall SJ.(2006). Principles of Fermentation Technology.2nd edition, Elsevier Science Ltd.

Discipline Specific Elective Courses

SEMESTER 5

TIU-HMB-T3D1: BIOMATHEMATICS ANDBIOSTATISTICS (THEORY)

TOTAL HOURS: 60 CREDITS: 4Unit 1 Biomathematics No of Hours: 30 Sets. Functions and their graphs : polynomial, sine, cosine, exponential and logarithmic functions. Motivation and illustration for these functions through projectile motion, simple pendulum, biological rhythms, cell division, muscular fibres etc. Simple observations about these functions like increasing, decreasing and, periodicity. Sequences to be introduced through the examples arising in Science beginning with finite sequences, followed by concepts of recursion and difference equations.For instance, the

Fibonacci sequence arising from branching habit of trees and breeding habit of rabbits.Intuitive idea of algebraic relationships and convergence.Infinite Geometric Series.Series formulas for ex, log (1+x), sin x, cos x. Step function.Intuitive idea of discontinuity, continuity and limits.Differentiation.Conception to be motivated through simple concrete examples as given above from Biological and Physical Sciences.Use of methods of differentiation like Chain rule, Product rule and Quotient rule. Second order derivatives of above functions. Integration as reverse process of differentiation. Integrals of the functions introduced above. Differential Equations of first order, Linear Differential Equations.Points in plane and space and coordinate form.Examples of matrices arising in Biological Sciences and Biological networks. Sum and Produce of matrices upto order 3.

Unit 2 Biostatistics No of Hours: 30 Measures of central tendency, Measures of dispersion; skewness, kurtosis; Elementary Probability and basic laws; Discrete and Continuous Random variable, Mathematical Expectation; Curve Fitting; Correlation and Regression. Emphasis on examples from Biological Sciences; Mean and Variance of Discrete and Continuous Distributions namely Binomial, Poisson, Geometric, Weibull, Logistic and Normal distribution. Fitting of Distributions; Statistical methods: Scope of statistics: utility and misuse. Principles of statistical analysis of biological data.Sampling parameters. Difference between sample and Population, Sampling Errors, Censoring, difference between parametric and non-parametric statistics; Sampling Distributions, Standard Error, Testing of Hypothesis, Level of Significance and Degree of Freedom; Large Sample Test based on Normal Distribution, Small sample test based on t-test, Z- test and F test; Confidence Interval; Distribution-free test - Chi-square test; Basic introduction to Multivariate statistics, etc.

TIU-HMB-P3D1: BIOMATHEMATICS ANDBIOSTATISTICS (PRACTICAL)

TOTAL HOURS: 60 CREDITS: 2 1. Word Problems based on Differential Equations

2. Mean, Median, Mode from grouped and ungrouped Data set

3. Standard Deviation and Coefficient of Variation

 4. Skewness and Kurtosis

5. Curve fitting

6. Correlation

7. Regression

8. Finding area under the curve using normal probability

9. Testing of Hypothesis- Normal Distribution, t-test and Chi-Square-test

10. Confidence Interval

SUGGESTED READINGS

1. H. S. Bear: Understanding Calculus, John Wiley and Sons (Second Edition); 2003.

2. E. Batschelet : Introduction to Mathematics for Life Scientists,SpringerVerlag, International Student Edition, Narosa Publishing House, New Delhi (1971, 1975)

3. A. Edmondson and D. Druce : Advanced Biology Statistics, Oxford University Press; 1996.

4. W. Danial : Biostatistics : A foundation for Analysis in Health Sciences, John Wiley and Sons Inc; 2004.

TIU-HMB-T3D3 MEDICAL & DIAGNOSTIC MICROBIOLOGY

TIU-HMB-T3D5:ADVANCES IN MICROBIOLOGY

(THEORY)

TOTAL HOURS: 60 CREDITS: 4Unit 1 Evolution of Microbial Genomes No. of Hours: 15 Salient features of sequenced microbial genomes, core genome pool, flexible genome pool and concept of pangenome, Horizontal gene transfer (HGT), Evolution of bacterial virulence - Genomic islands, Pathogenicity islands (PAI) and their characteristics

Unit 2 MetagenomicsNo. of Hours: 15 Brief history and development of metagenomics, Understanding bacterial diversity using metagenomics approach, Prospecting genes of biotechnological importance using metagenomics Basic knowledge of viral metagenome, metatranscriptomics, metaproteomics and metabolomics.

Unit 3 Molecular Basis of Host-Microbe Interactions No. of Hours: 15 Epiphytic fitness and its mechanism in plant pathogens, Hypersensitive response (HR) to plant pathogens and its mechanism, Type three secretion systems (TTSS) of plant and animal pathogens, Biofilms: types of microorganisms, molecular aspects and significance in environment, health care, virulence and antimicrobial resistance

Unit 4 Systems and Synthetic Biology No. of Hours: 15 Networking in biological systems, Quorum sensing in bacteria, Co-ordinated regulation of bacterial virulence factors, Basics of synthesis of poliovirus in laboratory, Future implications of synthetic biology with respect to bacteria and viruses

GET IT ON
Google Play

WWW.TECHNOINDIAUNIVERSITY.AC.IN

TIU-HMB-P3D5:ADVANCES IN MICROBIOLOGY

(PRACTICAL)

TOTAL HOURS: 60 CREDITS: 21. Extraction of metagenomic DNA from soil

2. Understand the impediments in extracting metagenomic DNA from soil

3. PCR amplification of metagenomic DNA using universal 16s ribosomal gene primers

4. Case study to understand how the poliovirus genome was synthesized in the laboratory

5. Case study to understand how networking of metabolic pathways in bacteria takes place

SUGGESTED READING

1. Fraser CM, Read TD and Nelson KE. Microbial Genomes, 2004, Humana Press

2. Miller RV and Day MJ. Microbial Evolution- Gene establishment, survival and exchange, 2004, ASM Press

3. Bull AT. Microbial Diversity and Bioprospecting, 2004, ASM Press

4. Sangdun C. Introduction to Systems Biology, 2007, Humana Press

5. Klipp E, Liebermeister W. Systems Biology – A Textbook, 2009, Wiley –VCH Verlag

6. Caetano-Anolles G. Evolutionary Genomics and Systems Biology, 2010, John Wiley and Sons

7. Madigan MT, Martink JM, Dunlap PV and Clark DP (2014) Brook's Biology of Microorganisms, 14th edition, Pearson-Bejamin Cummings

8. Wilson BA, Salyers AA Whitt DD and Winkler ME (2011)Bacterial Pathogenesis- A molecular Approach, 3rd edition, ASM Press,

9. Bouarab K, Brisson and Daayf F (2009) Molecular Plant-Microbe interaction CAB International 10.Voit EO (2012) A First Course in Systems Biology, Istedition,Garland Science

WWW.TECHNOINDIAUNIVERSITY.AC.IN