

Atal Bihari Vajpayee Vishwavidyalaya, Bilaspur (C.G.)



Scheme and Syllabus

of

M. Sc. (Microbiology)

Program Code: MSCMBR117

**Semester system for affiliated college
(As per LOCF and credit system)**

w.e.f. 2023-2024

(As approved by AC and EC meetings held on 16.08.2023 and 18.04.2023 respectively)



अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)

कोनी पुलिस थाना के सामने, बिलासपुर-रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009

Website : www.bilaspuruniversity.ac.in

Scheme for M.Sc. Microbiology Program Code: MIC

Semester	Course Code	Subject Name	Credit			Total Credit	Marks			
			L	T	P		ESE	IA	Total	
									Max	Min
First	MICT101	General Microbiology and Bacteriology	3	1	-	4	80	20	100	36
	MICT102	Virology	3	1	-	4	80	20	100	36
	MICT103	Phycology, Mycology and Proto-Zoology	3	1	-	4	80	20	100	36
	MICT104	Biochemistry	3	1	-	4	80	20	100	36
	MICP101	Lab 1	-	-	2	2	100	-	100	36
	MICP102	Lab 2	-	-	2	2	100	-	100	36
	Subtotal			12	4	4	20	-	-	600
Second	MICT201	Bioinstrumentation and Biochemical Techniques	3	1	-	4	80	20	100	36
	MICT202	Microbial Physiology	3	1	-	4	80	20	100	36
	MICT203	Microbial Genetics and Molecular Biology	3	1	-	4	80	20	100	36
	MICT204(A)	Cell Biology (Elective)	3	1	-	4	80	20	100	36
	MICT204(B)	Genetic Engineering (Elective)								
	MICT204(C)	Agriculture Microbiology (Elective)								
	MICP201	Lab 3	-	-	2	2	100	-	100	36
	MICP202	Lab 4	-	-	2	2	100	-	100	36
Subtotal			12	4	4	20	-	-	600	

Note: Students have to opt one paper from the pool of Elective I of 2nd Semester, one paper from the pool of Elective II of 3rd Semester and Elective III of 4th Semester.

Abbreviations used: ESE: End Semester Exam; IA: Internal Assessment

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Semester I

Part A: Introduction			
Program: M.Sc. Microbiology	Semester: I	Year: I	w.e.f.: 2023-2024
1. Course Code	MICT101		
2. Course Title	General Microbiology and Bacteriology		
3. Course Type	Theory		
4. Pre-requisite (if any)	As per Govt. and University norms		
5. Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: <ol style="list-style-type: none"> 1. Understand the Selection of microbes for Particular use. 2. Isolate and Culture desired microbes. 3. Understand the application of general microbiology in day-to-day life 		
6. Credit Value	04		
7. Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36	

Part B: Content of the Course		
Unit	Topics	Total Hours
I.	Introduction, History and Scope of Microbiology: Microorganism, their general characteristics and composition of microbial world, and microbial evolution including the origin of life. Scope of Microbiology, Contributions of eminent scientists (Antony Von Leeuwenhoek, Edward Jenner, Louis Pasture, A. Fleming, Robert Koch).	12 Periods / 08 Hours
II.	Bacterial Taxonomy: Haeckel's, Whittaker's and Carl Woese's concepts of Bacterial classification. Modern trends in the classification of microbial world. Introduction to the Bergey's Manual of Determinative and Systematic classification of Bacteria.	12 Periods / 08 Hours
III.	General characters of major groups of Eubacteria & Archaeobacteria: Morphology of Eubacteria and Archaeobacteria, ultra structure, L-form structure.	12 Periods / 08 Hours
IV.	Bacterial Morphology: Morphology of Eubacteria and Archaeobacteria, ultra structure, L-form structure, cell wall and cell membrane. Structure and function of capsule, flagella, fimbriae, mesosome and cytoplasmic inclusions (polyhydroxy butyrate, polyphosphate granules, oil droplets, cyanophycin granules). Endospore - structure, development and germination.	12 Periods / 08 Hours
V.	Bacterial Nutrition and Cultivation: Nutritional and physical requirements, growth media complex, synthetic, differential and selective media and relevant bacterial characteristics. Cultivation of bacteria - aerobic & anaerobic; batch, continuous and synchronous culture. Bacterial growth - growth kinetics, growth curve, measurement of growth and environmental factors affecting growth.	12 Periods / 08 Hours

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Part C - Learning Resource	
Text Books, Reference Books, E-Resources	
Text Books:	
1. J. Salle, Fundamental Principles of Bacteriology (Latest Edn.).	
2. Brock, T. D.; Madigan M. T. Biology of Microorganisms. Prentice Hall Int. Inc. (Latest Edn.).	
3. Pelczar, M. J., Chan E. C. S. Kreig, N.R, Microbiology, Mc. Graw Hil, (Latest Edn.).	
Reference Books:	
1. Prescott, M.J., Harley, J.P. and Klein, D.A. (2002). Microbiology. 5 th Edition WCB McGrawHill, NewYork	
2. Tortora, G.J., Funke, B.R. and Case, C.L. (2004). Microbiology: An Introduction. Pearson Education, Singapore.	
3. Alcom, I.E. (200 1). Fundamentals of Microbiology. VI Edition, Jones and Bartlett Publishers. Sudbury. Massachusetts.	
4. Black J.G.(2002) Microbiology-Principles and Explorations. John Wiley & Sons Inc. New York	
E-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	

Declaration

Syllabus is framed as per the ToR

Name	Signature
Dr. DSVGK Kaladhar, Chairman BOS, Microbiology, Professor, Atal Bihari Vajpayee University, Bilaspur	
Dr. Secma A Belorkar, Member BOS, Microbiology, Assistant Professor, Atal Bihari Vajpayee University, Bilaspur	
Dr. Swati Rose Toppo, Member BOS, Microbiology, Assistant Professor, Atal Bihari Vajpayee University, Bilaspur	
Dr. Reshmi Parihar, Member BOS, Microbiology, Assistant Professor, ERR Science PG College, Bilaspur (CG)	
Dr. Subhrajya Pandey, Member BOS, Microbiology, Assistant Professor, DP Vipra College, Bilaspur (CG)	

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Part A: Introduction			
Program: M.Sc. Microbiology	Semester: I	Year: I	w.e.f.: 2023-2024
1. Course Code	MICT102		
Course Title	Virology		
2. Course Type	Theory		
3. Pre-requisite (if any)	As per Govt. and University norms		
4. Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand the Features of Viruses. 2. Advantage and Disadvantage of viruses. 3. Understand about the Diseases and control.		
5. Credit Value	04		
6. Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36	

Part B: Content of the Course		
Unit	Topics	Total Hours
I	History of Virology, Contribution Eminent: Scientists in discovery of important Plant, Animal and Bacterial Viruses six example (TMC, Cauliflower Mosaic Virus, Pox Virus, Corona Virus, λ virus, T ₄ Virus), Viral related agents Viroids, Virions and Prions.	12 Periods / 08 Hours
II	Structure and Morphology of Viruses: General properties of viruses, morphology and ultra-structure of viruses, capsid and their arrangements, types of envelopes and their composition. Viral genome, their types and structure, viral related agents-viroids, virions and prions.	12 Periods / 08 Hours
III	Plant Viruses: Plant viruses- recent advances in classification of plant viruses; Structure, pathogenicity and its transmission with/without vectors. Biochemical changes induced by virus in plant cell. Common viral diseases of Tobacco, Paddy, Tomato, Bhindi & Sugarcane.	12 Periods / 08 Hours
IV	Animal Viruses- Nomenclature and classification. Retroviruses and Oncogenic viruses (oncogenes and oncoprotein. DNA virus oncogenesis, multistep oncogenesis. Important human diseases: Small pox, AIDS, influenza, acute hepatitis, Pneumonia, Chickenpox, Pharyngoconjunctival fever.	12 Periods / 08 Hours
V	Bacterial Viruses: Classification, morphology and ultra-structure. One step growth curve (latent period, eclipse period and burst of size). Lytic and lysogenic life cycle, Cyanophages, general account of M13, T3, T4 and Lambda Ph.	12 Periods / 08 Hours

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Part C - Learning Resource	
Text Books, Reference Books, E-Resources	
Text Books:	
1. Medical Virology- by Morag C and Timbury M. C; X Edt. Churchill Livingstone, London.	
2. Introduction to Modern Virology-by Dimmock and Primrose (1994), IV Edt. Blackwell Scientific Publications, Oxford.	
3. Functional of Plant Virology- by Mathews, R. E. (1992), Academic press, San Diego.	
Reference Books:	
1. A Text Book of Microbiology; R. P. Singh.	
2. Prescott's Microbiology. Wiley JM, Sherwood LM and Woolverton CJ	
3. General Microbiology. 5th edition. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR.	
4. General Microbiology; Vol I & II, Powar C.B. and Dagainawala H.I., Himalay Pub. House, Bombay.	
5. A Text Book of Microbiology; Dubey & Maheshwari	
E-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_27lm.pdf	

Declaration

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Name	Signature
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Dr. Seema A Belorkar, Member BOS, Microbiology, Assistant Professor, Atal Bihari Vajpayee University, Bilaspur	
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Part A: Introduction			
Program: M.Sc. Microbiology	Semester: I	Year: I	w.e.f.: 2023-2024
1. Course Code	MICT103		
2. Course Title	Phycology, Mycology and Proto-Zoology		
3. Course Type	Theory		
4. Pre-requisite (if any)	As per Govt. and University norms		
5. Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand about fungi and their application. 2. Understand about algae and their application. 3. Understand about Protozoa and their application.		
6. Credit Value	04		
7. Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36	

Part B: Content of the Course		
Unit	Topics	Total Hours
I	Fundamentals of Phycology: General concept of Phycology, thallus organization of micro-algae. General account of Cyanobacteria; Dinoflagellateae, Euglenoids and Diatoms. Algal blooms. Economic importance of algae, as a food, bio-fertilizer. Role of Cyanobacteria in soil fertility.	12 Periods / 08 Hours
II	General concept of Mycology: Basic classification and cellular organization of fungi. General features, structure, nutrition, reproduction. Heterothallism and Para-sexuality. Sex hormones in fungi, physiological specialization, phylogeny of fungi. General account and importance of lichen. All features, taxonomic status and evolutionary significance economic importance of important genera Mucor, Saccharomyces, Neurospora, Agaricus, Fusarium, Alternaria, Curvularia and Cladosporium.	12 Periods / 08 Hours
III	Common Fungal Diseases: Important plant diseases caused by fungi-symptom, disease cycles and control (Late & Early blight, Black rust, Smut, Wilt and Red rot). Superficial and Deep Mycoses.	12 Periods / 08 Hours
IV	Basic concepts of Protozoans: Basic classification of protozoa. Occurrence, habitat, morphology and reproduction of Protozoa. Structure and reproduction of important Protozoans – Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosoma and Plasmodium.	12 Periods / 08 Hours
V	Common Protozoa Diseases: Important human diseases caused by Protozoans-their serology, disease symptoms, cycles, prevention measures and their control (Amoebiasis, Malaria, Kala-azar, Sleeping sickness, Giardiasis and Filaria).	12 Periods / 08 Hours

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(Signature)

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Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Nester E.W, Anderson D. G. and Nester M.T. Microbiology: A human perspective, McGraw-Hill (Latest Ed.)
2. Atlas R. M. Principles of microbiology II Ed., McGraw Hill (Latest Ed.).
3. Lee. R. E. I. Parasitology, Calcutta publication (Latest Ed.).

Reference Books:

1. Talaro K. P. & Talaro A. Foundations of microbiology (6th Ed.), McGraw-Hill college Dimensions (Latest Ed.).
2. Wiley J., Sherwood L. and Woolverton C. Prescott/Harley/Klein's Microbiology, McGraw Hill (Latest Ed.).

E-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_27lm.pdf

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Part A: Introduction			
Program: M.Sc. Microbiology		Semester: I	Year: I
w.e.f.: 2023-2024			
1.	Course Code	MICT104	
2.	Course Title	Biochemistry	
3.	Course Type	Theory	
4.	Pre-requisite (if any)	As per Govt. and University norms	
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: <ol style="list-style-type: none"> 1. Understand about basic types of molecules in the cell 2. Understand the interplay of their molecule to support the reaction for sustaining life 3. Understand role of each Biomolecule. 	
6.	Credit Value	04	
7.	Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36

Part B: Content of the Course		
Unit	Topics	Total Hours
I	Fundamentals of Biochemistry: General concept of biomolecules, chemical bonds, water molecules, stabilizing interactions (Vander Waals, electrostatic, hydrogen bonding, hydrophobic interaction), essential microelements. Biochemistry of carbohydrates: Structure of different types of carbohydrates, anabolism of monosaccharide, catabolism of mono, oligosaccharides and polysaccharides.	12 Periods / 08 Hours
II	Bioenergetics and strategy of metabolism: Basic concept of Law of Thermodynamics, Flow of energy through biosphere, strategy of energy production of the cell, G, G and equilibrium, basic concepts of acid, base pH and buffers, oxidation-reduction coupled reaction and group transfer, ATP production, structural features of bio membranes, transport, free energy and spontaneity of reaction.	12 Periods / 08 Hours
III	Biochemistry of Nucleic acids: Nucleic acids- Types of Nucleic acids, DNA – Watson and crick model, Forms of DNA- A, B, Z, RNA – Types (mRNA, rRNA, tRNA), Structure and Functions.	12 Periods / 08 Hours
IV	Enzymes as biocatalysts: Enzyme classification, specificity, active site, isoenzymes. Enzymes kinetics, Michalis-Menton Equation for simple enzymes. (Determination of kinetic parameter, multistep reactions and rate limiting steps, enzyme inhibition, allosterism, kinetic analysis of Allosteric enzymes, principles of Allosteric regulation.	12 Periods / 08 Hours
V	Biochemistry of Proteins & Lipids, Vitamins: Structure of different types of protein, Ramchandran plots, catabolism of protein. Structure and types of lipids; Metabolism synthesis of fat, catabolism of fat (α, β and ω oxidation). Vitamins- structure and function- types and their application.	12 Periods / 08 Hours

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Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Biochemistry, Stryer 6th edition W. H. Freeman 20012. Principles of Biochemistry Lehninger 3 Edition by Nelson and Cox (Worth) 2000.
2. Voet, D. & Voet, J. G. 2005. Biochemistry, John Wiley and sons. Inc. 3. Berg J. M., Tymoczko J. L. & Stryer, L. 2007. Biochemistry, 6 Ed. W. H. Freeman and Company, N.Y.
3. Nelson D. & Cox M. M. 2009. Principles of Biochemistry
4. Talaro K. P. & Talaro, A. 2006. Foundations in Microbiology (6 Ed), McGraw-Hill College Dimensi.
5. Potter G. W. H & Potter, Geoffrey W. 1995. Analysis of Biological Molecules: An Introduction to Principles, Instrumentation and Techniques, Kluwer Academic publishers.
6. Wiley J., Sherwood L. And Woowerton C.2007.Prescott / Harley / Klein's Microbiology. McGraw Hill.
7. Atlas R. M. 1997. Principles of microbiology II Ed., McGraw Hill.

Reference Books:

1. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New York), ISBN:978-0-470-28173-4.
2. G. L. Zubay Biochemistry, Wm.C. Brown Publishers, 1998
3. Jeremy M. Berg., Lubert Stryer, John Tymoczko, Gregory Gatto, Biochemistry, WH Freeman; 9th ed. 2019.
4. Garrett and Grisham Biochemistry, Brooks/Cole; 6th edition, 2016

E-learning Resources

<https://ncert.nic.in/textbook/pdf/lech205.pdf>

<https://www.pdfdrive.com/biomolecules-books.html>

<https://schools.aglasem.com/ncert-books-class-11-biology-chapter-9/>

<https://swayam.gov.in/>

<https://www.edx.org/search?q=biomolecules&tab=course>

<https://britannica.com>

<https://en.wikibooks.org/wiki/Biochemistry>

<https://nptel.ac.in>

<https://drive.google.com/file/d/0B9Hi1Cy7Y34ERXJXzRGSjd5bm8/view?resourcekey=0-SgrHs9064AQKVk4Go-65mw>

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Part A: Introduction			
Program: M.Sc. Microbiology		Semester: I	Year: I
w.e.f.: 2023-2024			
1.	Course Code	MICP101	
2.	Course Title	Lab I	
3.	Course Type	LABORATORY COURSE	
4.	Pre-requisite (if any)	As per Govt. and University norms	
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Isolate desired microorganism 2. Cultivate desired microorganism 3. Able to identify unknown microbe 4. Able to preserve the important culture	
6.	Credit Value	02	
7.	Total Marks	Internal Marks: - External Marks: 100	Min Passing Marks:36

Part B: Content of the Course	
Topics	Total Hours
1. Lab safety rules and handling basic instruments of Microbiology laboratory (Hot Air Oven, Autoclave, Laminar Air Flow, Water Bath, Colony Counter)	60 Periods 40 Hours
2. Preparation of Glassware: Various techniques of cleaning (Decontamination, Discarding and washing) and sterilization of Glassware for various microbial techniques.	
3. Preparation of basic media like PDA and nutrient Agar.	
4. Isolation techniques: Streaking types, Pour Plate Technique, Dilution Plate Technique, Spread Plate Technique, Point Inoculation, Slant Preparation, Stab Culture. Well making with Cork Borer.	
5. Isolation, identification and Characterization of Bacteria: Cultural characteristics of bacteria (autotrophic and heterotrophic) using Selective and Differential Media, growth on Nutrient Agar, Blood Agar, Chocolate Agar, DCA, Maconkey's Agar, EMB and Sabouraud Agar. Study of nutritional needs of bacterial growth (growth in the presence of different Carbon Source, N source)	
6. Parts of Compound Microscope and its handling	
7. Staining: Preparation of Bacterial Suspension, Preparation of Smear, Fixation. Simple Staining, Gram Staining, Negative Staining, Acid Fast Staining, Endospore and Capsule Staining. Hanging Drop Technique.	
8. Biochemical Tests for the Identification of Bacteria: Amylase test, Catalase, Cellulase, Oxidase, Gelatinase test, Urease, IMViC, Mannitol Motility Test, TSI test, Coagulase test, Nitrate Reduction test. Production of acid and gas from glucose, arabinose, inositol, lactose, maltose, mannitol, rhamnose, sucrose, xylose, fructose, Starch hydrolysis, Casein hydrolysis, Assessment of effect of metals on Microbial Growth.	
9. Determination of Growth of Bacteria; Growth Curve and Generation time.	
10. Pathological examination: Plant diseases caused by Viruses as mentioned in the course (a case study of any one disease)	

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Part C - Learning Resource
Text Books, Reference Books, E-Resources
Text Books: 1. Aneja K. R., Laboratory Manual Of Microbiology And Biotechnology, Meditech; 1st edition, 2017 2. Text books and Laboratory manuals as mentioned in MICT101 and MICT102
Reference Books: 1. Atlas R. M. 1997. Principles of microbiology II Ed., McGraw Hill. 2. Wiley J., Sherwood L. and Woolverton C. Prescott/Harley/Klein's Microbiology, McGraw Hill (Latest Ed.).
E-Resources: https://thebookee.net/ http://site.iugaza.edu.ps/mwhindi/files/Laboratory_Manual_And_Workbook_In_Microbiology.pdf http://site.iugaza.edu.ps/ydahdohh/files/General-Microbiology-Laboratory-pdf.pdf

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Dr. Seema A Belorkar, Member BOS, Microbiology, Assistant Professor, Atal Bihari Vajpayee University, Bilaspur	
Dr. Swati Rose Toppo, Member BOS, Microbiology, Assistant Professor, Atal Bihari Vajpayee University, Bilaspur	
Dr. Reshmi Parihar, Member BOS, Microbiology, Assistant Professor, ERR Science PG College, Bilaspur (CG)	
Dr. Subhaja Pandey, Member BOS, Microbiology, Assistant Professor, DP Vipra College, Bilaspur (CG)	



अटल बिहारी वाजपेयी विश्वविद्यालय, बिलासपुर (छ.ग.)

कोनी पुलिस थाना के सामने, बिलासपुर-रतनपुर मार्ग, कोनी, बिलासपुर (छ.ग.) 495009

Website : www.bilaspuruniversity.ac.in

Part A: Introduction			
Program: M.Sc. Microbiology	Semester: I	Year: I	w.e.f.: 2023-2024
1. Course Code	MICP102		
2. Course Title	Lab 2		
3. Course Type	LABORATORY COURSE		
4. Pre-requisite (if any)	As per Govt. and University norms		
5. Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand different tests available for Biochemical identification. 2. Identify the nature of Biochemical molecules 3. Isolate, culture and identify algae, fungi and Protozoa.		
6. Credit Value	02		
7. Total Marks	Internal Marks: -- External Marks: 100	Min Passing Marks:36	

Part B: Content of the Course	
Topics	Total Hours
1. Isolation and Identification of algae from soil and water: Isolation and Identification of Cyanobacteria, extraction and separation of algal pigments.	60 Periods / 40 Hours
2. Isolation and Identification of fungi from different substrate (Saprophytic, Parasitic, Coprophilous, Keratinophilic)	
3. Study of environmental requirements of fungi (pH, temperature) by linear growth and biomass.	
4. Assessment of the effect antifungal agents (antibiotics/chemicals/plant extracts) on isolated fungal samples.	
5. Extraction and Separation of amino acid and mycotoxin (aflatoxin) by paper chromatography.	
6. Identification and characterization of protozoans as mentioned in course (a case study of anyone disease).	
7. Pathological examination: Human disease caused by protozoans as mentioned in course (a case study of anyone disease).	
8. Safety and First aid measures in biochemistry lab. Standardization of Glassware.	
9. Qualitative and Quantitative (Anthrone test, Folin wu, Nelson Somogyi, Liebermann buchard, Folin Lowry etc) estimation of Carbohydrate, Protein, Amino Acids and Lipids. Colorimetric or spectrophotometric estimations of pigments, DNA and RNA.	
10. Study of Enzyme activity and enzyme kinetics: Isolation of amylase producing microorganisms from the environment, effect of pH, temperature, incubation time, substrate concentration.	
11. Estimation of amylase activity and determining its Km and Vmax and also effect of environmental conditions on the activity of amylase.	
12. Estimation of enzyme activity: Phosphatase and Catalase.	
13. Separation of isolated Phospholipids by thin layer chromatography and haemoglobin by gel filtration.	

As approved by academic council and executive council meetings



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Part C - Learning Resource
Text Books, Reference Books, E-Resources
Text Books: 1. Aneja K. R., Laboratory Manual Of Microbiology And Biotechnology, Medtech; 1st edition, 2017 2. Text books and Laboratory manuals as mentioned in MICT103 and MICT104
Reference Books: 1. Atlas R. M. 1997. Principles of microbiology II Ed., McGraw Hill. 2. Wiley J., Sherwood L. and Woolverton C. Prescott/Harley/Klein's Microbiology, McGraw Hill (Latest Ed.).
E-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

Declaration

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Semester II

Part A: Introduction			
Program: M.Sc. Microbiology	Semester: II	Year: I	w.e.f.: 2023-2024
1. Course Code	MICT201		
2. Course Title	Bioinstrumentation and Biochemical Techniques		
3. Course Type	Theory		
4. Pre-requisite (if any)	As per Govt. and University norms		
5. Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand important instruments and their Suitable employability 2. Understand principle, construction and working of important instrument 3. Understand application of important instruments.		
6. Credit Value	04		
7. Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36	

Part B: Content of the Course		
Unit	Topics	Total Hours
I	Basic laboratory Instruments: Principle and working of pH meter, turbid meter, BOD. Principle, type and application of Autoclave, Laminar Air Flow, Incubator, Colony counter and Haemocytometer Centrifugation- types of centrifuge machine, methods and their application.	12 Periods / 08 Hours
II	Microscopy: Basic principles for the examination of microbes by light, dark field phase contrast, confocal, fluorescent and electron (transmission and scanning) Microscopy.	12 Periods / 08 Hours
III	Chromatography: Chromatographic techniques: Basic concepts, Gel filtration Chromatography, Ion exchange chromatography, Affinity chromatography, HPLC and FPLC.	12 Periods / 08 Hours
IV	Spectroscopy and Electrophoresis: Spectrophotometry – basic principles, law of absorption and radiation, principles and application of visible, ultraviolet, infrared and mass spectroscopy. Principles and application of Atomic Absorption And Emission spectrophotometer, NMR and ESR. Principle, types and applications of electrophoresis, frontal and zonal electrophoresis, paper, starch gel, polyacrylamide and agarose gel electrophoresis.	12 Periods / 08 Hours
V	Biochemical techniques: Extraction, purification, application and analysis of proteins, carbohydrates and lipids. General methods of extraction- salting out, use of organic solvents; Purification; mass determination- GC, MS, MALDI-TOF; structure determination- X-ray diffraction. DNA analysis- Southern blotting, Northern blotting, Western blotting.	12 Periods / 08 Hours

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Signature

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Website : www.bilaspuruniversity.ac.in

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Biochemistry, Stryer 6th edition W. H. Freeman 2012. Principles of Biochemistry Lehninger 3 Edition by Nelson and Cox (Worth) 2000.
2. Voet, D. & Voet, J. G. 2005. Biochemistry, John Wiley and sons, Inc. 3. Berg J. M., Tymoczko J. L. & Stryer, L. 2007. Biochemistry, 6 Ed. W. H. Freeman and Company, N.Y.
3. Nelson D. & Cox M. M. 2009. Principles of Biochemistry
4. Ed. W. H. Freeman and Company, New York.
5. Talaro K. P. & Talaro, A. 2006. Foundations in Microbiology (6 Ed), McGraw-Hill College Dimensi.

Reference Books:

1. Potter G. W. H & Potter, Geoffrey W. 1995. Analysis of Biological Molecules: An Introduction to Principles, Instrumentation and Techniques, Kluwer Academic publishers.
2. Wiley J., Sherwood L. And Woowerton C. 2007. Prescott / Harley / Klein's Microbiology. McGraw Hill.
3. Atlas R. M. 1997. Principles of microbiology II Ed., McGraw Hill.

E-Resources:

- <https://britannica.com>
<https://en.wikibooks.org/wiki/Biochemistry>
<https://nptel.ac.in>

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Part A: Introduction			
Program: M.Sc. Microbiology		Semester: II	Year: I
w.e.f.: 2023-2024			
1.	Course Code	MICT202	
2.	Course Title	Microbial Physiology	
3.	Course Type	Theory	
4.	Pre-requisite (if any)	As per Govt. and University norms	
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand the basic cell functioning 2. Understand mechanism of cell Communication 3. Understand the in-depth Principle of important Cellular Process like Photosynthesis and respiration	
6.	Credit Value	04	
7.	Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36

Part B: Content of the Course		
Unit	Topics	Total Hours
I	Nutritional types of bacteria: Various physiological Groups Autotrophy; photoautotrophs and Chemoautotrophs heterotrophy; Chemoheterotrophs and organoheterotrophs. Micro and Macro nutrients required for bacterial growth.	12 Periods / 08 Hours
II	Biological oxidation: Aerobic respiration: EMP pathway and Kreb's cycle. Electron transport system ; Components of electron transport chain, free energy changes, oxidative phosphorylation and theories of ATP formation. Inhibition of electron transport chain.	12 Periods / 08 Hours
III	Bacterial anaerobic respiration: electron transport chains in some anaerobic bacteria. Catalase, super oxide dismutase, mechanism of oxygen toxicity.	12 Periods / 08 Hours
IV	Bacterial photosynthesis: Photosynthetic microorganisms, photosynthetic pigments, and generation of reducing power by cyclic and non-cyclic photophosphorylation, electron transport chain in photosynthetic bacteria. Carbon dioxide fixation pathways.	12 Periods / 08 Hours
V	Bacterial chemolithotrophs, Ammonia oxidation by members of genus nitroso group, nitrite oxidation by nitro group of genera. Oxidation of molecular hydrogen by Hydrogenomonas species. Ferrous and sulphur / sulfide oxidation/ by Thiobacillus species.	12 Periods / 08 Hours

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Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Molecular Biology of the Cell - Albert, Johnson, Lewis, Raff, Roberts and Walter.
2. Molecular Cell Biology. Lodish, Birk, and Zipursky. Freeman. Microbial Physiology by Albert G. Moat and John W. Foster. Third edition, John Wiley and Sons.

Reference Books:

1. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
2. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education
3. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.
4. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.

E-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>

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Part A: Introduction			
Program: M.Sc. Microbiology	Semester: II	Year: I	w.e.f.: 2023-2024
1. Course Code	MICT203		
2. Course Title	Microbial Genetics and Molecular Biology		
3. Course Type	Theory		
4. Pre-requisite (if any)	As per Govt. and University norms		
5. Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: <ol style="list-style-type: none"> Understand the basic role of genes. The types, nature and function of DNA. Study types of molecular and mechanism of their interaction. 		
6. Credit Value	04		
7. Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36	

Part B: Content of the Course		
Unit	Topics	Total Hours
I	Basic concepts of Microbial Genetics: Nucleic acid as genetic material with experimental evidence. Bacterial transformation (types and mechanism). Transduction (types and mechanism), Sexduction, Conjugation F+/ F-/ Hfr's / F- Prime, Plasmids and Transposons, role of plasmids in biotechnology,	12 Periods / 08 Hours
II	Nucleic Acids: DNA: Structure; historical aspects & current concepts; types of DNA, melting of DNA; DNA replication and enzymes involved in prokaryotes and eukaryotes. Super helicity in DNA, linking number, topological properties, mechanism of action of topoisomerases. RNA: Types and structure of RNA, RNA polymerase, Ribozyme and splicing of RNA. Inhibition of RNA Synthesis.	12 Periods / 08 Hours
III	Transcription: Prokaryotic and Eukaryotic Enzyme involved in transcription, RNA Polymerases – Structure and Functions, Transcription Process- Initiation, Elongation, Termination, Rho dependent and Rho independent, Eukaryotic Transcriptional Factors, Promoters, Operators and Regulators, Post transcriptional Modification-RNA Editing.	12 Periods / 08 Hours
IV	Genetic code and Gene expression Translation: Genetic code – deciphering, properties and code dictionary. Central dogma of molecular biology. Protein synthesis in prokaryotes and eukaryotes; steps-detail of transcription and translation – initiation, elongation & termination, role of various factors in these steps, inhibitors of protein synthesis. Synthesis of exported protein on membrane bound ribosome; signal hypothesis. Post translational modification of proteins.	12 Periods / 08 Hours
V	Regulation of Gene expression: Concept of gene; one gene one enzyme hypothesis and its modification. Operon concept, negative and positive regulation, instability of bacterial mRNA, inducer and co-repressor, catabolic repression. Negative regulation – E. coli lac operon: positive regulation E. coli. Ara-operon; regulation by attenuation.	12 Periods / 08 Hours

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(Signatures)



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Part C - Learning Resource	
Text Books, Reference Books, E-Resources	
Text Books:	
1. Benjamin Lewin. (2008) Genes IX, Jones and Bartlett Publishers Inc.	
2. Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, and James D. Watson (2004), Molecular Biology of the Cell, 4 Edition, Garland Publishing	
3. Raff, Keith Roberts, Peter Waller, (2003) Essential Cell Biology, 2 Edition, Garland Publishing	
4. Watson James D., Tania Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick (2004)	
5. Molecular Biology of the Gene, 5 th Edition, Pearson Education, Inc. and Dorling Kindersley Publishing.	
Reference Books:	
1. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, Cold Spring Harbour Laboratory press.	
2. Wiley JM, Sherwood LM and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology. McGraw Hill Higher Education	
3. Wilson K and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7th Ed., Cambridge University Press.	
4. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.	
E-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/ccc19_bt11/preview	
3. https://www.britannica.com	

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Part A: Introduction			
Program: M.Sc. Microbiology	Semester: II	Year: I	w.e.f.: 2023-2024
1. Course Code	MICT204 (A)		
2. Course Title	Cell Biology		
3. Course Type	Theory (Elective I)		
4. Pre-requisite (if any)	As per Govt. and University norms		
5. Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand the basic hierarchy of a cell. 2. Understand the important Cellular process. 3. The cell balance and health of individual.		
6. Credit Value	04		
7. Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36	

Part B: Content of the Course		
Unit	Topics	Total Hours
I	History and Discovery of Cell, Basic concept of Prokaryotic and Eukaryotic cell.	12 Periods / 08 Hours
II	Structure and Chemical composition of Prokaryotic Cellular Structure: bio-membrane and cell wall, Capsule, flagella, Pili, plasmid and Cytoplasmic inclusions.	12 Periods / 08 Hours
III	Structure and Chemical composition of Eukaryotic Cellular Structure: bio-membrane and cell wall Cell Organelles: Structure and functions of cytoplasm organelles: peroxisomes, endoplasmic reticulum, Golgi apparatus, nucleus, nucleolus, mitochondria and chloroplasts.	12 Periods / 08 Hours
IV	Bio membrane: Function of bio membrane in transport- Active & Passive, Active transport – Types ABC, Group translocation Na^+/k^+ Pumps Membrane Potential Gradient, Role of Membrane Electron Transport, Role of carriers, Models, Symport, Antiport.	12 Periods / 08 Hours
V	Cell division, Cell cycle & Cell communication: Mechanism and biochemical activities during M-phase. Cell cycle and Programmed cell death-Control system, intracellular control of cell cycle events, Apoptosis, extracellular control of cell growth and apoptosis. Cell Junctions and cell adhesion: anchoring, adherence junctions, desmosomes, gap junctions, cohesion. Extracellular signal molecules, nitric oxide gas signal.	12 Periods / 08 Hours

Part C - Learning Resource	
Text Books, Reference Books, E-Resources	
Text Books: 1) Molecular Biology of the Cell - Albert, Johnson, Lewis, Raff, Roberts and Walter. 2) Molecular Cell Biology. Lodish, Birk, and Zipursky. Freeman. Microbial Physiology by Albert G. 3) Moat and John W. Foster. Third edition, John Wiley and Sons.	

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Reference Books:

1. De Robertis EDP and De Robertis EMF (2006) Cell and Molecular Biology, 8th edition. Lippincott Williams and Wilkins, Philadelphia
2. Karp G (2010) Cell and Molecular Biology: Concepts and Experiments, 6th edition, John Wiley & Sons, Inc.
3. Sambrook J and Russell DW. (2001). Molecular Cloning: A Laboratory Manual. 4th Edition, ColdSpring Harbour Laboratory press.
4. Krebs J, Goldstein E, Kilpatrick S (2013). Lewin's Essential Genes, 3rd Ed., Jones and Bartlett Learning
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 3. <https://www.britannica.com>

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Part A: Introduction			
Program: M.Sc. Microbiology		Semester: II	Year: I
w.e.f.: 2023-2024			
1.	Course Code	MICT204 (B)	
2.	Course Title	Genetic Engineering	
3.	Course Type	Theory (Elective I)	
4.	Pre-requisite (if any)	As per Govt. and University norms	
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand the important Cellular process 2. The cell balance and health of individual 3. Understand the basic hierarchy of a cell.	
6.	Credit Value	04	
7.	Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36

Part B: Content of the Course		
Unit	Topics	Total Hours
I	Basic techniques in Genetic Engineering: Isolation and purification of genomic and plasmid DNA. Pulse field gel electrophoresis. Nucleic acid blotting (Southern, Northern and Western blotting). RNase protection assay, in situ hybridization. PCR methods and application (RT-PCR, RT-Quantitative PCR). DNA sequencing methods- Maxam and Gilbert method, Sanger's dideoxy method, Automated DNA sequencing, pyrosequencing. Oligonucleotide synthesis, Site-directed mutagenesis: Analysis of genetic variation-Single nucleotide polymorphism, RFLP, RAPD, Restriction mapping, Chromosome mapping and chromosome painting, DNA Chips and Microarray.	12 Periods / 08 Hours
II	DNA manipulating Enzymes: Nucleases, polynucleotide kinase, DNA Ligase, DNA polymerase I, Klenow fragment, RNA dependent DNA polymerase, Terminal deoxynucleotidyl transferase, poly A Polymerase, alkaline phosphatase, Reverse transcriptase, Restriction endonucleases. Prokaryotic Host-Vector system: Vectors (Plasmid, Bacteriophage, Cosmids and Plasmid-Phage) for cloning in Prokaryotic host (E.coli), shuttle vectors and expression vectors.	12 Periods / 08 Hours
III	Recombinant DNA concept and Principles of Cloning: Construction of vector, ligation, infection, transfection and Cloning. Cloning in Yeast, Cloning in Animals System, Cloning in Plant System - Properties of Host, vectors and methods of introduction of foreign DNA in host system.	12 Periods / 08 Hours
IV	Methods of screening and selection of Recombinant clones: DNA Libraries- development of vectors, construction of genomic and full length cDNA Libraries. Screening libraries with gene probes, sequence dependent screening- colony hybridization, plaque hybridization, Screening by gain of function, Immunological screening, chromosome walking, studying gene function through protein interactions – two hybrid screening, phage display libraries. analysis of gene expression based on 17 RNA Polymerase, visible marker gene. Gene silencing.	12 Periods / 08 Hours

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V	Applications and legal issues: Applications of genetic engineering in agriculture, veterinary, industry, Forensic Science and Medicine. Transgenic crops, animals, recombinant enzymes, pharmaceuticals-Humulin, somatotropin and somatostatin, Ethical, legal, social and environmental issues.	12 Periods / 08 Hours
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Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Benjamin Lewin, Gene VII, Oxford University Press, (2000)
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter, Molecular biology of the Cell, (2002) 4th Edition. Garland publishing Inc.
3. Darnell, Lodish and Baltimore, Molecular Cell Biology, Scientific American Publishing Inc. (2000). Watson. J. D, Baker. T. A, Bell. S. P, Gann. A. Levine. M. Losick. R, Molecular Biology of Gene, 5 th Edition. The Benjamin/Cummings Pub. Co. Inc. (2003).

Reference Books:

1. David Frifielder, Stanely R. Maloy, Molecular biology and Microbial genetics. 2 nd Edition, Jones and Barlett Publishers. (1994).
2. Brown T.A., Gene Cloning and DNA analysis. 2nd Edition, ASM press. (2004).
3. Sandy Primrose. Principles of Gene Manipulation and Genomics. 7th Ed., Blackwell Publishers. (2006).
4. Glick BR and Pasternak JJ, Molecular Biotechnology, 2 nd Ed. ASM press. (2003).
5. Uldis N. Streips, Ronald E. Yasbin. Modern Microbial Genetics. 2 nd Edition WileyLiss, Inc. (2002).
6. Russel P J, Essential genetics, Blackwell Science Inc, 2 sub edition, (1987).
7. Gardner E J, Simmons M J and Snupstad DP, Principles of genetics, 8th edition John Wiley & Sons, (2006).

E-Resources:

1. 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>

Declaration

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Dr. Swati Rose Toppo, Member BOS, Microbiology, Assistant Professor, Atal Bihari Vajpayee University, Bilaspur	
Dr. Reshmi Parihar, Member BOS, Microbiology, Assistant Professor, ERR Science PG College, Bilaspur (CG)	
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As approved by academic council and executive council meetings



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Website : www.bilaspuruniversity.ac.in

Part A: Introduction			
Program: M.Sc. Microbiology		Semester: II	Year: I
w.e.f.: 2023-2024			
1.	Course Code	MICT204 (C)	
2.	Course Title	Agriculture Microbiology	
3.	Course Type	Theory (Elective I)	
4.	Pre-requisite (if any)	As per Govt. and University norms	
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. Understand the basic hierarchy of a cell. 2. Understand the important Cellular process. 3. The cell balance and health of individual.	
6.	Credit Value	04	
7.	Total Marks	Internal Marks: 20 External Marks: 80	Min Passing Marks:36

Part B: Content of the Course		
Unit	Topics	Total Hours
I	Introduction to Agriculture microbiology: Soil microorganisms in agro system: Types of microbial communities Interrelationship between plant and microbes: Above and below ground parts and effect of agricultural practices on soil.	12 Periods / 08 Hours
II	Microbial ecology: Chemical transformation and Nutrient mineralization by microbes in soil. Biological Nitrogen Fixation: Mechanism of nitrogen fixation, Biochemistry of nitrogenase. Genetics of nitrogen-fixation. Rhizobium -Legume Association, formation of root nodule. Importance of Leghaemoglobin.	12 Periods / 08 Hours
III	Disease Managemnet: Major plant diseases (Bacterial, Fungal and Viral) and their Biocontrol (bioherbicides, biopesticides, biofungicides and Bioinsecticides), Integrated Peat Management.	12 Periods / 08 Hours
IV	Biofertilizer: Bacterial biofertilizer (Nitrogen fixers, PSB), Cyanobacterial biofertilizer and Fungal biofertilizer . Industrial production of Biofertilizer. Green manuring ; algalization	12 Periods / 08 Hours
V	Plant Tissue Culture: History and Scope, Techniques and Applications. Biotechnology in agriculture- The new green revolution, Transgenic plants. Reclamation of barren lands using microbial technology.	12 Periods / 08 Hours

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Part C - Learning Resource	
Text Books, Reference Books, E-Resources	
Text Books:	
1. Eldor A. Paul. Soil Microbiology. Ecology and Biochemistry. VI Edition: Academic Press, (2007).	
2. Eugene L. Madsen. Environmental Microbiology : From Genomes to Biogeochemistry. I Edition, Wiley-Blackwell Publishing. (2008).	
3. Agrios, G. N. Plant pathology. Harcourt Asia Pvt. Ltd. (2000).	
4. Buchanan. B.B., Grissem, W. and Jones, R.L Biochemistry and Molecular Biology of Plants. I.K. International Pvt. Ltd. (2000).	
Reference Books:	
1. Mehrotra R S and Ashok Agrawal. Plant Pathology. Tata Mc Graw Hill ,6th reprint (2006).	
2. K. S. Bilgrami, H. C. Dube. A textbook of modern pathology. 6 th Edition, Vani Educational Books, a division of Vikas,(1984)	
3. Agricultural Microbiology by Bhagyaraj and Rangaswami	
E-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/	

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Part A: Introduction				
Program: M.Sc. Microbiology		Semester: II	Year: I	w.e.f.: 2023-2024
1.	Course Code	MICP201		
2.	Course Title	Lab 3		
3.	Course Type	Laboratory Course		
4.	Pre-requisite (if any)	As per Govt. and University norms		
5.	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to: 1. handle instruments in microbiology lab. 2. isolate, purify and observe microorganism. 3. can understand about biochemical nature and techniques of microorganisms 4. can understand physiology of microorganism.		
6.	Credit Value	04		
7.	Total Marks	Internal Marks: -- External Marks: 100	Min Passing Marks:36	

Part B: Content of the Course	
Topics	Total Hours
1. Calibration of pH meter and adjustment of buffer. 2. To verify Lambert Beer's law. 3. Studies of pH titration curve of amino acid/acetic acid and determination of pKa values and Handerson-Hasselbach equation. 4. Homogenisation of cells by centrifugation. 5. Testing efficiency of laminar flow hood. 6. Separation of bacterial lipid/amino acids/sugar/organic acid by TLC or paper chromatography. 7. Separations of serum proteins by horizontal submerged gel electrophoresis. 8. Paper electrophoresis and separation of haemoglobin or blue dextran by gel filtration. 9. Isolation and cultivation of autotrophic bacteria. 10. To study effect of salt concentration on bacterial growth by turbidometry method. 11. Determination of thermal death point (TDP) of an organism. 12. Effect of pH, salt concentration, metal, dyes, on growth of microorganism.	60 Periods / 40 Hours

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(Signature) *(Signature)*



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Part C - Learning Resource
Text Books, Reference Books, E-Resources
Text Books: 1. Aneja K. R., Laboratory Manual Of Microbiology And Biotechnology, Medtech; 1st edition, 2017 2. Text books and Laboratory manuals as mentioned in MICT201 and MICT202
Reference Books: 1. Atlas R. M. 1997. Principles of microbiology II Ed., McGraw Hill. 2. Potter G. W. H & Potter, Geoffrey W. 1995. Analysis of Biological Molecules: An Introduction to Principles, Instrumentation and Techniques, Kluwer Academic publishers.
E-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

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Part A: Introduction			
Program: M.Sc. Microbiology		Semester: II	Year: I
		w.e.f.: 2023-2024	
1.	Course Code	MICP202	
2.	Course Title	Lab 4	
3.	Course Type	Laboratory Course	
4.	Pre-requisite (if any)	As per Govt. and University norms	
5.	Course Learning Outcomes (CLO)	<p>At the end of this course, the students will be able to:</p> <ol style="list-style-type: none"> 1. handle the instruments / equipments applied for Genetics & molecular experiments 2. perform the exercise /experiments of molecular biology and Genetics 	
6.	Credit Value	02	
7.	Total Marks	Internal Marks: -- External Marks: 100	Min Passing Marks:36

Part B: Content of the Course		
	Topics	Total Hours
A	<ol style="list-style-type: none"> 1. Isolation of DNA from pant cells. (onion/mustard/banana). 2. Transformation of E coli, preparation of competent cell. 3. Isolation of plasmid DNA from E coli. 4. UV absorption of proteins, DNA and RNA. 5. Separations of bacterial DNA by Agarose Gel electrophoresis. 6. Isolation of streptomycin resistant strain of E coli by gradient plate method. 	60 Periods / 40 Hours
B	<p>Note: Any one choice of MCIP202 (A)/ MCIP202 (B)/ MCIP202 (C) as per chosen elective</p> <p>MICP202(A): Cell Biology</p> <ol style="list-style-type: none"> 1. Preparation of mitotic plate by Carmine Squashing method and phase identification. 2. Preparation of karyotype of metaphase plate. 3. Preparation of Meiotic plate and determination of phases. 4. Cytochemical staining of total proteins- Bromothymol Blue. 5. Cytochemical staining of Polysaccharide-Periodic Acid Schiff's (PAS). 6. Demonstration of Polytene chromosome in Chironomus larva. 7. Computation of chiasma frequency and terminalisation of phases. <p>MICP202(B): Genetic Engineering</p> <ol style="list-style-type: none"> 1. Demonstration of PCR, DNA sequencer and fermenter. 2. Isolation of genomic DNA from bacteria and purification by column Chromatography. 3. Isolation of genomic and plasmid DNA by polyethylene glycol method. 4. Restriction digestion of isolated DNA (Single and Double digestion). 	

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(Signatures)



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5. DNA elution by agarose gel.
6. Transformation of *E. coli*, Preparation of competent cell.
7. Conjugation of *E. coli* using plate method

MICP202(C): Agriculture Microbiology

1. Isolation and characterization of Bacterial and fungal microflora of soil.
2. Bioconversion of ammonia to nitrate (ammonification)
3. Production of Ammonia from organic compound.
4. Bioconversion of Ammonia to Nitrate. (nitrification).
5. Determination of Nitrate reduction.
6. Characterization of different soils for the detection of various enzymes- amylase lipase, protease and catalase.
7. Microbiological characterization of Cyanobacteria.
8. Separation and determination of Cyanobacterial pigment.
9. Isolation of Rhizobium from Root Nodule.
10. Isolation and enumeration of bacterial and fungal microflora from rhizosphere, rhizoplane and phyllosphere.
11. Demonstration of bacterial antagonism, antibiotic producing organism, identification of symbiotic bacteroids of rhizobium.
12. Isolation of Azotobacter /Azospirillum from soil.
13. Plant Tissue Culture- preparation of MS medium and Gamborg's B5 medium, Sterilization of explant, initiation of PTC by shoot bud or callus culture.

Part C - Learning Resource

Text Books, Reference Books, E-Resources

Text Books:

1. Aneja K. R., Laboratory Manual Of Microbiology And Biotechnology, Medtech; 1st edition, 2017
2. Text books and Laboratory manuals as mentioned in MICT203

Reference Books:

1. Atlas R. M. 1997. Principles of microbiology II Ed., McGraw Hill.
2. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication
3. 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
4. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier

E-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>

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