TECHNO INDIA UNIVERSITY

WEST BENGAL

DEPARTMENT OF MICROBIOLOGY

SYLLABUS STRUCTURE AND COURSE DETAILS

w.e.f 2024-25

SEMESTER 2

BACTERIOLOGY (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: BACTERIOLOGY (Theory)	**Subject Code:** TIU-UMB-MJ-T12101
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE :

Enable the student to:

1. To understand the fundamental characteristics of bacterial cells, including size, shape, and arrangement.
2. To learn methods of pure culture isolation, including streaking, serial dilution, and plating techniques.
3. To understand the working principles and applications of different types of microscopes, including Bright Field, Dark Field, and Phase Contrast Microscopes.
4. To understand the fundamental principles of microbial classification, systematics, and taxonomy.

OURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Understand Prokaryotic Cell Organization	K2
CO-2:	Interpret Bacteriological Techniques for Culture Isolation and Preservation	K2
CO-3:	Apply Staining Techniques for Bacterial Identification and Explore Advanced Microscopy Techniques	K4
CO-4:	Analyze Bacterial Growth and Nutritional Requirements	K3
CO-5:	Understand Bacterial Reproduction and Growth Kinetics	K3
CO-6:	Classify Important Archaeal and Eubacterial Groups	K3

COURSE CONTENT :

MODULE 1:	**HISTORY OF DEVELOPMENT OF MICROBIOLOGY**	**8 Hours**
Cell size, shape and arrangement, glycocalyx, capsule, flagella, endoflagella, fimbriae, and pili. Cell wall: Composition and detailed structure of Gram-positive and Gram-negative cell walls, Archaebacterial cell wall, Gram and acid-fast staining mechanisms, lipopolysaccharide (LPS), spheroplasts, protoplasts, and L-forms. Effect of antibiotics and enzymes on the cell wall. Cell Membrane: Structure, function, and chemical composition of bacterial and archaeal cell membranes. Cytoplasm: Ribosomes, mesosomes, inclusion		

bodies, nucleoids, chromosomes, and plasmids Endospore: Structure, formation, stages of sporulation.		
MODULE 2:	**BACTERIOLOGICAL TECHNIQUES**	**6 Hours**
Pure culture isolation: Streaking, serial dilution, and plating methods; cultivation, maintenance, and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, and accessing non- culturable bacteria.		
MODULE 3:	**STAINS AND STAINING TECHNIQUES**	**6 Hours**
Definition of auxochrome; chromophores; acidic and basic dyes; classification of stains; simple and differential staining: theories of staining, mordant and its function; Gram staining; acid fast staining; endospore staining; negative staining ; capsule staining; flagella staining; mechanism of Gram staining.		
MODULE 4:	**MICROSCOPY**	**5 Hours**
Bright Field Microscope, Dark Field Microscope, Phase Contrast Microscope, Fluorescence Microscope, Confocal microscopy, Scanning and Transmission Electron Microscope		
MODULE 5:	**GROWTH AND NUTRITION**	**7 Hours**
Nutritional requirements in bacteria and nutritional categories; Culture media: components of media, natural and synthetic media, chemically defined media, complex media, selective, differential, indicator, enriched and enrichment media Physical methods of microbial control: heat, low temperature, high pressure, filtration, desiccation, osmotic pressure, radiation Chemical methods of microbial control: disinfectants, types, and mode of action		
MODULE 6:	**REPRODUCTION IN BACTERIA**	**5 Hours**
Asexual methods of reproduction, logarithmic representation of bacterial populations, phases of growth, calculation of generation time, and specific growth rate		

MODULE 7:	IMPORTANT ARCHAEAL AND EUBACTERIAL GROUPS	8 Hours
Aim and basic principles of classification, systematics, and taxonomy, the concept of species, taxa, strain; Archaebacteria: General characteristics, phylogenetic overview, genera belonging to Nanoarchaeota(Nanoarchaeum), Crenarchaeota (Sulfolobus, Thermoproteus) and Euryarchaeota [Methanogens (Methanobacterium, Methanocaldococcus), thermophiles (Thermococcus, Pyrococcus, Thermoplasma), and Halophiles (Halobacterium, Halococcus)] Eubacteria: Introduction and importance of following groups: Gram Negative: Non-proteobacteria: General characteristics with suitable examples Alpha proteobacteria: General characteristics with suitable examples Beta proteobacteria: General characteristics with suitable examples Gamma proteobacteria: General characteristics with suitable examples, Delta proteobacteria: General characteristics with suitable examples, Epsilon proteobacteria: General characteristics with suitable examples Zeta proteobacteria: General characteristics with suitable examples		
TOTAL LECTURES		**45 Hours****

Books:

1. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition
3. Cappucino J and Sherman N. (2010). Microbiology: A Laboratory Manual. 9th edition. Pearson Education Limited
4. Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9 Edition. McGraw Hill International.
5. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
6. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
7. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR. (2005).GeneralMicrobiology. 5 th edition. McMillan.

BACTERIOLOGY (Practical)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: BACTERIOLOGY (Practical)	**Subject Code:** TIU-UMB-MJ-L12101
Contact Hours/Week: 0–0–1 (L–T–P)	**Credit:** 1

COURSE OBJECTIVE :

Enable the student to:

1. To understand the composition and preparation of synthetic media
2. To study the principles and applications of negative staining.
3. To understand the principle and mechanism of staining techniques.
4. To explore various bacterial culture preservation techniques such as refrigeration, deep freezing, and lyophilization.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Prepare and Utilize Different Microbiological Media	K2
CO-2:	Understand how to perform Essential Bacterial Staining Techniques	K2
CO-3:	Evaluate bacterial morphology and structure	K5
CO-4:	Apply the Techniques for bacterial culture Isolation	K3
CO-5:	Cultivation of Pure Cultures techniques in different selective medium	K3
CO-6:	Quantify Bacterial Growth Using CFU Estimation	K5

COURSE CONTENT :

MODULE 1:	SKILLED IN MICROBIOLOGICAL CULTURE PREPARATION	**15 Hours**
Preparation of different media: synthetic media CzapekDox media and /or BG-11, Complex media-Nutrient agar, McConkey agar, EMB agar. 2. Simple staining 3. Negative staining 4. Gram's staining 5. Capsule staining 6. Endospore staining. 7. Isolation of pure cultures of bacteria by the streaking methods. 8. Preservation of bacterial cultures by various techniques. 9. Estimation of CFU count by spread plate method/pour plate method.		
TOTAL LECTURES		**15 Hours****

B.Sc. Chemistry (minor)

Syllabus

Program: B.Sc. Chemistry (minor)	**Year, Semester:** Ist year., 2nd Sem.
Course Title: Chemistry	**Subject Code**: TIU-UCH-MI-T12101

Contact Hours/Week: 3-0-0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE:

Enable the student to:

1. Understand the basic concept of structure of atom, covalent bonding, non covalent bonding thermodynamics, chemical kinetics ionic equilibria, nomenclature, stereochemistry, structures, reactivity, and mechanism of chemical reactions.
2. Apply the concept of thermodynamics, chemical kinetics, and ionic equilibria, in the relevant advanced and emerging field of biotechnological studies.
3. Apply the concept of covalent and non covalent bonding, in acquiring information regarding the metals used in any process of biotechnological system.
4. Remember the knowledge of stereochemistry and reaction mechanism in understanding the glimpse of the reaction pathways involved in the biotechnology process.
5. Understand the concept of various types of bonding, energy distributions in atomic and molecular orbital makes the student easier to understand the technology based on them.

COURSE OUTCOME:

On completion of the course, the student will be able to:

COURSE CONTENT:

CO-1:	Understand the underlying concepts of development of periodic table and learn to predict properties of elements by going through periodic variations of properties across the period and down the group. They will be able to use the periodic table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity.	**K2**
CO-1:	Understand the underlying concepts of development of periodic table and learn to predict properties of elements by going through periodic variations of properties across the period and down the group. They will be able to use the periodic table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity.	**K2**
CO-1:	Understand the underlying concepts of development of periodic table and learn to predict properties of elements by going through periodic variations of properties across the period and down the group. They will be able to use the periodic table to rationalize similarities and differences of elements, including physical and	**K2**

	chemical properties and reactivity.	
CO-1:	Understand the underlying concepts of development of periodic table and learn to predict properties of elements by going through periodic variations of properties across the period and down the group. They will be able to use the periodic table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity.	**K1**
CO-1:	Understand the underlying concepts of development of periodic table and learn to predict properties of elements by going through periodic variations of properties across the period and down the group. They will be able to use the periodic table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity.	**K2**
CO-1:	Understand the underlying concepts of development of periodic table and learn to predict properties of elements by going through periodic variations of properties across the period and down the group. They will be able to use the periodic table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity	**K3**

MODULE 1:		**14 Hours**
1.	**PERIODIC TRENDS AND PROPERTIES**	**5 hours**
(i) General idea about modern periodic table, Definition and trends of variation of atomic and ionic radii, ionization energy, electron affinity and electro negativity, Prediction of chemical behaviour of elements and compounds. (ii) Comparative study of p-block elements: Electronic configuration, common oxidation states, inert pair effect. Important compounds and their properties and reactivity's		
2	**COORDINATION CHEMISTRY**	**4 Hours**
Werner's coordination theory. Structural and stereoisomerism in complexes, Drawbacks of VBT.		
3	**VBT AND LIGAND FIELD THEORY**	**5 Hours**
Valence Bond Theory (VBT), inner and outer orbital complexes. Ligand field effect, splitting of d orbitals in octahedral and tetrahedral complexes, Factors affecting the		

magnitude of splitting, spectrochemical series, crystal field stabilization energy (CFSE). Distortion in octahedral and tetrahedral geometries, Jahn-Teller theorem. Splitting of d orbitals in square planar complex.		
MODULE 2:		**15 Hours**
1.	**SUBSTITUTION ELIMINATION AND ADDITION REACTIONS**	**4 Hours**
Carbocations, non-classical carbocations, carbanions, carbon radicals, generation and stability, structure and electrophilic / nucleophilic behaviour of reactive intermediates (elementary idea). Nucleophilic substitutions: SN1, SN2 and SNi reactions. Eliminations: E1, E2 and E1cB reactions (elementary mechanistic aspects), Saytzeff and Hofmann eliminations. Electrophilic and nucleophilic addition reactions of unsaturated hydrocarbons and carbonyls		
2.	**AROMATIC ELECTROPHILIC SUBSTITUTION**	**5 Hours**
Mechanism of nitration, halogenation, sulphonation, and Friedel-Crafts (alkylationa and acylation) reactions. Effects of substituents on orientation and reactivity.		
3.	**PHYSICAL ORGANIC CHEMISTRY**	**6 Hours**
Free energy and equilibrium, enthalpy and entropy factor, calculation of enthalpy change via BDE, intermolecular & intramolecular reactions. Rate constant and free energy of activation, free energy profiles for one-step, and two-step reactions. Catalyzed reactions, principle of microscopic reversibility. Hammond's postulate. Halogenation of alkanes, mechanism (with evidence) and stereo chemical features. Reactivity-selectivity principle in the light of Hammond's postulate.		
MODULE 3:		**15 Hours**
1.	**LIQUID STATE**	**3 Hours**
Surface tension of liquids - capillary action, experimental determination of surface tension, temperature effect on surface tension. Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature		
2.	**IONIC EQUILIBRIA**	**3 Hours**
Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases. pH scale. Common ion effect. Salt hydrolysis, calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts, applications of solubility product		

principle.		
3.	**BIOMOLECULES**	**6 Hours**
Amino acids, peptides and proteins: Amino acids (Nature, Chemical reaction, Detection and Configuration); Peptides (The Peptide Linkage, Structure of Polypeptides); Proteins (General Characteristics, Classification, Structure). Carbohydrate: Introduction, occurrence, classification, constitution of glucose, osazone formation. Brief descriptions of lipids, fats and nucleic materials (DNA, RNA).		
TOTAL LECTURES		**44 Hours****
Note: ** Total teaching hours for a 4credit course = 39 – 45 hours with 3 Lecturers and 1 tutorial		

BOOKS

1. Basic Inorganic Chemistry, F. A Cotton, G. Wilkinson, John Wiley & Sons.
2. Concise Inorganic Chemistry, J. D. Lee, Chapman & Hall.
3. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice-Hall, New Delhi.
4. Organic Chemistry, I. L. Finar, [Vol. I & Vol. II], ELBS and Longman Ltd., New Delhi.
5. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, and E. Wothers, , Oxford Univ. Press.
6. Physical Chemistry, P. C. Rakshit**,** Sarat Book House, Calcutta.
7. Principles of Physical Chemistry, B. R. Puri, L. R. Sharma, and M. S. Pathania**,** Shoban Lal Nagin Chand & Co., Jalandhar.
8. L. Stryer, Biochemistry, Freeman & Co.
9. D. L. Nelson and M. M. Cox, Lehninger, Principles of Biochemistry, McMillan North Publication.

B.Sc. Chemistry (minor)
Lab Syllabus

Program: B.Sc. Chemistry (minor)	**Year, Semester:** 1st year., 2nd Sem.
Course Title: Chemistry Lab	**Subject Code**: TIU-UCH-MI-L12101
Contact Hours/Week: 0-0-2 (L–T–P)	**Credit: 1**

COURSE OBJECTIVE:

Enable the student to:

1. Understand the safety protocol and adhere to the best laboratory practical purpose

2. Understand the chemical nature of the hazardous chemicals.
3. Create an experimental procedure to perform reactions in order to synthesize important organic compounds and metal complexes.
4. Understand the characterization techniques such as melting point, UV-visible absorption etc.
5. Understand the basic analytical tool in order to prepare the solutions required for various types of titrimetric analysis
6. Apply the knowledge of analytical technique for the determination of exact strength of the solutions by using a primary standard.

COURSE OUTCOME:

On completion of the course, the student will be able to:

CO-1:	**Understand** the safety protocols, and practice the best practices inside a chemistry lab.	K2
CO-2:	**Understand** the nature of various types of reagents and their handling as well as storage.	K2
CO-3:	**Create** an experimental procedure and perform reactions to synthesize important organic compounds and metal complexes	K6
CO-4:	**Understand** the preliminary characterization techniques such as melting point, UV-visible absorption etc.	K2
CO-5:	**Understand** the basic analytical techniques, such as Prepare the solutions required for various types of titrimetric analysis and determination of exact strength of the solutions by using a primary standard.	K2
CO-6:	**Apply** the analytical skills to estimate quantitatively various metal ions, inorganic elements, active ingredients etc. present in samples of various types.	K3

COURSE CONTENT:

EXPERIMENT-1:	**Synthesis of metal complex**
(i) Synthesis of a series of metal complexes (with ligands of varying ligand field strength), electronic spectral interpretation and calculation of various ligand-field parameters. (ii) Synthesis of metal complexes and determination of melting point, UV-vis absorption.	
EXPERIMENT-2:	Preparation of Inorganic Compounds
(i) Standardization of $Na_2S_2O_3$ solution against standard $K_2Cr_2O_7$ solution. (ii) Estimation of available chlorine in bleaching powder. (iii) Determination of reaction rate of iodide with hydrogen peroxide in acidic medium (iodine clock reaction	

EXPERIMENT-3:	**Preparation of Organic Compounds:**
(i) m-dinitrobenzene, (ii) Acetanilide, (iii) Bromo acetanilide,	
EXPERIMENT-4:	**Determination of surface tension of liquids.**
EXPERIMENT-5:	**Determination of viscosity coefficients of liquids.**
EXPERIMENT-6:	**Quantitative Analysis through titrations (Physical and Volumetric)**
i) Preparation of standard solution of oxalic acid and standardization of (a) NaOH solution and (b) KMnO4 solution. ii) Estimation of Carbonate and bicarbonate present together in a mixture iii) Estimation of acetic acid in commercial Vinegar. iv) Preparation and standardization Mohr's solution by standard KMnO4 solution. v) Complexometric titrations: Zn2+, Mg2+, Ca2+, Fe2+ with EDTA vi) Estimation of total hardness of water by titration with EDTA vii) Estimation of Fe(II) and Fe(III) in a given mixture using standard K2Cr2O7	

BOOK

1. Mendham, J., A. I. Vogel's Quantitative Chemical Analysis 6th Ed., Pearson, 2009.

COMMUNICATIVE ENGLISH- II

Program:	**Year, Semester:** 1st year., 2nd Sem.
Course Title: Communicative English- II	**Subject Code:** TIU-UEN-AEC-S1201
Contact Hours/Week: 2–0–0 (L–T–P)	**Credit: 2**

COURSE OBJECTIVE :

The primary objective is to develop in the undergraduate students a level of competence in English required for independent and effective communication for academic and industry needs. In addition to fostering the ability to use English skillfully, the graduates are trained to adapt to the changing social circumstances. These courses also enable them to engage in life-long learning and pursue advanced level studies in future.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Apply common rules of English grammar in analyzing sentence structure	K1
CO-2:	Read, understand and evaluate a text intrinsically as well as extrinsically	K2
CO-3:	Articulate one's ideas and thoughts in grammatically correct and culturally appropriate language in various academic and professional writings.	K3
CO-4:	Apply the strategies and techniques learnt in carrying out conversations across different contexts.	K4
CO-5:	Create presentations to address general as well as technical audiences.	K5
CO-6:	Acquire skills required in a professional environment.	K6

COURSE CONTENT :

MODULE 1:	**Advanced Grammar & Expressive Language**	**6 Hours**
Sentence Structure, Tenses, Articles, Prepositions Subject-Verb Agreement Similes, Idioms, and Anecdotes		
MODULE 2:	**Professional & Technical Writing**	**6 Hours**
Poster & Multimedia Presentations Press Releases & Technical Documents Presentation Skills for Meetings		
MODULE 3:	**Workplace Communication & Email Etiquette**	**6 Hours**
Formal and Informal Communication Writing Effective Emails Interpersonal Communication and Empathy		
MODULE 4:	**Analytical Reading & Employability Skills**	**6 Hours**
Critical Reading and Evaluation Techniques Grooming and Social Etiquette		
MODULE 5:	**Course Review**	**6 Hours**

Course Review

Recommended Books:

Main Reading:

1. Lata, Pushp, *Communication Skills*, Oxford University Press, 2015.
2. Rizvi Ashraf, *Effective Technical Communication*, Tata McGraw-Hill, 2017
3. Wren & Martin, *High School Grammar & Composition*, S. Chand and Sons, 1998.

Supplementary Reading:

1. Viswamohan Aysha, *English for Technical Communication*, Tata McGraw-Hill.
2. Gregory Bassham, William Irwin, Henry Nardone & James M. Wallace. *Critical Thinking: A Student's Introduction,* Tata McGraw Hill.
3. CIEFL, Hyderabad, *Exercises in Spoken English*. Parts.I-III.. Oxford University Press
4. Robin Torres- Gouzerh. *Intermediate English Grammar for ESL Learners*. Tata McGraw Hill.
5. Christopher Davies. *Divided by a Common Language.* Houghton Mifflin Company.

FOOD FERMENTATION TECHNIQUES AND PACKAGING (Theory)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem
Course Title: FOOD FERMENTATION TECHNIQUES AND PACKAGING (Theory)	**Subject Code:** TIU-UMB-SEC-T1201
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE :

Enable the student to:

1. To define fermented foods and understand their classification and types.
2. To explore the fermentation process involved in Idli, Dosa, Bread, Soy Sauce, and Tempeh, and milk products.
3. To understand the microbiological criteria used for food quality control.
4. To understand the basic principles and importance of food packaging.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Understand the Fundamentals of Fermented Foods	K2
CO-2:	Examine Milk-Based Fermented Foods and Dairy Starter Cultures	K5
CO-3:	Study the Microbiology of Grain-Based Fermented Foods	K4
CO-4:	Analyze the Fermentation of Vegetables and Investigate Fermented Meat and Fish Products	K4
CO-5:	Evaluate the Role of Probiotics in Human Health by evaluating the implementation of Food Microbiological Quality Control Measures	K5
CO-6:	Explore Food Packaging Techniques and Their Impact	K6

COURSE CONTENT :

MODULE 1:	**FERMENTED FOODS**	**6 Hours**
Definition, types, advantages, and health benefits		
MODULE 2:	**MILK BASED FERMENTED FOODS**	**8 Hours**
Dairy starter cultures, Dahi, Yogurt, Buttermilk (Chach), acidophilus milk, kumiss, kefir, and cheese: Preparation of inoculums, types of microorganisms, and production process		
MODULE 3:	**GRAIN-BASED FERMENTED FOODS**	**4 Hours**
Idli, Dosa, Bread, Soy sauce, tampeh: Microorganisms and production process		
MODULE 4:	**VEGETABLE-BASED FERMENTED FOODS**	**6 Hours**
Pickle, Saeurkraut: Microorganisms and production process		
MODULE 5:	**FERMENTED MEAT AND FISH**	**5 Hours**
Types, microorganisms involved, fermentation process		
MODULE 6:	**PROBIOTICS**	**5 Hours**
Probiotics: Health benefits, types of microorganisms used, probiotic foods available in the market.		

MODULE 7:	**CONTROLLING THE MICROBIOLOGICAL QUALITY OF FOODS**	**5 Hours**
Quality Control using Microbiological Criteria, Control at Source (Training, Facilities and Operations, Equipment, Cleaning, and Disinfection), Codes of Good Manufacturing Practice (HACCP), Identification of Critical Control Points, Quality Systems: FSSAI, BSI and their importance.		
MODULE 8:	**FOOD PACKAGING TECHNIQUES**	**6 Hours**
Basic principle of food packaging, importance, techniques in practice, merits and demerits of food packaging techniques		
TOTAL LECTURES		**45 Hours****

Books:

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 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.

Introduction to DBMS and Data Science through R (TIU-UCA-MD-T1201)

Program: B. Sc. in Microbiology	**Year, Semester:** 1st Yr., 2nd Sem.

Course Title:Introduction to DBMS and Data Science through R	**Subject Code:**TIU-UCA-MD-T1201
Contact Hours/Week: 2–1–0 (L–T–P)	**Credit:** 3

COURSE OBJECTIVE :

Enable the student to:

COURSE OUTCOME :

1. To introduce fundamental concepts of database management and data science using R, with applications in microbiology.
2. To provide practical skills for managing and analyzing microbiological data using relational databases and R programming.
3. To develop the ability to process, analyze, and visualize data using R.
4. To equip students with techniques for efficient data storage, retrieval, and interpretation.

The student will be able to:

CO-1	**Remembering:** Define key concepts in DBMS and R programming.	K1
CO-2	**Understanding:** Explain the structure and components of databases	K2
CO-3	**Applying:** Perform basic data analysis and visualization using R.	K3
CO-4	**Analyzing:** Distinguish between different types of databases and data models.	K4
CO-5	**Evaluating:** Assess the suitability of various data analysis techniques for microbiological data.	K4
CO-6	**Creating:** Develop R scripts for data cleaning, analysis, and presentation.	K6

COURSE CONTENT :

MODULE 1:	**Introduction to DBMS**	**3 Hours**
Fundamentals of Database Management Systems, Importance of data in microbiological research, Overview of relational databases and SQL.		
MODULE 2:	**Database Models and ER Diagrams**	**3 Hours**
Relational, hierarchical, and network models, Entity-Relationship diagrams and data modeling, Applications in microbial data management.		

MODULE 3:	**SQL for Microbiology**	**3 Hours**
Basic SQL commands: SELECT, INSERT, UPDATE, DELETE, Querying biological datasets, Case studies in data extraction and manipulation.		
MODULE 4:	**Data Normalization and Integrity**	**3 Hours**
Concepts of data redundancy and normalization, Integrity constraints and data consistency, Normal forms and their application.		
MODULE 5:	**Introduction to R Programming**	**3 Hours**
Installing R and RStudio, Data types and basic syntax, Writing simple R scripts.		
MODULE 6:	**Data Manipulation in R**	**3 Hours**
Vectors, data frames, and lists, Subsetting and data filtering, Microbiological data handling using R.		
MODULE 7:	**Data Visualization with R**	**3 Hours**
Basic plotting techniques using ggplot2, Visualizing microbial growth and experiment data, Creating histograms, bar plots, and scatter plots.		
MODULE 8:	**Statistical Analysis using R**	**3 Hours**
Descriptive statistics and hypothesis testing, Correlation and regression analysis, Application to microbial data interpretation.		
MODULE 9:	**Integrating R with Databases**	**3 Hours**
Connecting R with SQL databases, Extracting, transforming, and loading data.		
MODULE 10:	**Project and Assessment**	**3 Hours**
Hands-on project: Analyzing microbial data, Presentation of results, Peer evaluation and feedback.		
TOTAL LECTURE		**30 Hours**

Recommended Books:

- Database Management Systems by Raghu Ramakrishnan
- Hands-On Programming with R by Garrett Grolemund
- Data Science with R for Beginners by Sharan Kumar Ravindran
- Online R practice platforms (e.g., DataCamp, Kaggle).

- **Course Articulation Matrix:**

Educational Perspectives (TIU-UED-CVA-T1202)

Program: BSc Microbiology	**Year, Semester: 1st year, 2nd SEM**.
Course Title: Educational Perspectives	**Subject Code:** TIU-UED-CVA-T1202
Contact Hours/Week: 2-0-0 L-T-P	**Credit: 2**

COURSE OBJECTIVE :

Enable the student to:

1. Get a background of contemporary Indian education systems.
2. Analyze the nature of problems in Indian education and possible solutions.
3. design and implement effective learning systems through innovative curricula and classroom management techniques.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Explain the concept, scope and types of education wrt India	K2
CO-2:	Analyse critically the history behind Macauley's minutes and it's consequences on the Indian Education system	K2
CO-3:	Study the recommendations of various commissions post independence and their impact on the education system	K4
CO-4:	Understand the need and highlights of NEP 2020 and NCF 2023 wrt Indian employment trends	K3
CO-5:	Develop educational models and classroom techniques best suited to contemporary needs of children and youth	K3
CO-6:	Utilise principles and theories of curriculum design to discuss best practices in science and humanities education .	K3

COURSE CONTENT :

MODULE 1:	**INTRODUCTION**	**3 Hours**
Definition of Education, stress on Vivekananda, Dewey, Tagore, Gandhi, nature and scope of education, types of education and their examples in Indian contexts		
MODULE 2:	**MACAULAY'S MINUTES: HISTORY AND CONSEQUENCES**	**3 Hours**

British decision making on Indian education, the origin of MACAULAY'S thought, main features of their education system, impact on indigenous learning systems and consequences till the present day		
MODULE 3:	**UNIVERSITY EDUCATION COMMISSION AND SECONDARY EDUCATION COMMISSION**	**5 Hours**
Principal thoughts of S. Radhakrishnan and Mudaliar, reflections of then social needs in the recommendations, salient features and impact on Indian education and socio economic progress, employment skill development		
MODULE 4:	**KOTHARI COMMISSION AND YASHPAL COMMITTEE**	**5 Hours**
Salient features of the 1964 commission and impact on educational policy, special emphasis on cluster schools, teacher education, 3 language formula, vocational education, Need for Yashpal Commitee and learning without burden		
MODULE 5:	**DELORS COMMISSION UNESCO AND NEP 2020**	**7 Hours**
Detailed discussion on all aspects of the documents, the need and requirements of contemporary India and the world, ODL, EFA, CAI, AI based educational initiatives, skill education, SDG based education, INdian knowledge systems		
MODULE 6:	**CLASSROOM MANAGEMENT AND CURRICULUM DESIGN**	**7 Hours**
Principles of classroom management, development of growth mindset, reinforcement and facilitation, models of curriculum development by Tyler and Hilda Taba		
TOTAL LECTURES		**30 Hours**

Books:

- http://www.academics-india.com/Radhakrishnan%20Commission%20Report%20of%201948-49.pdf
- https://www.educationforallinindia.com/1953%20Secondary_Education_Commission_Report.pdf
- http://www.academics-india.com/Kothari%20Commission%20Report.pdf
- https://hreat.org/impletter/Learning%20without%20Burden.pdf
- https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
- https://wbsu.ac.in/web/wp-content/uploads/2020/08/SEM4CSU-2_SCA.pdf

Psychology: Approach To Health and Society (TIU-UPY-MI-L12101)

Program: B.Sc. in Microbiology	**Year, Semester: 1st** Yr., 2nd Sem.
Course Title: Psychology: Approach To Health and Society	**Subject Code:**TIU-UPY-MI-L12101
Contact Hours/Week: 2–0–0 (L–T–P)	**Credit:** 2

COURSE OBJECTIVE :

Enable the student in:

4. Explore the origin, evolution, and key perspectives of psychology to understand human behavior.
5. Examine emotional intelligence models and apply strategies for self and social management.
6. Investigate stress, its physiological impact, and coping strategies for well-being.
7. Assess public health issues and interventions for health promotion and disease prevention.

COURSE OUTCOME :

On completion of the course, the student will be able to:

CO-1:	Explain the concept, origin, evolution, and key perspectives of psychology, including behavioral, cognitive, and socio-cultural approaches.	K2
CO-2:	Describe the nature, significance, and models of emotional intelligence and evaluate its building blocks, including self-awareness, self-management, social awareness, and relationship management.	K4
CO-3:	Demonstrate knowledge of measuring emotional intelligence and implement strategies to develop and enhance emotional regulation, including managing emotions, anxiety, fear, and anger.	K3
CO-4:	Explain the concept, models, and physiological response of stress while identifying internal, external, and interpersonal sources of stress and their impact on emotional and physical well-being.	K4
CO-5:	Analyze various coping strategies, factors affecting coping, and stress management techniques at physical, cognitive, and behavioral levels to enhance psychological resilience.	K5
CO-6:	Examine public health policies, health inequalities, health risk behaviors, and strategies for promoting community well-being, including disease prevention and self-empowerment initiatives.	K2

COURSE CONTENT :

MODULE 1:	**INTRODUCTION TO PSYCHOLOGY**	**7 Hours**
Unit i: Concept and introduction to psychology,its origin and evolution. Unit ii:Definition of Psychology, nature , ii.a.Early Definitions. ii.b.Current Definitions. ii.c. Nature and Characteristics of Behaviour. Unit iii: key perspective in psychology – Behavioural, Cognitive,Socio cultural.		
MODULE 2:	**EMOTIONAL INTELLIGENCE**	**9 Hours**
Unit i: Concept of Emotional Intelligence: Nature and Significance. Unit i.a: Emotion- Meaning, characteristics of emotion, components of emotion-cognitive component, Physiological component, Behavioural component. Unit ii: Models of emotional intelligence: Ability, Trait, and Mixed. Unit iii: Building blocks of emotional intelligence: self-awareness, self-management, social awareness, and relationship management. Unit iv: Emotional Intelligence: Measurement and Development. Unit iv.a. Measures of emotional intelligence. Unit iv.b.Strategies to develop and enhance emotional intelligence. Unit V: Self Management: Managing emotions, anxiety, fear, and anger.		
MODULE 3:	**STRESS AND COPING**	**7 Hours**
Unit-I: Stress: Concept, Meaning, Definition and Models, Stimulus, Response, Transaction. Unit I. a. Physiology of Stress: Endocrine Response Sequence, ANS response. Unit-II: Sources of Stress: Internal, External, Interpersonal; Systemic. Unit II .a: Impact of Stress: Physical, Emotional, Cognitive, Behavioral, Stress & Eustress. Unit-III: Coping with Stress: Complexity of Coping; Coping-concept, Process of coping, Coping and adaptation, Coping strategy and style, types of coping styles: Proactive and Explanatory, Factors affecting coping. Unit-IV: Stress Management and Coping: Symptoms/ Alarms; Management techniques, Physical Level, Cognitive and behavioural skills/ techniques.		
MODULE 4:	**COMMUNITY HEALTH PSYCHOLOGY**	**7 Hours**
Unit-I: Community Health: Concept, History, Approaches, Public Health Policies: WHO. Unit-II Health Inequalities and Community Health Programme: Health differentials; Issues related to poverty, Minority status and health; Gender and Health; Work and health; Community health programme and evaluation. Unit-III: Community Health and Hazards: Health habits and health behavior; Food habits, Health risk behavior (use of Tobacco, Alcohol, Drugs), Strategies for changing health risk behavior (cognitive, behavioral, motivational, emotional approaches), Reproductive health, Health promotion and disease, Prevention: Applications of Psychological principles, Self empowerment, Community development.		

Unit-IV: Community Health Care: Health seeking behavior (screening for disease detection); Immunization; Predicting health behavior (influences on health behavior)	
TOTAL LECTURES	**30 Hours**

Books:

1. Atkinson, R.L., Atkinson, R.C., Smith, E.E., &Hilgard, E.R. : Introduction to Psychology, (Latest Edition). Harcourt Brace Java Publishers, Tokyo.
2. Baron, R. &Misra.G. (2013).Psychology. New Delhi: Pearson.
3. Mangal, S.K. : General Psychology, (Latest Edition) Sterling Publishers Pvt. Ltd., 1998. McGraw Hill New Delhi, ISE,1988.
4. Goleman, D. (1998). Working with Emotional Intelligence. New York: Bantam Books.
5. Singh, D. (2003). Emotional intelligence at work (2nd ed.) New Delhi: Response Books
6. Snyder, C. R., Lopez, S. J., Edwards, L. M., & Marques, S. C. (Eds.). (2016). The Oxford Handbook of Positive Psychology (3rd ed.). Oxford University Press.
7. DiMatteo, M.R &. Martin, L.R.(2002). Health Psychology. New Delhi: Pearson.
8. Taylor. S.E. 2006).Health Psychology.6th Edition.New Delhi
9. Brannon, L., &Feist, J. (2007).Introduction to Health Psychology. Thomson India Edition.
10. Ghosh, Manika (2015). Health Psychology: Concepts in Health and Well-being. New Delhi: Pearson.