Scheme of B. Sc./ B.Sc. (Hons.) Microbiology

Year	Course Code	Subject Name	Theory/ Practical/Project	Total Credit	Total Marks	
					Max	Min
First year	MICRO -1T	Microbial World and Microbial Techniques	Theory	4	50	17
	MICRO -2T	Bacteriology, Virology & Proto-zoology	Theory	4	50	17
	MICRO -1P	LAB 1: BASIC MICROBIOLOGY	Practical	2	50	17
Second year	MICRO -3T	Cell Biology, Biochemistry and Bioinstrumentation	Theory	4	50	17
	MICRO -4T	Microbial Genetics, Molecular Biology & Genetic Engineering	Theory	4	50	17
	MICRO -2P	LAB 2: Bacterial cell, Biochemistry & Molecular Biology	Practical	2	50	17
Third year	MICRO -5T	Environmental, Agriculture, Industrial Microbiology & Biostatistics	Theory	4	50	17
	MICRO -6T	Immunology and Medical Microbiology	Theory	4	50	17
	MICRO -3P	LAB 3: Applied Microbiology	Practical	2	50	17
			Total (I+II+III years)	**30**	**450**	--

Note: There shall be four extra credits in each year for internship/apprenticeship. The certificate of extra credits for this would be provided by the concern University and is not mandatory.

Part - A: Introduction

Program: *Certificate Course*		Class: B. Sc. Part - I	Year: 2022	Session:2022-2023
1	Course Code	**MICRO -1P**		
2	Course Title	**BASIC MICROBIOLOGY**		
3	Course Type	**Laboratory Course**		
4	Pre-requisite (if, any)	As per Govt. norms		
5	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to ➢ ***handle instruments in microbiology lab.*** ➢ ***isolate, purify and observe microorganisms.*** ➢ ***maintain and preserve microbial culture***		
6	Credit Value	**02**		
7	Total Marks	**Max. Marks: 50**	**Min Passing Marks: 17**	

PART -B: Content of the Course

Total No. of Teaching Hours – 20 / 30 Periods

Group	Topics (Course contents) • It is a tentative list that can be amended by teacher/ department concerned.	No. of Period / Hour
A	1. Basic information about autoclave, hot air oven, laminar air flow and other laboratory instrument 2. Microscopy - Different parts of compound microscope. Handling and care of compound microscope 3. Preparation of solid &liquid culture media 4. Isolation of microorganism from soil, Isolation of single colonies on solid media by streak plate method. 5. Enumeration of bacteria by serial dilution and plating. 6. Measurement of microorganism (micrometry) and camera Lucida drawing of isolated organism. 7. Determination of bacterial growth by optical density measurements.	15 / 10
B	1. Preparation of laboratory Glass wares (Chemical washing, cleaning and drying) and Preparation of culture media (Liquid & solid). 2. Observation of microorganisms through permanent slides - Bacteria, Cyanobacteria, Protozoa, Fungi, Yeasts, and Algae 3. Observation of bacterial motility–Hanging drop technique / Agar Stab culture 4. Staining Techniques-Simple, Differential staining; Gram staining. Aseptic transfer techniques–types–Plate to slant/ slant to slant/ broth to broth. 5. Maintenance and preservation/stocking of pure cultures. 6. Study of the methods of isolation and propagation of plant viruses. 7. Study of cytopathic effects of viruses using photographs.	15 / 10
Keywords	***Isolation method, pure culture, culture media***	

PART – C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended:

1. Laboratory Manual of Microbiology and Biotechnology. by Aneja K. R
2. Practical Microbiology, R. C. Dubey and D. K. Maheshwari.
3. Laboratory Manual In Microbiology. By P. Gunasekaran.

OnlineResources –

1. https://open.umn.edu/opentextbooks/textbooks/499
2. https://vlab.amrita.edu/?sub=3&brch=73&sim=720&cnt=1

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE): Annual /University Exam(UE):	50 Marks NA 50 Marks	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

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Part-A: Introduction				
Program: *Certificate Course*		Class: **B. Sc. Part - I**	Year: **2022**	Session:2022-2023
1	Course Code	**MICRO -1T**		
2	Course Title	**Microbial World and Microbial Techniques**		
3	Course Type	**Core Course**		
4	Pre-requisite (if, any)	As per Government norms		
5	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able - ➢ ***to understand the nature, occurrence and diversity of Microorganisms in the environment*** ➢ ***to learn basic techniques microbial culture, identification and handling.*** ➢ ***to become familiar with the eminent microbiologists, historical background and scope of microbiology.***		
6	Credit Value	**04**		
7	TotalMarks	**Max.Marks:50**	**Min Passing Marks: 17**	

PART B: Content of the Course

Total No. of Teaching – Periods- 60 / Hours – 40

Unit	Topics (Course contents)	No. of Periods/ Hours
I	**Development of microbiology as a discipline**: Fundamental, History & Developments Introduction to various fields of Microbiology; Contributions of eminent scientists i.e. Antony von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Martinus W. Beijerinck, Sergei N. Winogradsky, Selman A. Waksman, Paul Ehrlich, Elie Metchnikoff, Edward Jenner, Hans Christian Gram.	12 Periods / 08 Hours
II	**Systems of classification:** Binomial Nomenclature, Haeckel's three kingdom concept, Whittaker's five kingdom classification and Carl Woese's three domain classification system. Concept of prokaryotic and eukaryotic microorganisms.	12 Periods / 08 Hours
III	**Diversity of Microbial World:** General features structure, reproduction and economic importance of major groups of microorganisms i.e.Virus, Bacteria, Fungi, Algae, Yeast, Protozoa, Cyanobacteria, Chlamydia, Actinomycetes, Mycoplasma.	12 Periods / 08 Hours
IV	**Basic Microbial Techniques:** Introduction to Microscopy (Bright Field, Dark Field, Phase Contrast Fluorescent Microscope and Electron Microscope) Staining Techniques (Gram staining, negative staining, acid fast staining) and Sterilization techniques (Physical and Chemical).	12 Periods / 08 Hours

V	**Pure Culture and Staining Techniques:** Culture media and theirs types (Natural, Synthetic, Complex Media- Differential, Enriched, Enrichment, Selective Media) Pure culture isolation Technique: (Streak plate, Waskman serial dilution and plating methods) Maintenance and Preservation of pure culture.	12 Periods / 08 Hours
Keywords	***Microbial Diversity, Microbial world. Microbes, Microbial techniques, Microbial culture***	

PART – C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended

1. General Microbiology; Vol I & II, Powar C.B. and Daginawala H.I., Himalay Pub. House, Bombay.
2. A Text Book of Microbiology; Dubey & Maheshwari.
3. Microbiology: An Introduction; Tortora, G. J, Funke B. R. and Case C. L.
4. Practical Microbiology; Dubey and Maheshwari.
5. Experiments in Microbiology: Plant Pathology and Biotechnology; K. R. Aneja.
6. A Text Book of Microbiology; R. P. Singh.
7. Prescott's Microbiology. Wiley JM, Sherwood LM and Woolverton CJ
8. Microbiology. 5th edition. Pelczar MJ, Chan ECS and Krieg NR.
9. General Microbiology. 5th edition. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR.

Online Resources –

- **e-Resources / e-books and e-learning portals**
- **Use of following sites**
  1. **https://nptel.ac.in/courses/102103015**
  2. **https://onlinecourses.swayam2.ac.in/cec19_bt11/preview**
  3. **https://www.britannica.com**

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE): Annual /University Exam(UE):	50 Marks NA 50 Marks	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

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Part A: Introduction

Program: *Diploma Course*		Class: **B. Sc. Part - II**	Year: **2023**	Session: 2023-2024
1	Course Code	**MICRO - 2P**		
2	Course Title	**Bacterial cell, Biochemistry & Molecular Biology**		
3	Course Type	Laboratory course		
4	Pre-requisite (if, any)	As per Govt. norms		
5	Course Learning. Outcomes (**CLO**)	At the end of this course, the students will be able to • - ***understand the microscopy, cytometry and relevant biochemical techniques*** • - ***handle the instruments / equipments applied for biochemical & molecular experiments*** • - ***perform the exercise /experiments of molecular biology***		
6	Credit Value	**02**		
7	Total Marks	Max. Marks: **50**	Min Passing Marks : **17**	

PART B: Content of the Course

Total No. of Teaching Hours - 20 / Periods -30

L. C.	Topics (Course contents)	No. of Period/Hours
A	1. Study of cell morphology – Prokaryotic & Eukaryotic cell 2. Study of cell division stages using Onion root tip. 3. Determination of antibiotic resistance by plating method. 4. Assaying of microbial enzymes; Catalase, Amylase 5. Separation of mixtures by paper / thin layer chromatography. 6. Demonstration of column packing in any form of column chromatography. 7. Separation of protein mixtures by any form of chromatography. 8. Determination of pH of various water and soil sample. 9. Testing of Lambert beer's law. 9. Production of any metabolite using batch fermentation.	**15 / 10**
B	1. Isolation of genomic DNA from *E. coli* 2. Isolation of DNA from plant cell (Onion/Mustard/Banana) 3. Transformation of E. coli – Preparation of competent cell 4. Conjugation in E. coli using plate method 5. Estimation of RNA using colorimeter or UV spectrophotometer 6. Resolution and visualization of DNA by Agarose Gel Electrophoresis. 7. Study survival curve of bacteria after exposure to ultraviolet (UV) light 8. Isolation of Plasmid DNA from *E. coli* 9. Separation of protein mixtures by Polyacrylamide Gel Electrophoresis (PAGE)	**15 / 10**
Keywords	***Biochemical techniques, Chromatography, DNA isolation, RNA estimation, Plasmid***	

PART – C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended –

1.Aneja K. R., Laboratory Manual Of Microbiology And Biotechnology, Medtech; 1st edition, 2017 2. Text books and Laboratory manuals as mentioned in MICRO – 3T and 4T

Online Resources –

https://thebookee.net/

http://site.iugaza.edu.ps/mwhindi/files/Laboratory_Manual_And_Workbook_In_Microbiology.pdf

http://site.iugaza.edu.ps/ydahdouh/files/General-Microbiology-Laboratory-pdf.pdf

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE): Annual /University Exam(UE):	50 Marks NA 50 Marks	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

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Part-A: Introduction				
Program: *Certificate Course*		Class: **B. Sc. Part - I**	Year: **2022**	Session:2022-2023
1	Course Code	**MICRO - 2T**		
2	Course Title	**Bacteriology, Virology & Proto-zoology**		
3	Course Type	**Core Course**		
4	Pre-requisite (if, any)	As per Government norms		
5	Course Learning. Outcomes (CLO)	At the end of this course, the students will be able to - ➢ ***understand ecological distribution of microorganism and their significance for society*** ➢ ***aware with the essential and current knowledge of bacteria, virus and protozoa*** ➢ ***become familiar with beneficial & harmful behavior of Viruses, Bacteria, Protozoan and other microbes***		
6	Credit Value	**04**		
7	Total Marks	**Max. Marks: 50**	**Min Passing Marks:** 17	

PART B: Content of the Course

Total No. of Teaching Periods – 60 / Hours - 40

Unit	Topics (Course contents)	No. of Period / Hours
I	**Morphology and Ultra structure of Bacteria:** Cell size, shape and arrangements. Composition, structure and function of cell membrane and cell wall of gram-positive, gram-negative and archaea bacteria, capsule, flagella, pili, ribosomes, inclusions, nucleoid, plasmids. Structure and stages of spore formation.	12 / 08
II	**Ecological significance and economic importance Archaea**: methanogens, thermophiles and halophiles. Eubacteria: Gram negative(non-proteobacteria– *Deinococcus, Spirochetes*. Alpha proteobacteria-, *Rhizobium, Agrobacterium*. Gamma proteo-bacteria– *Escherichia, Pseudomonas)*. Gram positive low G+C; *Bacillus, Clostridium, Staphylococcus*. High G+C: *Streptomyces, Frankia*.	12 / 08
III	**Morphology and ultrastructure of viruses;** General Introduction, morphologyand ultra- structure of viruses, capsid and their arrangements, types of envelopes and their composition. Viral genome; their types and structure, viral related forms-virions, viroids, virusoids, and prions.	12 / 08

IV	**Classification and multiplication of viruses;** Classification of Bacterial Plant and animal viruses. Salient features and life cycle of viruses: Bacteriophages (T4 & Lambda), Plant (TMV & CMV), Animal (Adenovirus, Pox virus & retrovirus).	12 / 08
V	**Basic Introduction to protozoa;**occurrence and classification of protozoa. Structure, reproduction, life cycle and diseases caused by important protozoans- *Entamoeba, Giardia, Leishmania, Trypanosoma* and *Plasmodium.*	12 / 08
Keywords	***Bacteria, Virus, Protozoan,***	

PART – C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended -

1. General Microbiology; Vol I & II, Powar C.B. and Daginawala H.I., Himalay Pub. House, Bombay.
2. A Text Book of Microbiology; Dubey & Maheshwari.
3. Microbiology: An Introduction.Tortora GJ, Funke BR and Case CL.
4. Practical Microbiology; Dubey and Maheshwari.
5. Experiments in Microbiology: Plant Pathology and Biotechnology; K. R. Aneja.
6. A Text Book of Microbiology; R. P. Singh.
7. Prescott's Microbiology. Wiley JM, Sherwood LM and Woolverton CJ.
8. Microbiology. Pelczar MJ, Chan ECS and Krieg NR.
9. General Microbiology. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR.

Online Resources –

- **e-Resources / e-books and e-learning portals**
- **Use of following sites**

1. ***www.nos.org/media/documents/dmlt/microbiology***
2. ***www.columbia.edu/itc/hs/medical/pathophys/id/2009***
3. ***https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/botany/04._plant_genetic_engineering/strategies_for_resistance_to_plant_viral_diseases/lm/403_lm_edited_module_27_m.pdf***

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE)/Field work Annual /University Exam(UE):		 50 Marks NA 50 Marks
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Field work	NA

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Part A: Introduction

Program: *Advance Diploma*	Class: **B. Sc. Part - III**	Year: **2024**	Session: 2024-202

1	Course Code	**MICRO - 3P**	
2	Course Title	**Applied Microbiology**	
3	Course Type	**Laboratory course**	
4	Pre-requisite (if any)	**As per Govt. norms**	
5	Course Learning. Outcomes (**CLO**)	At the end of this course, the students will be able to • ***- conduct experiments and evaluate results in microbial isolations from environment.*** • ***- demonstrate several aspects in industrial microbes and their products*** • ***- perform and analyze statistical models in biology*** • ***- understand about the immune system.*** • ***- perform basic diagnostic tests for pathogenic microbes***	
6	Credit Value	**02**	
7	Total Marks	Max. Marks: **50**	Min Passing Marks: 17

PART B: Content of the Course

Total No. of Teaching Hours – 20 / Periods -30

Group	Topics (Course contents)	No. of Period/ Hour
A	1. Isolation of Bacterial Microflora from Air by Settle Plate Technique 2.Isolation of Bacterial Microflora from Agriculture Soil, Rhizosphere, Phyllosphere, 3. Isolation of Fungi Microflora fromAir by Settle PlateTechnique 4.Isolation of Fungi Microflora fromAgriculture Soil, Rhizosphere, Phyllosphere. 5. Isolation, Identification and preservation of any five fungal strains. 6. Isolation of rhizobium from root nodules. 7. Qualitative assaying of Microbial Enzymes- Catalase, Proteases, Cellulase, Amylase, Gelatinase. 8. Bacterial Analysis of Water- Presumptive, Confirmed andCompleted test. 9. Composting of vegetable and fruit peels and using it on garden plants. 10. Demonstration of Bacterial Antagonism 11. Demonstration of fermentation. 12.Demonstration of Acetic Acid production in lab. 13.Demontration of Wine Production from Grapes. 14. Cultivation of edible mushroom. 15. Calculation of Mean Median and Mode.	15 / 10

B	1. Identification of human blood groups. 2. Perform Total Leukocyte Count of the given blood sample. 3. Perform Differential Leukocyte Count of the given blood sample. 4. Separate serum from the blood sample (demonstration). 5. Perform immune diffusion by Ouchterlony method. 6. Identify bacteria (any three of *E. coli, Salmonella, Pseudomonas, Staphylococcus, Bacillus*) using laboratory strains on the basis of cultural, morphological and biochemical characteristics: IMViC, TSI, nitrate reduction, urease production and catalase tests 7. Study of composition and use of important differential media for identification of bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS 8. Study of bacterial flora of skin by swab method 9. Perform antibacterial sensitivity by Kirby-Bauer method 10. Determination of minimal inhibitory concentration (MIC) of an antibiotic. 11. Analysis of soil - pH, moisture content, water holding capacity, percolation, capillary action. 12. Isolation of microbes (bacteria & fungi) from soil (28°C & 45°C). 13. MBRT of milk samples and their standard plate count. 14. Microbial fermentation for the production and estimation of ethanol	15 / 10
Keywords	***Isolation, Identification, Immunity, Disease, Diagnosis, Fermentation***	

PART – C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended

5. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Company, New Delhi.
6. Patel AH. (1996). Industrial Microbiology. 1st edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India.
7. Gregory P.H. Microbiology of the atmosphere. 2nd edition. Leonard Hill.
8. Agricultural Microbiology by Bhagyaraj and Rangaswami
9. Biostatistics by Veerbala Rastogi Kalyani Publication
!0. Statistical Methods by S.P Gupta
11. Biostatistics by Sunder Rao.
12. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
13. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology. 7th edition Garland Science Publishers, New York.
14. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
15. Aneja K. R., Laboratory Manual Of Microbiology And Biotechnology, Medtech; 1st edition, 2017

Online Resources –

https://thebookee.net/

http://site.iugaza.edu.ps/mwhindi/files/Laboratory_Manual_And_Workbook_In_Microbiology.pdf

http://site.iugaza.edu.ps/ydahdouh/files/General-Microbiology-Laboratory-pdf.pdf

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE): Annual /University Exam(UE):	50 Marks NA 50 Marks	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

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Part - A: Introduction

Program: *Diploma Course*	Class: **B. Sc. Part - II**	Year:**2023**	Session:2023-2024

1	Course Code	**MICRO -3T**	
2	Course Title	**Cell biology, Biochemistry and Bioinstrumentation**	
3	Course Type	**Core course**	
4	Pre-requisite (if, any)	As per Government norms	
5	Course Learning. Outcomes **(CLO)**	At the end of this course, the students will be able to -- • ***- clarify the basic concept of feature, types, function and importance of living cell as a structural & functional unit of living body*** • ***- get acquaintance of the knowledge about biochemical reactions and cellular mechanism to provide bio energy for living activities*** • ***- know about basic principle, procedure and application of various instruments and techniques to explore the biological system*** • ***- exercise the various experiments and perform fundamental biological techniques operating the concern instruments***	
6	Credit Value	**04**	
7	Total Marks	Max. Marks: **50**	Min Passing Marks: **17**

PART B: Content of the Course

Total No. of Teaching Hours – 40 / Periods - 60

Unit	Topics (Course contents)	No. of Period / Hour
I	**Structure and organization of Cell** Cell Organization –Plant and animal cells: Plasma membrane: Structure and functions, Cell Wall: Eukaryotic cell wall. Cell-Cell Interactions - adhesion junctions, tight junctions, gap junctions, and plasmodesmata (only structural aspects). Mitochondria, endoplasmic reticulum, Golgibody, Ribosomes, Lysosomes, Chloroplasts and Peroxisomes.	12 / 08
II	**Biomolecules - Structure, classification, function and properties** Carbohydrates Monosaccharide, Oligosaccharides (Disaccharides) and Polysaccharides. Protein - Amino acids, peptides and Proteins structural organisation. Lipids Saturated and unsaturated.	12 / 08
III	**Metabolism** Glycolysis, TCA cycleand Oxidative Phosphorylation. Anaerobic catabolism of glucose; Fat Biosynthesis,alpha and beta oxidation of fatty acids, Decarboxylation, Deamination, trasns-amination and Urea cycle.	12 / 08

IV	**Bioinstrumentation - I: Principle, Instrumentation and applications** pH Meter, Microscopy (Light compound, Phase-contrast microscope & Electron microscope), Colorimeter, Spectrophotometer, Turbidometer, Centrifuge - differential & density gradient centrifugation techniques	12 / 08
V	**Bioinstrumentation –II: Principle, Instrumentation and applications** Electrophoresis - types, Gel electrophoresis, Chromatography - Paper Chromatography, Thin Layer Chromatography, Column Chromatography Ion Exchange Chromatography, High Pressure Liquid Chromatography and Gas Chromatography	12 / 08
Keywords	***cell biology, bio-molecules, metabolism, bioinstrumentation***	

PART - C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended -

1. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology of the
2. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott
3. Williams and Wilkins, Philadelphia
4. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley &Sons. Inc.
5. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, ColdSpring Harbour Laboratory press.
6. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
7. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
8. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.
9. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freema and Company.

Online Resources –

- **e-Resources / e-books and e-learning portals**
- **Use of following sites**

1. **https://nptel.ac.in/courses/102103015**
2. **https://onlinecourses.swayam2.ac.in/cec19_bt11/preview**
3. **https://www.britannica.com**

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods:		
Maximum Marks:	50 Marks	
Continuous Comprehensive Evaluation (CCE):	NA	
Annual /University Exam(UE):	50 Marks	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

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Part - A: Introduction

Program: *Diploma Course*	Class: **B. Sc. Part - II**	Year:**2023**	Session:2023-2024

1	Course Code	**MICRO - 4T**	
2	Course Title	**Microbial Genetics, Molecular Biology & Genetic Engineering**	
3	Course Type	**Core course**	
4	Pre-requisite (if, any)	As per Government norms	
5	Course Learning. Outcomes **(CLO)**	At the end of this course, the students will be able to -- • - ***clarify the basic concept of Genetics, Microbial genetics, mode of recombination microbes as basis of sexuality in living beings*** • - ***get acquaintance of the knowledge about the Gene expression & regulation with concept of central dogma of Molecular biology*** • - ***know about basic principle, procedure and application of Recombinant DNA Technology***	
6	Credit Value	**04**	
7	Total Marks	Max. Marks: **50**	Min Passing Marks: **17**

PART B: Content of the Course

Total No. of Teaching Hours – 40 / Periods - 60

Unit	Topics (Course contents)	No. of Period / Hour
I	**Microbial Genetics:** Mechanisms of Genetic Exchange Transformation, Conjugation and Transduction. Types of plasmids – F plasmid, R Plasmids, colicinogenic plasmids, Ti plasmids, linear plasmids. Plasmid replication and partitioning. Prokaryotic transposable elements – Insertion Sequences, Replicative and Non replicative transposition, composite and non-composite transposons, Mutations and mutagenesis.	12 / 08
II	**Genetic material:** Miescher to Watson and Crick- historic perspective, DNA structure, Types of DNA, Organization of DNA Prokaryotes, Viruses, and Eukaryotes. RNA Structure, Organelle DNA-mitochondria and chloroplast DNA. Replication of DNA (Prokaryotes). DNA Repair system and its types.	12 / 08
III	**Fundamentals of Molecular genetics:** Central dogma of Molecular biology. Transcription, Translation in Prokaryotes, Post Translational Processing. Regulation of gene Expression in Prokaryotes. Principles of transcriptional regulation, regulation at initiation with examples from lac- and trp- operons.	12 / 08

IV	**Introduction to Genetic Engineering:** Molecular Cloning- Tools; Restriction modification systems: Types I, II and III. Mode of action, nomenclature, DNA modifying enzymes and their applications. Cloning Vectors: Definition and Properties Plasmid vectors: pBR and pUC series. Bacteriophage lambda and M13 based vectors. Cosmids, BACs, YACs. Expression vectors: E.coli lac and T7 promoter-based vectors, SV40-based expression vectors.	12 / 08
V	**Molecular Cloning and Transformation:** Methods in Molecular Cloning and Transformation of DNA: Chemical method, Electroporation, Gene delivery: Microinjection, electroporation, DNA, RNA and Protein analysis: Agarose gel electrophoresis, Southern - and Northern - blotting techniques, dot blot, DNA microarray analysis, SDS-PAGE and Western blotting. Applications of Recombinant DNA Technology	12 / 08
Keywords	***Genetics, Microbial genetics, Nucleic acid, Central dogma, Gene, Gene expression***	

PART - C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended -

1. Genetics by P. K. Gupta, Rastogi Publication, New Delhi
2. Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008) Molecular Biology
3. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott
4. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons.
5. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.
6. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology McGraw Hill Higher Education
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- **e-Resources / e-books and e-learning portals**
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  1. **https://nptel.ac.in/courses/102103015**
  2. **https://onlinecourses.swayam2.ac.in/cec19_bt11/preview**
  3. **https://www.britannica.com**

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE): Annual /University Exam(UE):	50 Marks NA 50 Marks	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

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Part A: Introduction

Program: *Advance Diploma*	Class: **B. Sc. Part - III**	Year: **2024**	Session: 2024-2025

1	Course Code	**MICRO -5T**	
2	Course Title	**Environmental, Agriculture, Industrial Microbiology and Biostatistics**	
3	Course Type	**Core course**	
4	Pre-requisite (if, any)	As per Govt. norms	
5	Course Learning. Outcomes **(CLO)**	At the end of this course, the students will be able to • ***- describe and comprehend basic concepts of Environmental and Agriculture Microbiology*** • ***- develop critical thinking and understanding of Environmental and Agriculture Microbiology, which will also contribute to conservation and life improvement skills.*** • ***- learn about Microbial Interaction, Soil Microbes, Air and Water micro-flora and their impact on human life and Environment.*** • ***- impart commercial exploitation of microbial world to improve quality of life.*** • ***- enrich students with Systematic evaluation, presentation and interpretation of data collected and prove and process the given information***	
6	Credit Value	**04**	
7	Total Marks	Max. Marks: **50**	Min Passing Marks : **17**

PART B: Content of the Course

Total No. of Teaching Hours – 40 / Periods -60

Unit	Topics (Course contents)	No. of Period Hours
I	**Air and water Microbiology:** Layers of Atmosphere and distribution of Microorganisms. Droplet nuclei and fomite infection. Methods of assessment of air quality. Aero allergy. Hydrological cycle, water zonation (fresh water and marine), Upwelling, Eutrophication, Hydrothermal vent and its microbial biodiversity, coral reef and its microbial biodiversity. Potability of water and its purification. Waste water reclamation.	12 / 08
II	**Microbial Interaction:** Microbe-Microbe interaction, Plant-Microbe interaction (Rhizosphere, Rhizoplane, Phyllosphere, Mycorrhiza), Animal-Microbe (Rumen Microbiology). Extremophiles. Xenobiotic compounds, Biodeterioration and Biomagnification.	12 / 08
III	**Soil and Agriculture Microbiology:** Soil profile, Litter degradation and Humus formation, Biogeochemical cycle- Nitrogen Cycle with special reference to microbial contribution (ammonifiers, symbiotic and non- symbiotic N- fixation, nitrifiers and denitrifiers) Nodulation and mechanism of biological nitrogen fixation. Phosphorous cycle and Phosphate Solubilizing Microorganisms, Sulphur cycle. Siderophores.	12 / 08

IV	**Industrial Microbiology:** History of Industrial Microbiology, Fermenter design and Principal Types of Fermenters, Production Media and Raw Material, Scale up, Industrial Sterilization. Isolation, Screening and Strain Improvement. Types of fermentation processes-Solid State, Liquid State, Batch, fed-batch and continuous fermentation. Industrial Production of Citric Acid, Ethanol, Amylases, Penicillin, Mushroom Production, Single Cell Protein	12 / 08
V	**Biostatistics:** Collection, Classification, and presentation of data. Sampling, **Measures of central tendency:** Mean, Median, Mode. **Measures of dispersion:** Standard deviation and Standard Error. Concept of Probability	12 / 08
Keywords	*Air microbiology, Water microbiology, Industrial microbiology, Biometary*	

PART – C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended -

1. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.
2. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.
3. Madigan MT, Martinko JM and Parker J. (2014).Brock Biology of Microorganisms. 14th edition. Pearson / Benjamin Cummings.
4. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press.
5. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Company, New Delhi.
6. Patel AH. (1996). Industrial Microbiology. 1st edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India.
7. Gregory P.H. Microbiology of the atmosphere. 2nd edition. Leonard Hill.
8. Agricultural Microbiology by Bhagyaraj and Rangaswami
9. Biostatistics by Veerbala Rastogi Kalyani Publication
10. Statistical Methods by S.P Gupta
11. Biostatistics by Sunder Rao.

Online Resources –

https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB2203.pdf
https://microbenotes.com/microbial-interaction-and-its-types-with-examples/
https://microbenotes.com/category/agricultural-microbiology/
https://sites.google.com/site/soilagrlmicrobiol/
https://bookarchive.net/pdf/industrial-microbiology-by-l-e-casida-jr/
https://www.researchgate.net/publication/280733465_A_TEXT_BOOK_OF_BIOSTATISTICS

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE): Annual /University Exam(UE):	50 Marks NA 50 Marks	
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

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Part A: Introduction

Program: *Advance Diploma*	Class: **B. Sc. Part - III**	Year: **2024**	Session: 2024-2025

1	Course Code	**MICRO - 6T**	
2	Course Title	**Immunology and Medical Microbiology**	
3	Course Type	Core course	
4	Pre-requisite (if any)	As per Govt. norms	
5	Course Learning. Outcomes **(CLO)**	At the end of this course, the students will be able to • - ***understand about immunological process within the human system.*** • - ***learn about the immune reactions and their applications*** • - ***understand about the mechanism of diseases and their diagnosis*** • ***-know about the concepts of medical microbiology and the pathogenesis*** • ***-understand the concepts of clinical bacteriology and clinical mycology***	
6	Credit Value	**04**	
7	Total Marks	Max. Marks: **50**	Min Passing Marks : **17**

PART B: Content of the Course

Total No. of Teaching Hours - 40 / Periods -60

Unit	Topics (Course contents)	No. of Period/Hour
I	**History and development of Immunology and Immune system:** Concept of Innate and adaptive immunity, Immune cells- Stem cells, T cells, B cells NK cells Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell. Immune organs- Bone marrow, Thymus, Lymph node, Spleen, GALT, MALT, CALT, Antigens; Characteristics, Haptens. Antibodies; Structure, types and properties of antibodies.	12 / 08
II	**Immunological Reactions:** Immunological techniques: Agglutination, precipitation, Compliment fixation test, ELISA and their applications. Hypersensitivity and its types- Type I. II, III, IV and diseases mediated by them. **Compliment system:** Classical and alternative pathway.	12 / 08
III	**Historical development in Medical Microbiology** History and contribution of scientists in development of medical microbiology. Koch and River's postulates, normal microbial flora of human body and role of resident flora **Pathogenesis:** Host parasite relationship, Portal of entry of pathogens, De-polymerizing enzymes	12 / 08

IV	**Clinical Bacteriology:** Pathogenic bacteria- morphological characteristics, epidemiology, pathogenesis, laboratory diagnosis and treatment of pathogenic bacteria; *Staphylococcus aureus, group A Streptococcus, Pneumococci, E. coli, Salmonella, Corynebacterium Mycobacterium* and drug resistance.	12 / 08
V	**Clinical Mycology:** Superficial subcutaneous cuteness and systemic mycosis. Morphological characteristics, epidemiology, pathogenesis, laboratory diagnosis and treatment of following pathogenic fungi; *Trichophyton, Histoplasma capsulatum and Candida albicans.*	12 / 08
Keywords	***Immune system, Immunological reactions, Compliment system, Medical Microbiology, Pathogenesis, Clinical Bacteriology, Clinical Mycology***	

PART – C

Learning Resources: Text Books, Reference Books and Others

Suggested Readings:

Text Books Recommended

1. Abbas AK, Lichtman AH, Pillai S. (2007). Cellular and Molecular Immunology. 6th edition Saunders Publication, Philadelphia.
2. Delves P, Martin S, Burton D, Roitt IM. (2006). Roitt's Essential Immunology.11th edition Wiley-Blackwell Scientific Publication, Oxford.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition W.H. Freeman and Company, New York.
4. Murphy K, Travers P, Walport M. (2008). Janeway'sImmunobiology. 7th edition Garland Science Publishers, New York.
5. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
6. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
7. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier
8. Willey JM, Sherwood LM, and Woolverton CJ. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education
9. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition
10. Madigan MT, Martinko JM and Parker J. (2014). Brock Biology of Microorganisms. 14th edition Pearson/ Benjamin Cummings

Online Resources –

https://docs.google.com/file/d/0B0Izh6GcIA_DdUxuWFhMWDNOSFE/edit?pli=1&resourcekey=0-Gxm4B8zdfp683ID7LbysmA

https://www.academia.edu/23738538/Immunology_Lecture_Notes_Immune_Responses

https://www.libraryofbook.com/books/lecture-notes-medical-microbiology-and-infection

Part D: Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: Continuous Comprehensive Evaluation (CCE): Annual /University Exam(UE):		50 Marks NA 50 Marks
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test/Assignment /Field work	NA

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