FOUR YEAR UNDERGRADUATE PROGRAM (NEP 2020)
PROGRAM: BACHELOR OF SCIENCE (2024-28)
DISCIPLENE: MICROBIOLOGY
Session: 2024-25

DSC- 01 to 08		DSE- 01 to 12		DGE- 01 to 02	
MBSC- 01 T	Introductory Microbiology and Microbial Techniques	**MBSE- 01 T**	Microbial Enzyme Technology	**MBGE- 01 T**	Introductory Microbiology and Microbial Techniques
MBSC- 01 P	Lab Course	**MBSE- 01 P**	Lab Course	**MBGE- 01 P**	Lab Course
MBSC- 02 T	Bacteriology, Virology and Protozoology	**MBSE- 02 T**	Industrial Microbiology	**MBGE- 02**	Bacteriology, Virology and Protozoology
MBSC- 02 P	Lab Course	**MBSE- 02 P**	Lab Course	**MBGE- 02 P**	Lab Course
MBSC- 03 T	Cell Biology and Biochemistry	**MBSE- 03 T**	Food and Dairy Microbiology		
MBSC- 03 P	Lab Course	**MBSE- 03 P**	Lab Course		
MBSC- 04 T	Bioinstrumentation and Biostatistics	**MBSE- 04 T**	Microbial Biotechnology		
MBSC- 04 P	Lab Course	**MBSE- 04 P**	Lab Course		
MBSC- 05 T	Microbial Physiology and Metabolism	**MBSE- 05 T**	Medical Microbiology		
MBSC- 05 P	Lab Course	**MBSE- 05 P**	Lab Course	**SEC**	
MBSC- 06 T	Molecular Biology and Microbial Genetics	**MBSE- 06 T**	Mycology and Plant Pathology	**MBSEC- 01**	Mushroom Cultivation
MBSC- 06 P	Lab Course	**MBSE- 06 P**	Lab Course		
MBSC- 07 T	Immunology	**MBSE- 07 T**	Agriculture and Veterinary Microbiology		
MBSC- 07 P	Lab Course	**MBSE- 07 P**	Lab Course	**VAC**	
MBSC- 08 T	Environmental Microbiology and Microbial Ecology	**MBSE- 08 T**	Fermentation Technology	**MBVAC- 01**	Microbes and Human Health
MBSC- 08 P	Lab Course	**MBSE- 08 P**	Lab Course		
		MBSE- 09 T	Clinical Microbiology		
		MBSE- 09 P	Lab Course		
		MBSE- 10 T	Pharmaceutical Microbiology		
		MBSE- 10 P	Lab Course		
		MBSE- 11 T	Metagenomics, Basic Computer and Bioinformatics		
		MBSE- 11 P	Lab Course		
		MBSE- 12 T	Biosafety and Inteliectual Property Rights		
		MBSE- 12 P	Lab Course		

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10/6/24 10/6/24 10.6.24 10.6.24 Dr. Nelson Xess Dr. K.K. Patel

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Certificate/Diploma/Degree/Honors)		**Semester - I**		**Session: 2024-25**
1	**Course Code**	**MBSC- 01 T**		
2	**Course Title**	**Introductory Microbiology and Microbial techniques**		
3	**Course Type**	**DSC**		
4	**Prerequisite (If Any)**	**As per program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ relate the development and scope of Microbiology ➢ illustrate the contributions made by prominent scientists including Indian Vedic Knowledge on microbiology ➢ demonstrate the nomenclature and characteristics of different types of microorganisms ➢ identify the basic techniques in microbiology ➢ explain the methods of microbial control		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**	

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**History and scope of microbiology** – History, development and Scope of Microbiology, Golden era of microbiology, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming and Edward Jenner, The Forgotten Past of Microbiology in Indian Vedic Knowledge.	**12**
II	**Systems of classification** – Binomial nomenclature, principles of microbial classification, Whittaker's five kingdom and Carl Woese's three domain classification systems and their utility, Major groups of microorganisms; General features and structure of bacteria, virus, fungi, algae and protozoa.	**11**
III	**Microbial culture and staining techniques** – Obtaining pure culture by streaking, serial dilution and plating; types of culture media, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, cultivation of fungi, actinomycetes and algae. Principle, procedure and applications of Simple staining, negative staining; Differential staining- Gram's staining, acid fast staining.	**11**
IV	**Microbial control** – Sterilization: Physical Agents - Heat: Boiling, Tyndallization, Steam under pressure (Autoclave), incineration, hot air Oven. Radiations: Ionizing and non-ionizing radiations. Filtration, Chemical agents - Disinfection, Antiseptic, Germicide, Sanitizer, Principle and application of Laminar airflow, Biological agents - Antibiotics	**11**
Key Words	**History and scope, Nomenclature, Pure culture technique, Microbial control**	

Name and Signature of Convener and Members of CBoS

10/6/24 · 10.6.24 · Rashmi 10.6.24 · 10.6.24 · Dr. K. Ichpaly · 10.6.24 · Sadhana 10.6.24 · Dr. Sadhana Tarsodal · 10/6/24 (DR. V. Chanthe) · NAGAL 10/6/24 · Dr. Nelson Xe

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Microbiology: P. D. Sharma, Rastogi Publications.
2. A textbook of Microbiology: R. C. Dubey and Maheshwari, S Chand publications.
3. General Microbiology, Vol. II, C. B. Powar and Daginawala
4. Fundamentals of Microbiology and Immunology, Ajit Kr. Banerjee and Nirmalya Banerji, Central publication.

Reference Books:

1. Microbiology: Pelczar, MJ Chan ECS and Krieg NR, McGraw-Hill.
2. Microbiology: 5th Edition Prescot, M.J., Harley, J.P. and Klein, D.A. WCB Mc Graw Hill, New York.
3. Microbiology: An Introduction: Pearson Education Tortora, G.J., Funke, B.R. and Case, C.L., Singapore.
4. Fundamentals of Microbiology: VI Edition Alcomo, I.E., Jones and Bartlett Publishers. Sudbury. Massachusetts, (2001).

Online Resources – e-Resources/ e-Books and e- learning portals

- **https://www.jsscacs.edu.in/sites/default/files/Department%20Files/History%20of%20Microbiology.pdf**
- **https://www.britannica.com/science/microbiology**
- **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7810802/**
- **https://www.slideshare.net/HarinathaReddyA/methods-for-isolation-of-pure-culture**
- **https://microbenotes-com.webpkgcache.com/doc/-/s/microbenotes.com/sterilization-physical-and-chemical-methods/**

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**
Continuous Internal Assessment (CIA): **30 Marks**
End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10/6/24 Dr. Kachan Choudhary

10.6.24

Rashmi 10.6.24

10.6.24

DNCall

DR. Ajit Kotal

10/6/24 (DR. V Chandra)

Sadhana 10-6-24 Dr: Sadhana Jaiswal

DNAGAE 10/6/24

Dr. Nelson Ke

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Certificate/Diploma/Degree/Honors)		**Semester I**		**Session: 2024-25**
1	**Course Code**	**MBSC- 01 P**		
2	**Course Title**	**Lab. Course – MBSC-01**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ define the basic laboratory practices and safety measures ➢ explain the principle, working and applications of Instruments ➢ select the proper culture media for microbial growth ➢ identify different microorganisms in the laboratory		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./ Field Training/ Experiment contents of Course	1. Good Laboratory Practices and Bio-safety in Microbiology. 2. To study the principle and applications of autoclave, incubator, BOD incubator, hot air oven, laminar air flow, light microscope. 3. Preparation of culture media (liquid & solid), sterilization and assessment of sterility 4. Isolation of microorganisms from environment by pour plate, streak plate and spread plate technique. 5. Observation of microorganisms - cyanobacteria, protozoa, fungi, yeasts and algae from natural habitats. 6. Observation of bacteria by Gram staining technique. 7. Study of common fungi, algae and protozoan using temporary / permanent mounts.	**30**

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Experiments in microbiology, plant pathology and biotechnology: K R Aneja
2. Practical microbiology: R C Dubey and D K Maheshwari.

Online Resources:

- **https://www.youtube.com/watch?v=IIndcMyuEXs**
- **https://www.youtube.com/watch?v=CbMGr9wFV2w**

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 10.6.24 10/6/24 Dr. Nelson Kels DR. K. IC Pathy

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Certificate/Diploma/Degree/Honors)		**Semester - II**	**Session: 2024-25**
1	**Course Code**	**MBSC-02 T**	
2	**Course Title**	**Bacteriology, Virology and Protozoology**	
3	**Course Type**	**DSC**	
4	**Prerequisite (If Any)**	**As per program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ recall the ultrastructure of bacteria ➢ relate ecological distribution of microorganism and their significances for society ➢ illustrate the essential and current knowledge of bacteria ➢ identify virus, protozoa and archaebacteria with their special characteristics ➢ outline the beneficial & harmful behavior of viruses, bacteria, protozoan and other microbes	
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

UNIT	**TOPIC (Course Contents)**	**No. of Period**
I	**Morphology and Ultra structure of Bacteria:** Cell size, shape and arrangements. Composition, structure and function of cell membrane, cell wall of gram-positive, gram-negative bacteria, capsule, flagella, pili, ribosomes, inclusions, nucleoid, plasmids. Structure and stages of spore formation.	**12**
II	**Gram negative, positive bacteria & Archaebacteria:** Gram negative and positive bacteria; characteristics and examples - 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*. General characteristics, **Ecological significance and economic importance of Archaea:** Methanogens, thermophiles (Thermococcus, pyrococcus, thermoplasma) and halophiles (halobacteria and halococcus).	**11**
III	**Morphology, ultrastructure, Classification & multiplication of viruses:** General introduction, morphology and ultra- structure of viruses, capsid, envelopes. Types of Viral genome. Viral related forms -virions, viroids, virusoids, and prions. Classification of viruses. Salient features and life cycle of viruses: Bacteriophages (T4 & Lambda), Plant (TMV & CMV), Animal (Adenovirus & Pox virus).	**11**
IV	**Introduction to protozoa;** Occurrence and classification of protozoa. Structure, reproduction, life cycle and diseases caused by important protozoans - *Entamoeba, Giardia, Leishmania, Trypanosoma* and *Plasmodium*	**11**
Key Words	**Bacteria, Archaea, Virus, Bacteriophage, Prions, Protozoan**	

Name and Signature of Convener and Members of CBoS

10/6/24
Dr. Rachana Chaudhary

10.6.24

Rashmi
10.6.24

10.6.24

DR. LALITA PATEL

10/6/24

10/6/24

Sadhana
10.06.24

Dr. Nelson Xes

Part – C: Learning Resources

Text Books, Reference Books and Others

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. A Text Book of Microbiology; R. P. Singh.
4. Fundamentals of Microbiology and Immunology, Ajit Kr. Banerjee and Nirmalya Banerji, Central publication.
5. Parasitology; H.S. Singh and P. Rastogi, First Edition, Rastogi Publications.

Reference Books:

6. Prescott's Microbiology. Wiley J M, Sherwood L M and Woolverton C J.
7. Microbiology. Pelczar M J, Chan E C S and Krieg N R.
8. General Microbiology. Stanier R Y, Ingraham J L, Wheelis M L, and Painter P R.
9. Microbiology: An Introduction. Tortora G J, Funke B R and Case C L.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://www.ncbi.nlm.nih.gov/books/NBK8477_/
- https://www.britannica.com/science/archaea
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7150055/
- https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson-53.pdf
- http://ecoursesonline.iasri.res.in/Courses/Agricultural%20Microbiology/

Part- D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10/6/24 · 10.6.24 · Rashmi 10.6.24 · 10.6.24 · 10/6/24 · Dr. Nelson Xess · NAGAR 10/6/24 · 10.6.24 · Sadhana 10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Certificate/Diploma/Degree/Honors)		Semester - II		Session: 2024-25
1	Course Code	MBSC-02 P		
2	Course Title	Lab. Course – MBSC-02		
3	Course Type	Laboratory Course		
4	Prerequisite (If Any)	As per program		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to – ➢ culture microorganisms and get the knowledge about their morphological features ➢ illustrate different staining procedures ➢ identify bacteria and protozoa from different samples ➢ get practice of identification of colonies on different culture media		
6	Credit Value	1 Credit	*Credit = 30 Hours. Laboratory or Field learning/ Training*	
7	Total Marks	Max. Marks: 50	Min. Passing marks: 20	

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./ Field Training/ Experiment contents of Course	1. Isolation and characterization of bacteria by colony characteristics. 2. Growth on simple media – Nutrient agar and Nutrient broth 3. Growth on complex media – Blood agar, Chocolate agar, Maconkey's, and EMB agar. 4. Differential Staining Techniques: Gram staining and acid-fast staining 5. Special Staining Techniques: Negative staining and Endospore staining 6. Study of cytopathic effects of viruses using photographs. 7. Observation of protozoa from different samples.	30
Key Words	Isolation, Identification, Staining Techniques, Cytopathic effects, Protozoa	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Laboratory Manual of Microbiology and Biotechnology: Aneja K. R
2. Practical Microbiology: R. C. Dubey and D. K. Maheshwari.
3. Laboratory Manual in Microbiology: P. Gunasekaran.

Online Resources:

- **https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec= age&q&f=false**

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks – 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10-6-24 10.6.24 10.6.24 10.6.24 10/6/24 Dr. Nelson Xess DR. I.C. Pickle

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Diploma/Degree/Honors)		**Semester - III**	**Session: 2024-25**
1	**Course Code**	**MBSC-03 T**	
2	**Course Title**	**Cell Biology and Biochemistry**	
3	**Course Type**	**DSC**	
4	**Prerequisite (If Any)**	**As per program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the student will able to –** ➢ illustrate the structural organization of eukaryotic and prokaryotic cells ➢ interpret cell division ➢ classify the biomolecules and compare their characteristics ➢ relate structure and functions of nucleic acids ➢ interpret the mechanism of enzyme action	
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**History of Cell Biology:** Contribution of Indian Cell biologists and Biochemists: Ramakrishnan Nagaraj, Joyoti Basu, Veena Krishnaji Parnaik. **Cell Structure:** Prokaryotic and Eukaryotic cell, cellular organelles; Plasma membrane, Mitochondria, Golgi body, Nucleus, Ribosome, Lysosome, Endoplasmic reticulum. Cell division.	**12**
II	**Carbohydrate:** Structure, properties & classification of carbohydrates; Monosaccharides, Disaccharides and Polysaccharides. **Proteins:** Structure, properties & classification of amino acids. Structure & Classification of Protein- Primary, secondary; salient of α helix, β sheet, tertiary and quaternary.	**11**
III	**Lipid**: Structure, properties and classification of lipids. **Nucleic acids**: Structure of purine and pyrimidine bases, nucleoside and nucleotide; DNA structure and types: A, B, Z form; RNA - Structure, types and functions.	**11**
IV	**Enzymes:** Classification of enzymes, mechanisms of enzyme action; Lock and key hypothesis, induced fit hypothesis. Active site and activation energy, coenzyme, Isoenzyme, metal cofactors.; Allosteric enzymes. Enzyme inhibition; competitive, noncompetitive, uncompetitive.	**11**
Key Words	**Cell structure, Carbohydrates, Protein, Lipids, Enzymes, DNA, RNA**	

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 Rashmi 10.6.24 10.6.24 DR. HOD Botany

NAGAR 10/6/24 10/6/24 10.6.24 Dr. Nelsonke

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Cell and molecular biology; P. K. Gupta
2. Cell biology; C B Pawar
3. Biochemistry; U Satyanarayan and U Chakrapani
4. Fundamentals of Biochemistry; J L Jain, Sanjay Jain and Nitin Jain

Reference Books:

1. Lehninger's principles of Biochemistry; M.M. Cox, D. L. Nelson and W H Freeman.
2. Quick Review Biochemistry; Arun Kumar Singhal, AITBS Pub. India

Online Resources – e-Resources/ e-Books and e- learning portals

- https://www.khanacademy.org/science/biology/structure-of-a-cell
- https://microbenotes-com.webpkgcache.com/doc/-/s/microbenotes.com/carbohydrates-classification-structure-functions/
- https://microbenotes.com/carbohydrates-structure-properties-classification-and-functions/
- https://www.onlinebiologynotes.com/classification-of-protein-on-the-basis-of-structure-composition-and-function/

Part- D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

Sadhana 10-6-24

10.6.24

Rashmi 10.6.24

10.6.24

Dr. Nelson Xe

Manik 10/6/24

10/6/24 Dr. Rachana Chowdhary

NAGAL 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Diploma/Degree/Honors)		**Semester III**	**Session: 2024-25**
1	**Course Code**	**MBSC - 03 P**	
2	**Course Title**	**Lab. Course – MBSC-03**	
3	**Course Type**	**Laboratory Course**	
4	**Prerequisite (If Any)**	**As per program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, students will be able to –** ➢ identify the various stages of cell division ➢ quantify the carbohydrates and protein in any sample ➢ determine the Vmax and Km value of enzymes ➢ analyse the effect of environmental factors on enzyme activity.	
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./ Field Training/ Experiment contents of Course	1. Identification of different stages of mitosis in onion root tips. 2. Staining and visualisation of mitochondria by Janus green stain. 3. Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars. 4. Qualitative tests for lipids and proteins. 5. Quantitative estimation of proteins by Folin Lawry method. 6. Study of protein secondary and tertiary structures with the help of models. 7. Study of enzyme kinetics – calculation of Vmax, Km values. 8. Study effect of temperature, pH and heavy metals on enzyme activity.	**30**

PART – C: Learning Resources

Text Books, Reference Books and Others

Books Recommended:

1. Practical microbiology: R C Dubey and D K Maheshwari.
2. An introduction to practical biochemistry: David T Plummer.
3. Basic concepts in clinical Biochemistry: A practical guide: Vijay Kumar, Kiran Dip Gill

Online Resources:

- **https://www.youtube.com/watch?v=hqbt7wtznrs**
- **https://www.youtube.com/watch?v=QacQmS3aaTI**

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks – 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 10/6/24 Dr. Nelson

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Diploma/Degree/Honors)		**Semester - IV**		**Session: 2024-25**
1	**Course Code**	**MBSC – 04 T**		
2	**Course Title**	**Bioinstrumentation and Biostatistics**		
3	**Course Type**	**DSC**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course the student will able to –** ➢ recall the principle of microscopy and compare the types of microscopes for specialized viewing ➢ identify the basic analytical instruments for performing microbiological manipulations ➢ relate the techniques used for processing the microbial samples ➢ recognize the basics of radiobiology and its applications ➢ illustrate basic concept of Biostatistics and develop their application		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**	

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

UNIT	**TOPIC (Course Contents)**	**No. of Periods**
I	**Microscopy:** Principle, Mechanism and application of different types of microscopes- Bright field, Dark field and Phase Contrast microscope; Fluorescence microscopy, Confocal microscopy, Scanning and Transmission Electron Microscopy (SEM & TEM). Micrometry **pH metry:** Principle, Types of electrodes, factors affecting pH measurement, application of pH meter.	**12**
II	**Centrifugation:** Principle and Types of Centrifugal Machines, Analytical, Preparatory, differential, Rate zonal and ultracentrifugation and their applications. **Chromatography:** Principle and techniques with applications of Partition, ion-exchange, exclusion and affinity chromatography. **Electrophoresis:** Principle of Agarose and Polyacrylamide Gel Electrophoresis, Components, working and applications.	**11**
III	**Spectrophotometry:** Electromagnetic spectrum, Basic principles and Law of absorption; principle, mechanism and applications of Visible and UV spectrophotometer. **Radiobiology:** Radioactivity, forms of radioactive emissions, biological effects of radiation exposure, characters of radioisotopes and their applications, Principles and methods of radioactive detection, GM counter, Scintillation counter and Autoradiography.	**11**
IV	**Biostatistics:** Definitions, Basic concepts, sample and population, Measurement scales, Statistical inference and parameters, methods of sampling, Classification of Data, Tabulation, Frequency distribution, diagrammatic and Graphical presentation of data, Data analysis- Central Tendencies (Mean, Median and Mode). Deviation (Variance, SD and SE).	**11**
Key Words	**Microscope, Centrifuge, pH meter, Chromatography, Electrophoresis, Spectrophotometer, Radiobiology, Biostatistics**	

Name and Signature of Convener and Members of CBoS

10.6.24 10.6.24 10.6.24 10.6.24 10/6/24 10/6/24 10/6/24 10/6/24 Dr. Nelson Kers

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Biophysical Chemistry, Principles and Techniques – A. Upadhyay, K. Upadhyay and N. Nath, Himalaya Pub.
2. Biotechniques: Theory and Practice – S.V.S. Rana, Rastogi Pub.
3. Analytical Chemistry – G. Chatwal and Anand, Himalaya Pub.
4. Statistical Methods; S.P. Gupta
5. Fundamentals of Biostatistics; Khan and Khanum, Ukaaz Publications, Hyderabad.

Reference Books:

1. Fundamental of light Microscopy & Electron Imaging. 1st Edition. Murphy D.B.
2. Fundamentals and techniques of biophysics and molecular biology (2016) Pranav Kumar.
3. Techniques and methods in biology PHI publication (2011) K L Ghatak.
4. Biostatistics; Sunder Rao

Online Resources – e-Resources/ e-Books and e- learning portals

- https://www.sathyabama.ac.in/sites/default/files/course-material/2020-10/SCY2.pdf
- https://faculty.ksu.edu.sa/sites/default/files/instrumental_chemical_analysis.pdf
- https://www.academia.edu/31125635/Biotechniques_Theory_and_Practice_eBook
- https://cbpbu.ac.in/userfiles/file/2020/STUDY_MAT/ZOO/PK%20(2).pdf

Part- D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 Roshni 10.6.24 10.6.24 Dr. K. K. Patel

Dr. Nelson

10/6/24 10.6.24 10.6.24 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Diploma/Degree/Honors)		**Semester IV**		**Session: 2024-25**
1	**Course Code**	**MBSC - 04 P**		
2	**Course Title**	**Lab. Course – MBSC-04**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course the student will able to –** ➢ identify microorganisms on the basis of microscopic features ➢ relate common analytical techniques in microbiology ➢ infer the concept of Biostatistics ➢ explain the significance of central tendencies		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**	

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./ Field Training/ Experiment contents of Course	1. Study of different parts of microscope. 2. Determination of λ max of given coloured solution and Confirmation of Beer's law. 3. Separation of components of a given mixture using a laboratory scale centrifuge. 4. Separation of Ink components/ chlorophyll / Amino acids by Paper Chromatography. 5. Separation of Amino acids by Thin Layer Chromatography. 6. Demonstration of Gel Filtration Chromatography. 7. Measurement of pH of water and soil samples and maintenance of required pH. 8. Demonstration of SDS-PAGE and Submarine Gel Electrophoresis. 9. Preparation of Tables, Bar diagrams and Histograms from given data. 10. Calculation of Mean, Median and Mode from grouped and ungrouped data.	**30**
Key Words	**Microscopy, Spectrophotometry, Chromatography, Centrifugation, Electrophoresis, Presentation of Data, Calculation of Central Tendencies**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. An Introduction to practical Biochemistry; McGraw Hill Publication 1987. D.T Plummer.
2. Principles and Techniques in Practical Biochemistry; Wilson & Walker.
3. Biotechniques: Theory and Practice; S.V.S. Rana, Rastogi Pub.
4. Statistical Methods; S.P. Gupta

Online Resources:

- https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec= age&q&f=false
- https://www.academia.edu/31125635/Biotechniques_Theory_and_Practice_eBook

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 10.6.24 10.6.24 Dr. Nelson Dr. K.K. Patel

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Degree/Honors)		**Semester - V**		**Session: 2024-25**
1	**Course Code**	**MBSC – 05 T**		
2	**Course Title**	**Microbial Physiology and Metabolism**		
3	**Course Type**	**DSC**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcome (CLO)**	**At the end of this course the student will able to –** ➢ explain the growth characteristics of the microorganisms ➢ outline bacterial photosynthesis ➢ relate the translocation of metabolic products ➢ examine types of carbohydrate metabolism ➢ summarize lipid and amino acid metabolism		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**		**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Microbial Growth:** Definition, Generation time, Phases of growth curve, measurement of microbial growth, Batch culture, Continuous culture, synchronous growth, diauxic growth curve. Factors affecting the growth of microbes, Nutritional types of bacteria.	**12**
II	**Bacterial photosynthesis:** Photosynthetic pigments- bacteroid chlorophyll, carotenoids, bacteriorhodopsin and phycobilins. Photosynthetic bacteria- purple sulphur bacteria, purple non- sulphur bacteria, green sulphur bacteria & Green non-sulphur bacteria, heliobacteria **Membrane transport:** Passive and facilitated diffusion. active transport, concept of uniport, symport and antiport Group translocation.	**11**
III	**Carbohydrate metabolism:** Gycolysis, TCA cycle, ED, Pentose phosphate pathway. Electron transport chain: components of ETC, Fermentation - Alcohol fermentation and Pasteur effect; Lactate fermentation. Glycogenolysis, Gluconeogenesis.	**11**
IV	**Lipid catabolism:** alpha, beta and omega oxidation of fatty acids. **Amino acid catabolism:** Deamination, Transamination and Decorboxylation of amino acids. Urea cycle.	**11**
Key Words	**Microbial growth, Photosynthetic bacteria, carbohydrate metabolism, lipid catabolism**	

Name and Signature of Convener and Members of CBoS

10.6.24 Roshni 10.6.24 10.6.24 DR.I.G.T.Patel Dr. Nelson Xe

10/6/24 10.6.24 Sadhane 10.6.24 NAGAE 10/6/24

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. General Microbiology; Vol II C B Pawar & H F Daginawala.
2. A textbook of Microbiology; R C Dubey & D K Maheshwari.
3. Fundamentals of Biochemistry; J.L. Jain, Dr. Sunil Jain and Nitin Jain, S. Chand Pub.
4. Biochemistry; U. Satyanarayana and U. Chakrapani

Reference Books:

1. Microbiology; Prescott, Harley and Klein, 5th edition, Mc Graw Hill, New Yark .
2. Brock Biology of Microorganisms; Madigan.
3. Bacterial physiology; Moat & Foster.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://byjus.com/biology/carbohydrate-metabolism/
- https://www.slideshare.net/subramaniansethupath/overview-of-lipid-metabolism.
- https://www.britannica.com/science/bacteria/Growth-of-bacterial-populations

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 Roshni 10.6.24 10.6.24

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Degree/Honors)		**Semester V**		**Session: 2024-25**
1	**Course Code**	**MBSC - 05 P**		
2	**Course Title**	**Lab. Course - MBSC - 05**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcome (CLO)**	**At the end of this course the student will able to –** ➢ relate the growth pattern of bacteria ➢ determine the effect of various environmental factors on growth of microorganisms ➢ apply the factors for microbial control ➢ demonstrate the fermentation process		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**	

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Study of growth curve of bacteria by turbidometric and standard plate count methods. 2. Calculations of generation time and specific growth rate of bacteria from the graph. 3. Effect of temperature/ pH/ salt on growth of bacteria. 4. Demonstration of alcoholic fermentation. 5. Demonstration of the thermal death time and decimal reduction time of *E.coli*. 6. Isolation of Saccharophilic (starch hydrolysis), Proteolytic (casein and gelatin hydrolysis) and Lipolytic microorganisms. 7. Oxidative and Fermentative test of bacteria.	**30**
Key Words	**Growth Curve, Generation time, Factors of Growth, Fermentation, Microbial Enzymes**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Experiments in microbiology, plant pathology and biotechnology by K R Aneja
2. Practical microbiology by R C Dubey and D K Maheshwari.

Online Resources:

- **https://books.google.co.in/books/about/Practical_Microbiology.html?id=Wh9OTbjcsfUC&redir_esc=y**
- **Practical Microbiology: Microbial Physiology and Biochemistry**

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 10.6.24 10.6.24 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Degree/Honors)		**Semester - VI**	**Session: 2024-25**
1	**Course Code**	**MBSC-06 T**	
2	**Course Title**	**Molecular Biology and Microbial Genetics**	
3	**Course Type**	**DSC**	
4	**Prerequisite (If Any)**	**As per Program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course the student will able to –** ➢ recall the structures and functions of biomolecules ➢ relate the DNA replication, recombination and repair mechanism ➢ interpret protein synthesis and protein regulations ➢ explain Mutations and Mutagens ➢ identify and distinguish genetic regulatory mechanisms	
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Fundamentals of molecular biology:** History and scope of molecular biology, Contributions of scientists, contributions of Dr. Har Govind Khurana, DNA as genetic material – experimental evidences. Components of DNA and RNA, Nucleosides & Nucleotides Double helical structure of DNA (Watson-Crick model), various forms of DNA-A, B and Z.	**12**
II	**Central Dogma of Protein synthesis: DNA replication-**Experiments performed, Mechanism, process and enzymes / proteins involved. **Transcription in Prokaryotes -** initiation, elongation and termination, RNA polymerases and general Transcription factors. **Translation in Prokaryotes** - initiation, elongation and termination. Factors involved in translation. Genetic code; properties.	**11**
III	**Mutation and DNA repair system:** Introduction and type of gene mutation; Base substitution, frame shift (insertion, deletion, miss-sense, nonsense mutation). Mutagens; physical and chemical. DNA repair system (mismatch repair, photo-reactivation, excision and SOS repair).	**11**
IV	**Gene regulation:** Concept of gene- Cistron, Recon, Mutton. Principles of gene regulation and Operon concept- *lac* Operon and *trp* Operon. Activator, Coactivator and Repressor.	**11**
Key Words	**Replication, transcription, Translation, Repair system, Mutation, Operon**	

Name and Signature of Convener and Members of CBoS

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. A Text book of Microbiology; Dubey &Maheshwari; S. Chand & Sons.
2. General Microbiology; Powar & Daginawala Vol. I, Himalaya Publication
3. Cell biology & Genetics; P.K. Gupta

Reference Books:

1. Principles of Genetics; Gardner, Simmons and Snustad.
2. Concepts of Genetics; Klug and Cummings.
3. Microbial Genetics; Freifelder.
4. Genetics; Arora and Sandhu.
5. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology; P.S Verma &V. K. Agarwal
6. Genes XI; B. Lewin.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://ncert.nic.in/textbook/pdf/lebo105.pdf
- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBB2101.pdf
- https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_(Boundless)/07%3A_Microbial_Genetics
- https://microbenotes.com/category/molecular-biology/
- https://asutoshcollege.in/new-web/Study_Material/microbial_genetics_07042020.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 Roshni 10.6.24 10.6.24 DR Ketki Patel Dr. Nelson Xe

10/6/24 10.6.24 10.6.24 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Degree/Honors)		**Semester VI**		**Session: 2024-25**
1	**Course Code**	**MBSC-06 P**		
2	**Course Title**	**Lab. Course - MBSC-06**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course the student will able to –** ➢ experiment with isolation of DNA ➢ demonstrate electrophoretic separation of DNA ➢ develop the concept of mutagenic agents ➢ perform quantitative estimation of DNA & RNA		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Study UV light as a mutagenic agent. 2. To perform Replica plating technique. 3. Isolation of genomic DNA. 4. Resolution and visualization of DNA by Agarose Gel Electrophoresis. 5. Isolation of antibiotic resistant mutants by gradient plate technique. 6. Quantitative estimation of DNA by DPA method. 7. Quantitative estimation of RNA by oricinol method.	**30**
Key Words	**DNA, Electrophoresis, Mutagenic, Genomic, Antibiotic resistant**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Microbiology – A Practical Approach - Bhavesh Patel and Nandini Phanse
2. Solutions to Practical Microbiology - Bhavesh Patel and Nandini Phanse
3. Experiments in Biotechnology - Nighojkar and Nighojkar
4. Practical Microbiology- Dr. R.C Dubay, Dr. D.K. Maheshwari

Online Resources:

- https://faculty.ksu.edu.sa/sites/default/files/bch361_handnote_1.pdf
- https://www.brainkart.com/article/Isolation-of-DNA-from-plant-materials_38351/
- https://cales.arizona.edu/spls/sites/cals.arizona.edu.spls/files/PLP%20428528%20Lab%20Manual%202019.pdf

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**A. Laboratory/ Field Skill Performance: On spot Assessment** **B. Performed the Task based on lab. work – 20 Marks** **Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10-6-24 10.6.24 Roshni 10.6.24 10-6-24 DD-KK Poly 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VII**		**Session: 2024-25**
1	**Course Code**	**MBSC-07 T**		
2	**Course Title**	**Immunology**		
3	**Course Type**	**DSC**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, students will be able to –** ➢ define the functions of the immune system ➢ distinguish innate immunity and acquired immunity ➢ relate the structure and function of the molecules, cells, and organs involved in Immunity ➢ discuss cell mediated and antibody-mediated immunity ➢ explain immunological techniques		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**		**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Immunity and Immune system** – History: Contribution of G.P. Talwar, M.C. Vaidya and Indira Nath; Concept of Innate and acquired immunity, Host defense mechanism- First, second and third line of host defense. Hematopoiesis, structure, functions and properties of Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; Organs of Immune; Bone Marrow, Thymus, Lymph Node, Spleen.	**12**
II	**Antigens and Antibodies-** Characteristics of an antigen (Foreignness, Molecular size and Heterogeneity); Epitopes, Haptens, Adjuvants. Structure, Types, Functions and Properties of Immunoglobulins (Antibody); Antigenic determinants on antibodies (Isotypic, allotypic, idiotypic).	**11**
III	**Immune Response -** Primary and Secondary Immune Response; Generation of Humoral Immune Response; Generation of Cell Mediated Immune Response; Killing Mechanisms by CTL (Cytotoxic T lymphocytes) and NK cells. Structure and Functions of MHC I & II molecules, Components and biological activities of Complement.	**11**
IV	**Antigen and Antibody Reactions and Immunological Techniques-** Principles of Agglutination, precipitation, Complement Fixation test, Immunodiffusion, Immuno electrophoresis, Hemagglutination, Immunofluorescence, ELISA, RIA, Coombs test.	**11**
Key Words	**Immunity, Antigens and Antibodies, Agglutination, precipitation, Innate immunity**	

Name and Signature of Convener and Members of CBoS

10.6.24 Rashmi 10.6.24 10.6.24 DR K K Pathak

10/6/24 10.6.24 10-6-24 10/6/24 Dr. Nelson Xess

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Text book of Microbiology; R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman.
2. Medical microbiology; Chrakraborthy P.
3. A text book of Microbiology; Dubey & Maheshwari.
4. Immunology, A Textbook; C.V. Rao.
5. Immunology; J. Kuby.

Reference Books:

1. Fundamental Immunology; W.E. Paul.
2. Essentials of Immunology; Roitt, I.M.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://repository.stikesbcm.ac.id/id/eprint/168/1/books_5453_0.pdf
- https://www.mbbcollege.in/db/notes/474.pdf
- http://www.helmberg.at/immunology.pdf
- https://www.utep.edu/eerael/immunology.htm
- https://conursing.uobaghdad.edu.iq/wp-content/uploads/sites/20/2019/09/Microbiology-L10-Immunity-and-immune-system.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100 Marks
Continuous Internal Assessment (CIA): 30 Marks
End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 Roshni 10.6.24 10.6.24 DR-K-K-Patel Dr. Nelson Xess

10/6/24 10.6.24 10.6.24 NAGAR 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		Semester VII		Session: 2024-25
1	Course Code	MBSC-07 P		
2	Course Title	Lab. Course - MBSC-07		
3	Course Type	Laboratory Course		
4	Prerequisite (If Any)	As per Program		
5	Course Learning Outcomes (CLO)	At the end of this course, the student will be able to – ➢ identify blood group and estimate of haemoglobin ➢ perform Gel Diffusion assays used to examine antigen-antibody reactions ➢ perform DOT ELISA test ➢ understand the Flocculation and Agglutination reaction		
6	Credit Value	1 Credit	*Credit = 30 Hours. Laboratory or Field learning/ Training*	
7	Total Marks	Max. Marks: 50		Min. Passing marks: 20

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./ Field Training/ Experiment contents of Course	1. Identification of human blood groups. 2. Estimation of haemoglobin. 3. Perform Total Leukocyte Count of the given blood sample. 4. Separate serum from the blood sample. 5. Flocculation reactions - VDRL Agglutination, Widal test, Blood Grouping. 7. Immuno-diffusion techniques- ODD and RID. 8. To Perform DOT ELISA. 9. Examination of skin microflora.	30
Key Words	Blood group, Hemoglobin, Serum, Agglutination, ELISA	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Practical Immunology, Frank C. Hay, Olwyn M.R. Westwood & Paul N. Nelson. 4th Edition, 1 January
2. Handbook of Practical and Clinical Immunology, 2e, Vol. II 2nd Edition, Kindle Edition
3. Immunological Techniques Interpretations Validation and Safety Measures; Ankita Joshi & R S Chauhan

Online Resources:

- https://doi.org/10.1002/9780470757475.index
- http://www.lucp.net/books-pdf/Lab%20Manual%20Dr.%20Idris%20Adewale%20Ahmed/15.%20BASIC%20IMMUNOLOGY.pdf
- https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC106J-lab-manual.pdf

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10.6.24 10.6.24 10.6.24 10.6.24 10.6.24 10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VIII**		**Session: 2024-25**
1	**Course Code**	**MBSC-08 T**		
2	**Course Title**	**Environmental Microbiology and Microbial Ecology**		
3	**Course Type**	**DSC**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course the student will able to –** ➢ relate different types of environments and their habitats ➢ explain the extremophiles ➢ identify the role microorganisms in solid/liquid waste management ➢ compare beneficial and harmful microbial interactions ➢ examine biogeochemical cycles and their importance		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**	

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Microorganisms of different habitats:** Terrestrial Environment - Soil profile and soil microflora; Aquatic Environment - Microflora of fresh water and marine habitats; Air Atmosphere - Aeromicroflora and dispersal of microbes; Animal Environment - Microbes in/on human body (microbiomics) & animal (ruminants) body; Extreme Habitats - Extremophiles, Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity and low nutrient levels.	**12**
II	**Waste management:** Sources and types of solid waste, Methods of solid waste disposal (Composting and sanitary landfill). Composition of Liquid waste, strength of sewage (BOD and COD), Primary, secondary (oxidation ponds, trickling filter, activated sludge process and septic tank) and tertiary sewage treatment	**11**
III	**Ecosystems:** Structure, types and roll of microorganisms in ecosystems. **Biological Interaction:** Microbe–Microbe Interactions: Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation; Biocontrol agents; Microbe–Plant Interactions: Roots, Aerial Plant surfaces.	**11**
IV	**Biogeochemical Cycles:** Carbon cycle - Microbial degradation of cellulose, hemicelluloses, lignin and chitin; Nitrogen cycle - Biological Nitrogen fixation (symbiotic/nonsymbiotic), ammonification, nitrification, denitrification and nitrate reduction; Phosphorus cycle - Phosphate immobilization and solubilisation; Sulphur cycle - Microbes involved in sulphur cycle.	**11**
Key Words	**Terrestrial Microflora, Aquatic Microflora, Aeromicroflora, Extremophiles, Waste management, Biological Interactions, Biogeochemical Cycles**	

Name and Signature of Convener and Members of CBoS

Sadhana 10.6.24 | 10.6.24 | Roshmi 10.6.24 | 10.6.24 | DR K-K Patel | Dr. Nelson Xess | 10.6.24 | 10/6/24 | NAGAL 10/6/24

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Text book of Microbiology; R.P. Singh, Kalyani publication.
2. General microbiology; Vol. I and Vol. II, Power and Daginawala, Himalaya Publication.
3. Microbiology; Pelczar, MJ Chan ECS and Krieg NR, McGraw-Hill.

Reference Books:

1. Prescott's Microbiology. Wiley J M, Sherwood L M and Woolverton C J.
2. Microbiology; Tortora, Funke, Case. Pearson Benjamin Cummings.
3. Microbial Ecology; Alexander, M John. Wiley & Sons, Inc., New York.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB2101.pdf
- https://kamarajcollege.ac.in/wp-content/uploads/Core-IX-Environmental-Microbiology.pdf
- https://nou.edu.ng/coursewarecontent/BIO320_0.pdf
- https://content.e-bookshelf.de/media/reading/L-12090079-7c15e330d2.pdf
- https://booksite.elsevier.com/samplechapters/9780123705198/Sample_Chapters/01~Front_Matter.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

Sadhana 10.6.24 — 10.6.24 — Roshini 10.6.24 — 10.6.24 — Dr. Nelson X

10.6.24 — 10/6/24 — 10/6/24 — DR.K.K.Patel

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester VIII**		**Session: 2024-25**
1	**Course Code**	**MBSC-08 P**		
2	**Course Title**	**Lab. Course - MBSC-08**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course the student will able to –** ➢ define ecological factors affecting microbial growth ➢ compare diversity of microorganisms in different habitats ➢ explain microbiological quality of water ➢ identify microbial interactions		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./ Field Training/ Experiment contents of Course	1. Analysis of soil for pH, moisture content 2. Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane 3. Assessment of microbiological quality of water by presumptive test/MPN test 4. Confirmed and Completed tests for faecal coliforms 5. Determination of BOD of wastewater sample 6. Study of biological interactions (Competition, Parasitism) 7. Isolation of Rhizobium from root nodules. 8. Study the Effect of salt concentration/ pH on growth of microbes 9. Demonstration of Winogradsky's Column Preparation	**30**
Key Words	**Soil microflora, Water microflora, Aeromicroflora, Extremophiles, microbial interactions**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

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

Online Resources:

- https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec= age&q&f=false
- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB2101.pdf

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 10.6.24 10.6.24 10.6.24 DRKK Patel

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Diploma/Degree/Honors)		**Semester - III**	**Session: 2024-25**
1	**Course Code**	**MBSE-01 T**	
2	**Course Title**	**Microbial Enzyme Technology**	
3	**Course Type**	**Discipline Specific Elective (DSE)**	
4	**Prerequisite (If Any)**	**As per Program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ learn the fundamentals of enzymes, enzyme-action and metabolic reactions ➢ explain the mechanism of enzyme action ➢ relate enzyme modifications ➢ identify the applications of enzymes in various fields ➢ attain knowledge about various biochemical techniques	
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Basic concept of enzymes:** Nomenclature, classification, methods for determination of enzyme activity. Enzyme kinetics: Michaelis-Menten equation, effect of pH, substrate concentration, temperature and inhibitors. Iso-enzymes and allosteric enzymes. Enzyme inhibition-competitive and non-competitive inhibition.	**12**
II	**Mechanism of enzyme action:** Action of ribonuclease, chymotrypsin and trypsin. Coenzyme catalysis. Mechanism of action of thiamine pyrophosphate enzyme. Control and regulation of enzyme activity and feedback mechanisms. Metabolic compartmentalization in relation to enzyme, enzymes and secondary metabolites.	**11**
III	**Enzyme engineering & applications of microbial enzymes:** Chemical modification and site-directed mutagenesis structure & function relationship of industrially important enzymes. Microbial enzymes in textile, leather, wood industries and detergents.	**11**
IV	**Biochemical techniques**: Determination of molecular weights, purity, General methods of extraction-salting out, use of organic solvents; Purification; analysis of proteins - mass determination- GC-MS; structure determination-X-ray diffraction.	**11**
Key Words	**Enzyme, Enzyme action, Enzyme inhibition, Enzyme engineering, Biochemical techniques,**	

Name and Signature of Convener and Members of CBoS

10.6.24 Rashmi 10.6.24 10.6.24

10.6.24 10/6/24 10.06.24

10/6/24

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. A Text Book of Microbiology: R. C. Dubey & D. K. Maheshwari
2. A text book of Industrial Microbiology. 2nd edition. Panima Publishing Company, New Delhi.
3. Industrial Microbiology: Patel A H. (1996).1st edition. MacMillan India Limited Publishing Company Ltd. New Delhi, India.
4. Fundamentals of Biochemistry; Dr. J.L. Jain, Dr. Sanjay Jain, Nitin Jain, S. Chand Publication

Reference Books:

1. Principles of Biochemistry and molecular biology: Wilson & Walker
2. Lehninger Principles ob Biochemistry, 8th Edition, David L. Nelson, Micheal M. Cox
3. Biotechnology: Crueger Wand Crueger A. (2000).

Online Resources – e-Resources/ e-Books and e- learning portals

- **https://www.britannica.com/science/enzyme**
- **https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBB2204.pdf**
- **https://www.khanacademy.org/science/ap-biology/cellular-energetics/environmental-impacts-on-enzyme-function/a/basics-of-enzyme-kinetics-graphs**
- **https://microbeonline.com/maldi-tof-ms-principle-applications-microbiology/**
- **https://www.technologynetworks.com/analysis/articles/gc-ms-principle-instrument-and-analyses-and-gc-msms-362513**

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 10.6.24 10.6.24 10.6.24

Dr. Nelson Xess

10.6.24 10/6/24 10.6.24

10/6/24
Dr. Rachana Choudhary

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Diploma/Degree/Honors)		**Semester - III**		**Session: 2024-25**
1	**Course Code**	**MBSE-01 P**		
2	**Course Title**	**Lab. Course - MBSE-01**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ show the enzyme production by microorganisms ➢ demonstrate the actions of different enzymes ➢ determine various parameters of enzyme action ➢ examine various biochemical techniques used for enzyme technology		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**	

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Screening of amylase producing microorganisms. 2. Demonstrations of enzyme activity: Phosphatase and Catalase 3. Determination of kinetic constant of enzyme: Amylase activity, Vmax. Km. 4. Effect of pH and temperature on amylase activity. 5. Effect of inhibitors on amylase activity. 6. Effect of UV absorption on proteins.	**30**
Key Words	**Enzyme, Enzyme activity, Enzyme inhibition, Biochemical techniques**	

PART – C: Learning Resources

Text Books, Reference Books and Others

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.

Online Resources:

- **https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec= age&q&f=false**
- **https://books.google.co.in/books/about/Practical_Microbiology.html?id=Wh9OTbjcsfUC&redir_esc=y**

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10/6/24 10-6-24 10.6.24 10.6.24 Dr. Nelson

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Diploma/Degree/Honors)		Semester - IV		Session: 2024-25
1	Course Code	MBSE-02 T		
2	Course Title	Industrial Microbiology		
3	Course Type	Discipline Specific Elective (DSE)		
4	Prerequisite (If Any)	As per Program		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to – ➢ define the role of microorganism in industry ➢ explain the processing of the best microbial strains for the industry ➢ outline the fundamentals of fermenters and fermentation processes ➢ relate metabolic pathways for industrial products ➢ identify the production of various industrially important products		
6	Credit Value	03 Credits	Credit = 15 Hours - Learning & Observation	
7	Total Marks	Max. Marks: 100		Minimum Passing marks: 40

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Multidisciplinary nature of Industrial microbiology**: Introduction, brief History, ancient Indian perspective, important characteristics of industrially useful microorganisms. **Upstream and Down-stream processing:** Detection and assay of the product, Recovery and Purification, storage and packaging methods.	12
II	**Scale up, Screening and Strain Development Strategies:** Industrial sterilization, Isolation. preservation and maintenance of industrial strains. Production Media and Raw materials, Fermenter design. Types of fermentation: Aerobic and anaerobic Batch, fed-batch and Continuous fermentation.	11
III	**Metabolic pathways:** Industrial production of citric acid, acetic acid, Lactic acid, Glutamic acid. **Vaccines and Hormones:** Hepatitis vaccine, Rabies vaccine, insulin.	11
IV	**Production of industrial fermentation products:** Fermented food and beverages, Ethanol, Amylases, Penicillin, Single Cell Protein, Biofertilizers and Biopesticides	11
Key Words	**Scale up, Fermenter, Fermentation, Downstream processing, Metabolic pathways, Fermented food**	

Name and Signature of Convener and Members of CBoS

Radhane 10.6.24 · Rashmi 10.6.24 · 10.6.24 · 10.6.24 · 10/6/24 · 10/6/24 · Dr. Nelson Xess

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Industrial Microbiology: Patel A. H. (1996). I edition, MacMillan India Limited publishing company Ltd New Delhi, India.
2. A Text Book of Microbiology: R. C. Dubey & D. K. Maheshwari
3. Industrial Microbiology by Prescott & Dunns, AVI Publishing Company Inc.
4. Biotechnology; V. Kumaresan, Saras Publications

Reference Books:

1. Modern Industrial Microbiology and Biotechnology: Okafor N. (2007).1st edition. Bios Scientific Publishers Limited. USA.
2. Industrial Microbiology: Casida LE, New age International (P) Ltd.

Online Resources – e-Resources/ e-Books and e- learning portals

- **https://bookarchive.net/pdf/industrial-microbiology-by-i-e-casida-jr/**
- **http://foodhaccp.com/foodsafetymicro/onlineindex.html**
- **https://sist.sathyyabama@ac.in/sist coursematerial/uploads/SMB2203.pdf**
- **http://www.cpe.rutgers.ed/courses/current/If0401wa.html**
- **https://www.classcentral.com/course/swayam-food-microbiology-and-food-safety-17609**

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 Dr. Nelson Xess

10/6/24 10.6.24 10/6/24 10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Diploma/Degree/Honors)		**Semester IV**		**Session: 2024-25**
1	**Course Code**	**MBSE-02 P**		
2	**Course Title**	**Lab. Course - MBSE-02**		
3	**Course Type**	**Laboratory course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ recall Laboratory discipline, instrumentation and techniques involved in industrial microbiology ➢ develop skill to culture and identify industrially important microbes ➢ relate about design of Fermenter ➢ experiment with the whole steps of Fermentation		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Study of Bioreactor used in large scale production. 2. Isolation and characterization of Industrial microorganisms. 3. Isolation of antibiotic producing microorganisms from soil. 4. Demonstration of production of Amylase/ Protease/ Cellulase by microorganisms. 5. Demonstration of Production of lipase by microorganisms. 6. Production of ethanol by Yeast. 7. Production of Citric acid by *Aspergillus niger.*	**30**
Key Words	**Fermenter, Bioreactor, Industrial Microorganisms, Production, Preservation techniques**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Practical Microbiology: Dubey, R.C. and Maheshwari. D.K. 2012., S. Chand & Company, Pvt. Ltd.
2. Experiments in Microbiology, Pathology and Tissue Culture: Aneja, K.R. 1993., Vishwa Prakashan.

Online Resources:

- http://www.onlinelabs.in
- http://www.vlab.co.in
- http://asm.org/articles/2020/december/virtual-resources-to-teach-microiology-techniques
- http://www.vlab.amrita.edu

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10-6-24 10.6.24 10/6/24 10.6.24 Dr. Nelson Xess

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Degree/Honors)		**Semester - V**		**Session: 2024-25**
1	**Course Code**	**MBSE-03 T**		
2	**Course Title**	**Food and Dairy Microbiology**		
3	**Course Type**	**Discipline Specific Elective (DSE)**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ define the significance and activities of microorganisms in food ➢ relate the principles in traditional food preservation techniques ➢ identify the starter cultures of different microbial food products ➢ explain the types of food intoxications ➢ examine the food born infections		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**		**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Introduction to food and dairy Microbiology:** Importance of studying food and dairy microbiology, Traditional and ayurvedic foods of Indian origin, Classification of food in relation to shelf life. **Microbial spoilage:** principles, Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.	**12**
II	**Principles and methods of food preservation:** Physical methods of food preservation: temperature, Pasteurization, canning, drying, High pressure and Irradiation; chemical methods of food preservation: salt, sugar, organic acids, SO2 and antibiotics.	**11**
III	**Microbiology of fermented milk and fermented food:** Starter lactic cultures, fermented milk products- yogurt, butter and cheese, other fermented foods- idly, bread. Microorganisms as food- Mushroom. **Prebiotics and Probiotics**- definition and uses.	**11**
IV	**Food borne diseases:** food poisoning, food infections and intoxications. Causative agents, symptoms and preventive measures. Food intoxications: Clostridium botulinum and mycotoxins; Food infections: *Bacillus cereus, Escherichia coli, Shigella, Listeria monocytogenes.*	**11**
Key Words	**Preservation, Food borne diseases, Food intoxications, Microbial spoilage, Prebiotics, Probiotics**	

Name and Signature of Convener and Members of CBoS

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10.6.24 10/6/24 10.6.24

Dr. Nelson Xess

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Biochemistry of milk products: Andrews AT, Varley J. (1994). Royal Society of Chemistry.
2. Food microbiology: Banwart GJ. (1989)
3. A textbook of Microbiology: R. C. Dubey and Maheshwari, S Chand publications.
4. Food Microbiology, 5th Edition; William C. Frazier, Dennis C. Westhoff and N.M. Vanitha

Reference Books:

1. Basic food microbiology: Chapman & Hall, New York.
2. Modern Food Microbiology: Jay JM, Loessner MJ and Golden DA. (2005).7th edition, CBS Publishers and Distributors, Delhi
3. Food Microbiology: Adams MR and Moss MO. (1995)., Cambridge.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://bookarchive.net/pdf/industrial-microbiology-by-i-e-casida-jr/
- http://foodhaccp.com/foodsafetymicro/onlineindex.html
- https://sist.sathyyabama@ac.in/sist_coursematerial/uploads/SMB2203.pdf
- http://www.cpe.rutgers.ed/courses/current/If0401wa.html
- https://www.classcentral.com/course/swayam-food-microbiology-and-food-safety-17609

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 Rashmi 10.6.24 10.6.24 DR-K.K.Patel

10/6/24 JNAGAR 10/6/24 10.6.24 Dr. Nelson Kess

10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Degree/Honors)		**Semester - V**		**Session: 2024-25**
1	**Course Code**	**MBSE-03 P**		
2	**Course Title**	**Lab. Course - MBSE-03**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ illustrate methods for isolation, detection and identification of microorganisms from food samples ➢ outline the spoilage microorganisms of food ➢ compare the effect of temperature on the spoilage of food products ➢ relate the parts of mushrooms		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Isolation of spoilage microorganisms from bread. 2. MBRT of milk samples and their standard plate count. 3. Isolation of bacteria and fungi from food products. 4. Microbiological examination of canned foods. 5. Isolation of spoilage bacteria from fruits and vegetables. 6. Effect of temperature on the spoilage of food products. 7. Microbiological examination of mushrooms. 8. Microbiological examination of packaged food.	**30**
Key Words	**Spoilage microorganisms, Food borne bacteria, Food borne fungi, Canned food**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Practical Microbiology: Dubey and Maheshwari. D.K., S. Chand & Company, Pvt. Ltd., New Delhi.
2. Laboratory experiments in Microbiology: Gopal Reddy
3. Microbiology Laboratory Manual: Cappuccino, Sherman, Pearson Education.

Online Resources:

- http://www.onlinelabs.in
- http://www.vlab.co.in
- http://www.vlab.amrita.edu

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

FOUR YEAR UNDERGRADUATE PROGRAM (2924 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Degree/Honors)		**Semester - VI**	**Session: 2024-25**
1	**Course Code**	**MBSE-04 T**	
2	**Course Title**	**Microbial Biotechnology**	
3	**Course Type**	**Discipline Specific Elective (DSE)**	
4	**Prerequisite (If Any)**	**As per Program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ relate the concepts of genetic engineering ➢ classify different types of vectors ➢ explain the techniques in Molecular Biology ➢ identify cDNA libraries and their applications ➢ examine the products of rDNA technology	
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Genetic Engineering:** Tools and techniques in genetic engineering, Restriction endonucleases- Types and uses, DNA modifying enzymes and their applications: DNA polymerases and DNA ligases. **Cloning Vectors:** Definition and Properties Plasmid vectors: pBR and pUC series. Bacteriophage lambda and M13 based vectors. Cosmids, BACs, YACs.	**12**
II	**Techniques in Molecular Biology:** DNA electrophoresis, Introduction to PCR, RAPD, RFLP. Nucleic acid hybridization techniques- Southern, Northern, Western and Dot blots. DNA microarray analysis.	**11**
III	**cDNA libraries and Applications of rDNA Technology:** Genomic and cDNA libraries; Preparation and uses, Screening of libraries: Colony hybridization and colony PCR.	**11**
IV	**Products of recombinant DNA technology:** Products of human therapeutic interest - insulin, hCGH, antisense molecules. Bt transgenic - cotton, brinjal, Gene therapy, recombinant vaccines, protein engineering and site directed mutagenesis.	**11**
Key Words	**Vectors, Plasmid, PCR, Colony hybridization, cDNA libraries, Bt transgenic, Gene therapy**	

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 DR. K K Patel

10.6.24 10/6/24 10.6.24 Dr. Nelson Kerketta

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. A Text Book of Microbiology: R. C. Dubey & D. K. Maheshwari
2. Biotechnology; V. Kumaresan
3. Genetics - Arora and Sandhu

Reference Books:

1. Genes XI - Lewin, B.
2. Principles of Genetics - Gardner, Simmons and Snustad
3. Concepts of Genetics - Klug and Cummings
4. Microbial Genetics - Freifelder
5. Molecular cloning Vol. 1-III. Sambrook & Russel.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://www.egyankosh.ac.in/bitstream/123456789/86112/1/Unit-14.pdf
- https://file.hukum.uns.ac.id/data/PDIH%20File/e-book/Wilson%20Wall%2C%20Genetic%20DNA%20Technology%20Legal_Aspects.pdf
- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBB2102.pdf
- https://asutoshcollege.in/new-web/Study_Material/microbial_genetics_07042020.pdf
- https://faculty.ksu.edu.sa/sites/default/files/5_68.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 Roshni 10.6.24 10.6.24 Dr. K.K Rahul Dr. Nelson Kerr

10/6/24 10.6.24 10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Degree/Honors)		**Semester -VI**		**Session: 2024-25**
1	**Course Code**	**MBSE-04 P**		
2	**Course Title**	**Lab. Course**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ identify the competent cells and demonstrate transformation ➢ make use of electrophoresis and examine restriction digestion and ligation ➢ perform Southern blotting ➢ examine PCR results		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Demonstration of Bacterial Transformation and calculation of transformation efficiency. 2. Interpretation of gel electropherograms. 3. Digestion of DNA using restriction enzymes and analysis by agarose gel electrophoresis. 4. Demonstration of Ligation of DNA fragments. 5. Demonstration of Amplification of DNA by PCR. 6. Demonstration of Southern blotting. 7. Observation of Bt crops.	**30**
Key Words	**Electrophoresis, Restriction enzymes, Ligation, PCR Amplification, Southern blotting**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Microbiology – A Practical Approach - Bhavesh Patel and Nandini Phanse
2. Experiments in Biotechnology - Nighojkar and Nighojkar
3. Current protocols in molecular biology- Ausbel

Online Resources:

- https://home.sandiego.edu/~josephprovost/Bacterial%20Transformation%20Protocol.pdf
- https://vyngocnguyen.files.wordpress.com/2016/04/e8-packet11-2.pdf
- https://faculty.ksu.edu.sa/sites/default/files/polymerase_chain_reaction_pcr.pdf
- https://www.deshbandhucollege.ac.in/pdf/e-resources/botany/LS-VI-Blotting-Techniques.pdf

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

FOUR YEAR UNDERGRADUATE PROGRAM (2924 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VII**	**Session: 2024-25**
1	**Course Code**	**MBSE-05 T**	
2	**Course Title**	**Medical Microbiology**	
3	**Course Type**	**Discipline Specific Elective (DSE)**	
4	**Prerequisite (If Any)**	**As per Program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ define the history of medical microbiology ➢ identify medically important microorganisms ➢ explain the mechanism of infection ➢ examine bacterial diseases ➢ examine fungal diseases	
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Introduction of medical microbiology and concept of infection:** Historical development, Koch & River's postulates, role of microbiology in medicine of medically important microbes; microbial flora of human body.	12
II	**Pathogenesis:** Microbial infection-types, stages and process. Mechanism of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urogenital tracts. Role of agresins, depolymerizing enzymes, organotropism, variation and virulence.	11
III	**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.	11
IV	**Clinical Mycology:** Superficial, subcutaneous, cutaneous and systemic mycoses. General description of mycotic pathogens, the diagnosis and prevention. Pathogenic fungi: *Microsporium, Trichophyton, Histoplasma capsulatum, Blastomyces dermatitidis, Candida albicans, Cryptococcus neoformans.*	11
Key Words	**Organotropism, Microbial infection, pathogenesis, epidemiology**	

Name and Signature of Convener and Members of CBoS

DS. S. Nagal 10.6.24 — Rashmi 10.6.24 — 10.6.24 — DR. K. D. Patel — Dr. Nelson Xess

10/6/24 Dr. Rachana Chaudhary — 10.6.24 — 10-6-24

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Text book of Microbiology; R. Anantharayanan, C. K. Jayaram Panikar, Orient Longman, Mumbai.
2. Medical microbiology; P. Chrakrborthy
3. A Text Book of Microbiology: R. C. Dubey & D. K. Maheshwari

Reference Books:

1. Medical Microbiology; N. C. Dey and T. K. Dey, Allied agency, Calcutta.
2. Microbiology; Davis, Dulbecco, Eisen Harper and Row Maryland.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://microbiologysociety.org/static/uploaded/23cbf9c5-f8c8-4f91-b092a4ad819e6357.pdf
- https://books.google.co.in/books?id=RLpEDwAAQBAJ&pg=PA46&source=gbs_toc_r&cad=2#v=onepage&q&f=false
- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB3101.pdf
- https://repository.poltekkes-kaltim.ac.id/1153/1/medical%20microbiology.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks

End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**

Name and Signature of Convener and Members of CBoS

10.6.24 Rashmi 10.6.24 10.6.24 DR.K.K.Patel

DS.S.Nagal Dr.Nelson Kes

10/6/24 10.6.24 10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester -VII**		**Session: 2024-25**
1	**Course Code**	**MBSE-05 P**		
2	**Course Title**	**Lab. Course MBSE-05**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ prepare culture media and examine of different pathological samples ➢ compare various staining techniques ➢ relate serological tests for disease diagnosis ➢ justify antibiotic sensitivity tests		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**	

PART: B CONTENT OF THE COURSE

Total No. of Teaching-Learning Periods: 30Hours

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Preparation of culture media: Blood agar, Chocolate agar, MacConkey agar. 2. Isolation of bacteria from tooth crevices. 3. Staining techniques: Gram staining, Acid fast staining, metachromatic granule staining. 4. Demonstration of hemolysis on blood agar. 5. Perform microscopic examination of urine. 6. Isolation and identification of bacteria from pathological samples. 7. Perform serological tests: WIDAL, VDRL. 8. Perform antibiotic sensitivity test by disc diffusion method.	**30**
Key Words	**Culture media, Staining Techniques, Pathological samples, Antibiotic sensitivity test**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Laboratory Manual of Microbiology and Biotechnology: Aneja K. R
2. Practical Microbiology: R. C. Dubey and D. K. Maheshwari.
3. Laboratory Manual in Microbiology: P. Gunasekaran.

Online Resources:

- https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec= age&q&f=false
- https://microbiologysociety.org/static/uploaded/23cbf9c5-f8c8-4f91-b092a4ad819e6357.pdf
- https://books.google.co.in/books?id=RLpEDwAAQBAJ&pg=PA46&source=gbs_toc_r&cad=2#v=onepage&q&f=false

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10.6.24 10.6.24 10-6-24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VII**		**Session: 2024-25**
1	**Course Code**	**MBSE- 06 T**		
2	**Course Title**	**Mycology and Plant Pathology**		
3	**Course Type**	**Discipline Specific Elective (DSE)**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ classify and distinguish different types of fungi ➢ relate some special phenomenon in fungi ➢ examine the important genera of fungi ➢ determine applied aspects of fungi ➢ explain basic concepts of plants diseases and their management		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**		**Minimum Passing marks: 40**

PART: B CONTENT OF THE COURSE

Total No. of Teaching-Learning Periods: 45Hours/ 45 Periods

Unit	**Topics (Course contents)**	**No. of Period**
I	**Mycology:** Characteristics, cellular and thallus organization in fungi, Classification, general features, structure, nutrition and reproduction in Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes; Heterothallism and Para sexuality, Physiological specialization, Sex hormones in fungi	**12**
II	**Important Fungal Genera:** General features, taxonomic status and economic importance of *Mucor, Aspergillus, Penicillium, Saccharomyces, Neurospora, Agaricus, Fusarium, Alternaria, Curvularia, Cladosporium*; General account and importance of Lichens.	**11**
III	**Fungal Biotechnology:** Role of fungi in biotechnology, Applications of fungi in food industry (Flavor, texture, fermentation, organic acids, enzymes, Mycoproteins) fungal secondary metabolites, Fungal biofertilizers, Mycotoxins, Mushroom cultivation.	**11**
IV	**Concept of plant disease:** Definition of disease, symptoms associated with plant disease, Methods of infection and dissemination of pathogens, forecasting of plant diseases and its relevance in Indian context, Defence Mechanisms in Plant, Principles and practices involved in the management of plant diseases, Koch's postulates, Contributions of eminent Indian plant pathologists.	**11**
Key Words	**Classification of fungi, Fungal biotechnology, Concept of plant disease, Mycotoxins, Mycoproteins**	

Name and Signature of Convener and Members of CBoS

10.6.24 Rashmi 10.6.24 10.6.24 DVal DR.K.R.Patel

10/6/24 10/6/24 10/6/24 10-6-24 Dr. Nelson Xess

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Introductory Mycology; Alexopoulus, C.J., Mims,C.W. and Blackwel, M,. John Wiley, New York.
2. An Introduction to Mycology; Mehrotra, R.S. and K.R.Aneja. New Age International
3. Plant Pathology; Mehrotra R S and Ashok Agrawal. Tata Mc Graw Hill ,6th reprint (2006).

Reference Books:

1. Introduction to fungi; Webster, J. Cambridge University Press. Cambridge, U.K. (1985).
2. Morphology and Taxonomy of fungi; Bessey E.A. Vikas Publishing House Pvt. Ltd., New Delhi.

Online Resources – e-Resources/ e-Books and e- learning portals

- Text Book of Modern Plant Pathology
- https://yeastwonderfulworld.files.wordpress.com/2016/10/fungal-biology.pdf
- http://www.deskuenvis.nic.in/pdf/WEBSTER30521807395.pdf
- https://www.rvskvv.net/images/I-Year-II-Sem_Principles_Plantpathology_ANGRAU_20.04.2020.pdf
- https://agri-bsc.kkwagh.edu.in/uploads/department_course/PATH-121_FUNDAMENTALS_OF_PLANT_PATHOLOGY.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 Rashmi 10.6.24 10.6.24 DR.K.K.Patel Dr.Nelson Xess

10/6/24 10/6/24 10/6/24 10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester -VII**	**Session: 2024-25**
1	**Course Code**	**MBSE-06 P**	
2	**Course Title**	**Laboratory exercises in Mycology and Plant Pathology**	
3	**Course Type**	**Laboratory Course**	
4	**Prerequisite (If Any)**	**As per Program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ distinguish pathogenic and non-pathogenic fungi ➢ demonstrate fungal preservation under laboratory conditions ➢ identify the life cycle of disease-causing fungi ➢ examine plant disease symptoms in the laboratory	
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**

PART: B CONTENT OF THE COURSE

Total No. of Teaching-Learning Periods: 30Hours

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Isolation of fungi from different sources. 2. Preservation of pure cultures of common fungi. 3. Study of the vegetative and reproductive structures through temporary and permanent slides: *Mucor, Rhizopus, Saccharomyces, Aspergillus, Penicillium, Erysiphe, Agaricus, Fusarium, Cercospora, Colletotrichum, Cladosporium and Alternaria.* 4. Study of common plant diseases on the basis of causal agent, symptoms, epidemiology and control; White rust of crucifers; Downy mildew; Late blight of potato; Powdery mildew, Ergot of rye; Black stem rust of wheat; Loose smut of wheat; Wilt of tomato.	**30**
Key Words	**Pathogenic fungi, Disease symptoms, Pure Culture, Plant Diseases**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Laboratory Manual of Microbiology and Biotechnology; K. R Aneja
2. Practical Microbiology; R. C. Dubey and D. K. Maheshwari.
3. Laboratory Manual in Microbiology; P. Gunasekaran.
4. Experiments in Microbiology, Plant Pathology and Biotechnology; K.R. Aneja. New Age Pub. 2017

Online Resources:

- https://nikolaussucher.github.io/bio-two/fungi.html
- Practical manual of Plant pathology
- Plant Pathology Concepts and Laboratory Exercises 240131 100459.pdf (tnau.ac.in)

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 10.6.24 10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VII**		**Session: 2024-25**
1	**Course Code**	**MBSE-07 T**		
2	**Course Title**	**Agriculture and Veterinary Microbiology**		
3	**Course Type**	**Discipline Specific Elective (DSE)**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ find the multifarious roles of microorganisms in agriculture ➢ illustrate microbial damages to plants ➢ explain harmful effects fungal toxins on human ➢ examine biological control measures of plant diseases ➢ relate animal diseases due to microorganisms		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**		**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Agricultural Microbiology**: History, Contributions of Subba Rao, Dr. M. Swaminathan in Indian agriculture. Microbes and their importance in agriculture. **Bio fertilizers:** classification of biofertilizers, Nitrogen fixers, Phosphate solubilizers, PGPR, biofertilizers. Phyllosphere microflora.	**12**
II	**Plant Diseases:** Fungal diseases of plants: Rusts of wheat, late blight of potato, red rot of sugarcane; Bacterial diseases of plants: Citrus canker, blight of rice; Viral diseases of plants: Leaf curl of Papaya, vein clearing of lady's finger **Storage fungi:** Categories of storage fungi, conditions during storage in relation to damage of seeds, harmful effects. Role of Enzymes and toxins in plant pathogenesis, Mycotoxins and their effect on human	**11**
III	**Biological Control of plant diseases**: Bacterial control of insect pests: Bacillus thuringiensis as bacterial insecticide; Viral control of insect pests: Nuclear polyhedrosis visuses (NPV) and cytoplasmic polyhedrosis viruses (CPV); Fungal control of insect pests: Entomopathogenic fungi: *Beauveria bassiana, Verticillium lecani.*	**11**
IV	**Veterinary Microbiology:** Introduction, history and scope, Sources and routes of infection, Zoonoses, Study of following animal diseases with respect to etiology, symptoms, mode of transmission, prophylaxis and control: FMD, swine flu, bird flu, Rabies, bovine tuberculosis, Marek's, Ranikhet disease, brucellosis, distemper, transgenic animals.	**11**
Key Words	**Biofertilizers, Biopesticides, Plant diseases, Storage fungi, biological control, Animal diseases**	

Name and Signature of Convener and Members of CBoS

10.6.24 10.6.24 10.6.24 10.6.24 10.6.24 10/6/24 10/6/24 10/6/24

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Microbial Ecology: Fundamentals & Applications. 4th edition Atlas RM and Bartha R. (2000). Benjamin/Cummings Science Publishing, USA
2. Hand Book of Microbial Biofertilizers, Mahendra K. Rai (2005)., The Haworth Press, Inc. New York.
3. Bioinoculants for Sustainable Agriculture and Forestry, Reddy, S.M. et. al. (2002)., Scientific Publishers.

Reference Books:

1. Soil Microbiology: An Exploratory Approach, Coyne MS. (2001). Delmar Thomson Learning.
2. Agriculture Biotechnology; Altman A (1998)., Ist edition, Marcel decker Inc.
3. Development of Bioinsecticide, Saleem F and Shakoori AR (2012), Lap Lambert Academic Publishing GmbH KG

Online Resources – e-Resources/ e-Books and e- learning portals

- http://www.jnkvv.org/PDF/020420201802 52Yogranjan_Lecture%20notes_Agricultural%20Microbiology.pdf
- https://hpuniv.ac.in/upload/syllabus/5f0d8da1ed0a4B.Sc.HonsMicrobiologyFinal.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

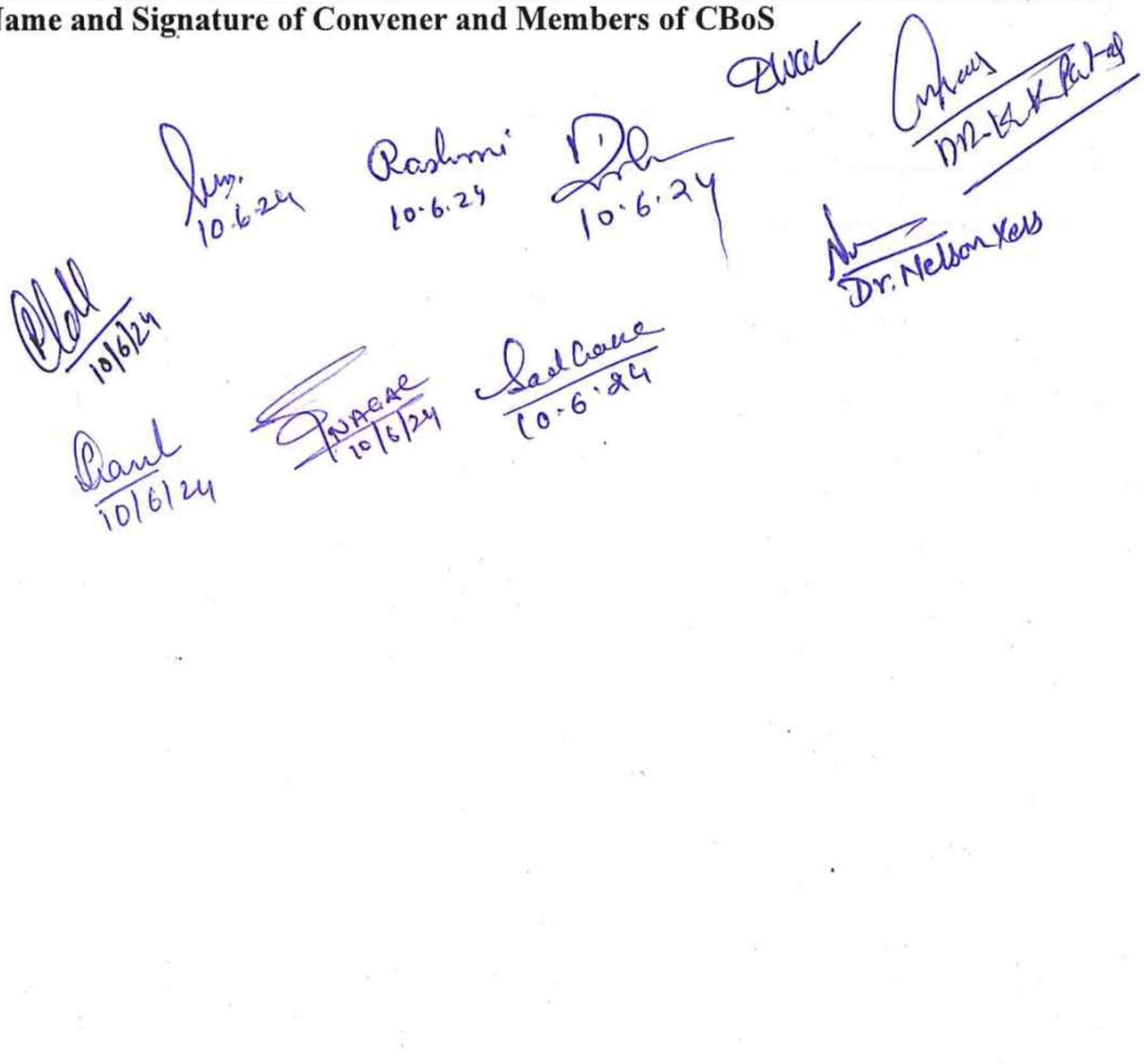
Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – (2): **20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS



FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester -VII**		**Session: 2024-25**
1	**Course Code**	**MBSE-07 P**		
2	**Course Title**	**Lab. Course - MBSE-07**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ examine microbial population of soil and their role ➢ demonstrate role of microorganisms for plant growth ➢ identify specific plant diseases ➢ identify specific animal diseases		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART: B CONTENT OF THE COURSE

Total No. of Teaching-Learning Periods: 30Hours

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. 2. Isolation of *Rhizobium* from legume root nodule and seed treatment studies. 3. Isolation of *Azotobacter/ Azospirillum* and study their effects. 4. Isolation of BGA from water/soil and its mass cultivation. 5. Isolation of PGPR from soil. 6. Study of storage fungi. 7. Symptomatic study of plant diseases and causal organism. 8. Symptomatic study of animal diseases and causal organism.	**30**
Key Words	**Soil Microflora, Beneficial Microbes for plants, Plant diseases, Animal diseases**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

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

Online Resources:

- https://nishat2013.files.wordpress.com/2013/11/laboratory-exercises-in-microbiology-book.pdf
- https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec= age&q&f=false

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 DR.K.K. Pate

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VII**		**Session: 2024-25**
1	**Course Code**	**MBSE-08 T**		
2	**Course Title**	**Fermentation Technology**		
3	**Course Type**	**Discipline Specific Elective (DSE)**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ classify the microorganisms for fermentation ➢ illustrate the basic concept of fermenter design ➢ explain the raw materials used in fermentation technology ➢ examine the methods of food preservation and assess quality ➢ compare the characteristics of fermented products		
6	**Credit Value**	**03 C**	**01 Credit = 15 Hrs. Teaching-Learning**	
7	**Total Marks**	**Max. Marks: 100**		**Minimum Pass marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Microbial growth and Design of fermenters:** Microbial culture selection for fermentation, Media formulation and optimization, inoculums development, strain improvement, microbial growth kinetics and yield kinetics. Design and operation of Fermenters, Basic concepts for selection of a reactor.	12
II	**Processes involved in fermentation:** Scale-up process and scale down process: Stages of fermentation-laboratory scale, pilot plant scale and production scale: Criteria of scale-up for critical parameters – aeration, agitation and sterilization; Scale down- Cell disruption; Filtration; Centrifugation; Chromatography; Lyophilization.	11
III	**Quality control & quality assurance test:** Principles of validation for pharmaceutical industry; QA Tests of finished product-Sterility testing, pyrogen testing, Ame's test toxicity testing, shelf-life testing.	11
IV	**Food preservation methods and Fermentation products:** High temperature, drying, food additives and radiation, preservation of milk, meat, fish, fruits and vegetables; food hygiene maintenance, large scale fermentation of Beer, Wine, Riboflavin, Streptomycin, Citric acid, Glutamic acid.	11
Key Words	**Fermenters and fermentation, Quality control, Quality assurance, Food preservation, Fermentation products**	

Name and Signature of Convener and Members of CBoS

Radhana 10.6.24 — Roshmi 10.6.24 — 10.6.24 — DRKKPatel — Dr. Nelson Xess

10/6/24 — 10/6/24 — 10/6/24

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. A Text Book of Microbiology: Dr. R. C. Dubey& Dr. D. K. Maheshwari
2. Industrial Microbiology, Casida, L. E. 1984, Wiley, Easterbs, New Delhi.
3. Industrial Microbiology. A. H. Patel 2nd Edition.

Reference Books:

4. Fermentation Microbiology and Biotechnology by M. El-Mansi and C. Bryce
5. Principles of Fermentation Technology Stanbury P.F., Whitaker A, and Hall S.J. (1997) Aditya Books Pvt. Ltd, N. Delhi.
6. Food Microbiology. 3rd edition. Frazier WC and Westhoff DC. (1992). Tata McGraw-Hill Publishing Company Ltd, New Delhi, India
7. Microbial Technology Vol. I and II by H. J. Peppler and D. Perlman. Academic Press INC.

Online Resources – e-Resources/ e-Books and e- learning portals

- **http://nsi.gov.in/study-materials/DIIPA_Lecture-2_Role_of_microorganismand_other_conditions_07042020.pdf**
- **https://www.technologytimes.pk/2019/03/13/food-preservation-methods/**
- **https://www.classcentral.com/course/swayam-food-microbiology-and-food-safety-17609**

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**		Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**		

Name and Signature of Convener and Members of CBoS

10.6.24 10.6.24 10.6.24 10/6/24 10/6/24 10/6/24 10/6/24 Dr. Nelson Xess

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester -VII**		**Session: 2024-25**
1	**Course Code**	**MBSE-08 P**		
2	**Course Title**	**Lab. Course - MBSE-08**		
3	**Course Type**	**Laboratory course**		
4	**Prerequisite (If Any)**	**As per Govt. norms**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ examine the role of microorganisms in fermentations ➢ experiment with fermenter design ➢ demonstrate production of fermented products ➢ identify method of food preservation		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART: B CONTENT OF THE COURSE		
Total No. of Teaching-Learning Periods: 30Hours		
Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Demonstration of Shake flask fermentation (Study of the effect of agitation) 2. Fermentative production of wine. 3. Isolation of organic acid producing microorganisms from soil. 4. Isolation of antibiotic producing microorganisms from soil.Isolation of enzyme producing microorganisms from soil. 5. Demonstration of production of Alcohol and Citric acid 6. Determination of Titrable acidity test. 7. Examination of preserved food and method of preservation	**30**
Key Words	**Bacterial fermentation, Organic acid, Antibiotic, Titrable acidity, phosphatase test**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Industrial Microbiology; AH Patel. Macmillan Publisher India.
2. Biology of Industrial microorganism; Arnold L. Domain, Benjamin/ cummings Pub. Co.
3. Practical Fermentation Technology; Brain McNeil & Harvey (2008), John Wiley & Sons Ltd.
4. Industrial Microbiology; Casida LE, New age International(P) Ltd.

Online Resources:

- http://asm.org/articles/2020/december/virtual-resources-to-teach-microiology-techniques
- https://www.tandfonline.com/doi/full/10.1080/13102818.2018.1440974
- https://user.eng.umd.edu/~nsw/ench485/lab8.htm
- https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1333&context=farms_reports

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 DRK Patel

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VIII**	**Session: 2024-25**
1	**Course Code**	**MBSE-09 T**	
2	**Course Title**	**Clinical Microbiology**	
3	**Course Type**	**Discipline Specific Elective Course (DSE)**	
4	**Prerequisite (If Any)**	**As per Program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ develop a clear vision about various aspects of infectious diseases ➢ explain the portal of entry of pathogens ➢ identify the method of collection of clinical samples and their processing ➢ distinguish different types of infectious diseases ➢ explain diagnostic procedures of infectious diseases	
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Basic concepts in Clinical Microbiology -** Classification of disease – infectious, communicable, contagious, nosocomial, iatrogenic& zoonotic diseases. Chain of infection -Portal of entry and exit of pathogen. Collection of clinical samples and Laboratory diagnosis: precautions required for sample collection (oral cavity, throat, skin, blood, urine, faeces).	**12**
II	**Viral Infections and Diseases -** Study of disease; causative agent, infectious dose, portal of entry, virulence, epidemiology, laboratory diagnosis, prophylaxis and treatment of AIDS, Polio, Rabies, Hepatitis. Newly emerging diseases: Dengue and Ebolla, COVID.	**11**
III	**Bacterial Infections and Diseases -** Study of disease; causative agent, infectious dose, portal of entry, virulence, epidemiology, laboratory diagnosis, prophylaxis and treatment of Tuberculosis, Typhoid, Cholera, Tetanus, Syphilis, Gastroenteritis caused by E. coli.	**11**
IV	**Fungal and Protozoal Diseases -** Study of disease; Causative agent, portal of entry, pathogenicity, laboratory diagnosis and treatment of Dermatophytosis, Malaria, Amoebic dysentery.	**11**
Key Words	**Clinical Diseases, Virulence, Pathogens, Infection, Dermatophytosis**	

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 Dr. I.K. Patel

10/6/24 10/6/24 Dr. Nelson Kess

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Textbook of Microbiology; Ed 8th, Anantnarayan P. and Paniker, C. K. J., (2009), Universities press, Hyderabad.
2. A text book of Microbiology; Chakraborty P (2013) New Central Book Agency, Delhi.
3. Medical Bacteriology and Microbiology; 16th Ed, Dey, N. C. and Dey, T. K., (1999) Allied Agency, Calcutta.

Reference Books:

1. Microorganisms in our world; Atlas, R. M. (1995), Mosby Year Book Inc.
2. Microbiology; 4th Ed., Davis, B. D., Dulbecco, R, Eisen, H. N., Ginsberg, R. S., (1990), Harper and Row Publishers, Singapore.
3. Microbiology; 2nd Ed., Prescott, L. M., Hartley, J. P. and Klein, D. A., (1993), W. M. C. Brown Publ, England.
4. Microbiology; 8th Ed., Tortora, G. J., Funke, B. R. and Case, C. L., (2004), Person Education (Low Price edition), Delhi

Online Resources:

- **https://www.routledge.com/Clinical-Microbiology/Struthers/p/book/9781498786898**
- **https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SMB3101.pdf**
- **https://repository.poltekkes-kaltim.ac.id/1153/1/medical%20microbiology.pdf**
- **https://pubmed.ncbi.nlm.nih.gov/21413252/ Medical Microbiology - PubMed (nih.gov)**

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – (2): **20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks

End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**

Name and Signature of Convener and Members of CBoS

Sadhana 10.6.24 Rashmi 10.6.24 10.6.24 DR.K.K.Patel Dr. Nelson Xess 10/6/24 10/6/24 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester -VIII**		**Session: 2024-25**
1	**Course Code**	**MBSE-09 P**		
2	**Course Title**	**Lab. Course - MBSE-09**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ find the methods of collection and transport of clinical samples ➢ explain the principles of clinical phenomena for diagnosis of diseases ➢ experiment with isolation and identification of disease-causing organisms ➢ relate antibiotic responses of pathogenic microorganisms		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**	

PART: B CONTENT OF THE COURSE

Total No. of Teaching-Learning Periods: 30Hours

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Collection & transport of clinical specimens. 2. Serological tests-WIDAL, VDRL, ELISA 3. Demonstration Chick Embryo techniques-inoculation and harvesting. 4. Study of growth characters of isolated pathogens on following media: MacConkey agar, EMB agar, Mannitoal salt agar, Salmonella Shigella agar, Glucose azide medium, Cetrimide agar, TSI agar. 5. Physical, Chemical and Microscopic examination of Clinical samples –urine, pus. *6.* Isolation, identification of following pathogens from clinical samples: *E. coli, Salmonella spp., Pseudomonas spp., Proteus spp., Klebsiella spp., Shigella spp., Staphylococcus spp, Streptococcus spp.* 7. Isolation and observation of fungal pathogens using Lactophenol cotton blue stain. 8. Direct examination of faces for ova and cysts. 9. Antibiotic sensitivity testing of the isolates	**30**
Key words	**Antibiotic sensitivity, lactophenol, Culture media, Isolation, Identification**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Laboratory Manual of Microbiology and Biotechnology; Aneja K. R
2. Practical Microbiology; R.C. Dubey and D. K. Maheshwari.
3. Laboratory Manual in Microbiology; P. Gunasekaran.

Online Resources:

- https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec=frontcover&source=gbs
- https://microbiologysociety.org/static/uploaded/23cbf9c5-f8c8-4f91-b092a4ad819e6357.pdf
- https://books.google.co.in/books?id=RLpEDwAAQBAJ&pg=PA46&source=gbs_toc_r&cad=2#v=onepage&q&f=false

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

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FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VIII**		**Session: 2024-25**
1	**Course Code**	**MBSE-10 T**		
2	**Course Title**	**Pharmaceutical Microbiology**		
3	**Course Type**	**Discipline Specific Elective (DSE)**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ relate Indian traditional therapies and contributors ➢ compare antimicrobial therapy and resistance ➢ develop basic awareness of pharmaceutical products, their testing and their spoilage ➢ identify drug designing and its applications ➢ illustrate agencies for clinical approval of pharmaceutical products		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**	

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	**Topics (Course contents)**	**No. of Period**
I	**Historical account:** History and principles of Indian traditional medicine, Contributors to ancient traditional medicine, Importance of Charak in Indian traditional knowledge. **Antimicrobial chemotherapy**: General properties of antimicrobial agent. Mode of action of antibiotics, its uses & limitations: Penicillin, Tetracycline, Chloramphenicol, Sulpha drugs, mode of action of quinolinones. Bacterial resistance to antibiotics and resistant barrier.	**12**
II	**Testing of Pharmaceutical products:** Sterility test: Microbial Limit test, Pyrogen testing, In vitro Pyrogen Test (IPT), Endotoxin (LAL) Test, Preservative Efficacy test, Carcinogenic test, Antibiotic Assay. Structure of cell wall of gram positive and gram-negative bacteria, synthesis of peptidoglycan and mode of action of different antibiotics on cell wall.	**11**
III	**Microbial Pharmaceuticals:** Vaccine; Types of vaccine, toxoid, Edible vaccine, DNA vaccine, Protein subunit vaccine, synthetic peptide vaccine. Hormone- Insulin. Microbial spoilage of pharmaceutical products: Microbial contamination of pharmaceutical products and their preservation.	**11**
IV	**Application of Biosensors in pharmaceuticals**: Financing R & D capital and market outlook, IP, BP, USP, FDA perspective, rational drug designing and macro - molecular, cellular, synthetic drug carriers.	**11**
Key Words	**Traditional medicine, Antibiotics, Vaccine, Drug carrier, Biosensors**	

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 DR.K.K.Patel Dr. Nelson Xess

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Medical Microbiology; N. C. Dey and T. K. Dey, Allied agency, Calcutta.
2. Text book of Microbiology; R. Anantharayanan, C. K. Jayaram Panikar, Orient Longman, Mumbai.
3. Medical microbiology; P. Chrakrborthy
4. A Text Book of Microbiology: Dr. R. C. Dubey & Dr. D. K. Maheshwari

Reference Books:

1. Microbiology; Davis, Dulbecco, Eisen Harper and Row Maryland.
2. British Pharmacoppoeia (2001). The stationary office London

Online Resources – e-Resources/ e-Books and e- learning portals

- http://microbiology.free.fr/Presentations/antimicrobialchemotherapy.pdf
- https://www.teachmint.com/tfile/studymaterial/class3rd/pharmaceuticalmicrobio/sterilitytestingpdf
- https://www.sciencedirect.com/science/article/pii/S2225411016000250
- https://en.wikipedia.org/wiki/Charaka
- https://www.sciencedirect.com/science/article/pii/S2225411016000250

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

10.6.24 10.6.25 10.6.24 Dr. K.K. Patel

10/6/24 Dr. Nelson Xess

10/6/24 10/6/24 10-6-24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester -VIII**	**Session: 2024-25**
1	**Course Code**	**MBSE-10 P**	
2	**Course Title**	**Lab. Course - MBSE-10**	
3	**Course Type**	**Laboratory Course**	
4	**Prerequisite (If Any)**	**As per Program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ compare antibiotic sensitivity tests ➢ demonstrate mode of action of anti-microbial products ➢ relate sterility of various pharmaceutical products and their spoilage ➢ examine agencies for clinical approval of pharmaceutical products	
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**

PART: B CONTENT OF THE COURSE

Total No. of Teaching-Learning Periods: 30Hours

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Study the antibiotic sensitivity by Disc Diffusion Method. 2. Study the antibacterial and antifungal effect of some plant extracts / natural products. 3. Find the minimum inhibitory concentration of a given antibiotic. 4. Sterility testing of pharmaceutical products- injectables, eye and eardrops.	**30**
Key Words	**Antibiotic sensitivity, MIV, injectables, Microbial Limit Test, FDA**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Laboratory Manual of Microbiology and Biotechnology; Aneja K. R
2. Practical Microbiology; R. C. Dubey and D. K. Maheshwari.
3. Laboratory Manual in Microbiology; P. Gunasekaran.

Online Resources:

- https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec= age&q&f=false

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 10/6/24 DR.K.K.Pat Dr. Nelson Xess

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VIII**		**Session: 2024-25**
1	**Course Code**	**MBSE-11 T**		
2	**Course Title**	**Metagenomics, Basic Computer & Bioinformatics**		
3	**Course Type**	**Discipline Specific Elective (DSE)**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ explain the concept and importance of metagenomics ➢ examine the perception of Microbiome ➢ develop an understanding of host-microbe interactions ➢ relate computer fundamentals and their applications ➢ examine resources and tools of Bioinformatics		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**		**Minimum Passing marks: 40**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Metagenomics:** Brief history and development of metagenomics, understanding bacterial diversity using metagenomics approach, Prospecting genes of biotechnological importance using Metagenomics, Basic knowledge of viral metagenome, meta transcriptomics, metaproteomics and metabolomics.	12
II	**Microbiomes:** Importance of microbial communities, VBNC (viable but not culturable bacteria). Modern methods of rapid identification of microbes (PCR, mass spectrometry, fluorescence techniques). CRISPR-Cas system **Molecular Basis of Host-Microbe Interaction:** Hypersensitive response (HR) to plant pathogens and its mechanism, Type three secretion systems (TTSS) of plant and animal pathogens.	11
III	**Computer fundamentals:** Basic concept of computer organization, generations of computer, hardware, software, basics of operating systems (windows, unix), Classification of computers and computer languages, MS office. **Internet & Web:** introduction; importance, requirements of internet, electronic mailing, chatting, search engines, webpages.	11
IV	**Concept of Bioinformatics:** Aim and branches, Applications, Basic biomolecular concepts: Protein, Amino acids, DNA, RNA sequences, structure and functions, Forms of biological information, Bioinformatics resources: NCBI, EBI, ExPASy, RCSB, DDBJ, available tools, Open access bibliographic resources and literature data bases: PubMed, BioMed Central, Public Library of Science (PloS), CiteXplore.	11
Key Words	**Metagenomics, Microbiome, computer fundamentals, Internet and web, Bioinformatics**	

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 10/6/24 10/6/24 10/6/24 10/6/24

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Fundamentals of Gene, Genomics and Genetic Engineering, Irfan Khan and Atiya Khanum, Ukaaz Publications Hyderabad.
2. Basic Bioinformatics, C.R. Hemlata
3. Bioinformatics, R. Sundaralingam, Saras Publications.
4. Bioinformatics and Computational Biology, Dr. Chittaranjan Baruah.
5. Computer Basics, G. Manjunath, Vasan Publications

Reference Books:

1. Introduction to Bioinformatics; Teresa K. Attwood, David J. Parry-Smith, Pearson Education. (1999).
2. Introduction to bioinformatics; Arthur M. Lesk. Oxford University Press (2004)
3. Fundamental Concepts of Bioinformatics; Dan E. Krane and Michael L. Raymer (2002)
4. Gene VII; Benjamin Lewin, Oxford University Press, (2000).
5. Molecular Biology of Gene; Watson. J. D, Baker. T. A, Bell S. P, Gann A. Levine. M. Losick R, 5th Edition.
6. Molecular biology and Microbial genetics; David Frifielder, Stanely R. Maloy, 2nd Edition, Jones and Barlett Publishers. (1994).
7. Molecular Biotechnology; Glick B. R. and Pasternak J.J., 2nd Ed.ASM press. (2003).

Online Resources – e-Resources/ e-Books and e- learning portals

- https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BI0505%20LAB%20MANUAL.pdf
- https://www.polygwalior.ac.in/file/20181204071417842813.pdf
- https://handelsmanlab.discovery.wisc.edu/wp-content/uploads/2018/01/Metagenomics-genomic-analysis.pdf
- https://handelsmanlab.discovery.wisc.edu/wp-content/uploads/2018/01/Sabree-Rondon-Handelsman-Metagenomics.pdf
- https://ashishmodi.weebly.com/uploads/1/8/9/7/18970467/computer_fundamental.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – (2): **20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks

End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**

Name and Signature of Convener and Members of CBoS

10/6/24 · 10.6.24 · 10-6-24 · 10.6.24 · Dr. K. K. Patel · Dr. Nelson Xess · 10/6/24 · 10/6/24 · 10-6-24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester -VIII**		**Session: 2024-25**
1	**Course Code**	**MBSE -11 P**		
2	**Course Title**	**Lab. Course - MBSE -11**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ experiment with soil to extract DNA and perform PCR ➢ identify hyper-sensitivity responses in plants ➢ develop skills to use computers for analysis of biological data ➢ select tools to retrieve biological data, compare and draw inference		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART: B CONTENT OF THE COURSE

Total No. of Teaching-Learning Periods: 30Hours

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Extraction of metagenomics DNA from soil. 2. PCR amplification of metagenomics DNA. 3. Demonstration of Hyper- sensitivity response in plant disease. 4. Creation of different formats on MS Word. 5. Construction of Bar Chart using MS Excel. 6. Formation of a Power Point Presentation. 7. Introduction to bioinformatics databases: NCBI/PDB/DDBJ, Uniprot, PDB. 8. Demonstration of Sequence retrieval using BLAST.	**30**
Key Words	**Metagenomic analysis, PCR amplification, MS Word, Bioinformatics databases**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Experiments in Biotechnology - Nighojkar and Nighojkar
2. Current protocols in molecular biology- Ausbel
3. Bioinformatics- A Practical Guide to the Analysis of Genes and Proteins; Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. (2009).

Online Resources:

- https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/BI0505%20LAB%20MANUAL.pdf
- https://www.polygwalior.ac.in/file/20181204071417842813.pdf

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester - VIII**		**Session: 2024-25**
1	**Course Code**	**MBSE-12 T**		
2	**Course Title**	**Biosafety and Intellectual Property Rights**		
3	**Course Type**	**Discipline Specific Elective (DSE)**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ define biosafety and discuss its importance ➢ explain the guidelines regarding GMO ➢ assess the risk of release of GMO and study its management ➢ identify the basic concepts related to IPR ➢ relate the knowledge of patent filing and examine case studies of IPR		
6	**Credit Value**	**03 Credits**	**Credit = 15 Hours - Learning & Observation**	
7	**Total Marks**	**Max. Marks: 100**	**Minimum Passing marks: 40**	

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Introduction to Biosafety:** Biosafety issues in biotechnology; Biosafety Cabinets &their types; Biosafety Levels of Specific Microorganisms, AERB/RSD/RES guidelines for using radioisotopes in laboratories and precautions.	12
II	**Biosafety Guidelines:** Biosafety guidelines and regulations (National and International); GMOs/LMOs- Concerns and Challenges; Role of Institutional Biosafety Committees (IBSC), RCGM, GEAC etc. for GMO, applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk assessment; Risk management and communication.	11
III	**Introduction to Intellectual Property:** Patents, Types, Trademarks, Copyright & Related Rights, Industrial Design and Rights, Traditional Knowledge, Geographical Indications-importance of IPR – patentable and non -patentable, patenting life, legal protection of biotechnological inventions, World Intellectual Property Rights Organization (WIPO), Plagiarism: Types and academic punishments	11
IV	**Grant of Patent and Patenting Authorities:** Types of patent applications: Ordinary, PCT, Conventional, Divisional and Patent of Addition; introduction to Patent Filing Procedures; Patent licensing and agreement; Rights and Duties of patent owner, GATT, TRIPS Agreements; Budapest Treaty on international recognition of the deposit of microorganisms; Indian Patent Act 1970 & recent amendments.	11
Key Words	**Biosafety, GMO, Intellectual Property, Patent, Indian Patent Act**	

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 DR.K.K.Katal

10.6.24 10.6.24 10/6/24 Dr. Nelson Yess

10/6/24

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Bioethics and Biosafety; M K Sateesh, Kindle Edition
2. IPR, Biosafety and Bioethics; Shomini Parashar, Deepa Goel Pearson India 2013

Reference Books:

1. Private Power, Public Law: The Globalization of Intellectual Property Rights; Susan K. Sell Cambridge University Press, 2000
2. Essentials of Intellectual Property: Law, Economics, and Strategy; Alexander I. Poltorak; Paul J. Lerner Wiley, 2011 (2nd edition
3. Biological Safety: Principles and Practices; Diane O. Fleming, Debra L. Hunt, 4th Edition. ASM 2006

Online Resources – e-Resources/ e-Books and e- learning portals

- https://www.cdc.gov/labs/pdf/CDC-BiosafetymicrobiologicalBiomedicalLaboratories-2009-P.pdf
- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBT1401.pdf
- https://iris.who.int/bitstream/handle/10665/337956/9789240011311-eng.pdf?sequence=1
- https://www.aphl.org/programs/preparedness/Smallpox/pdf/the-1-2-3s-of-biosafety-levels.pdf
- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBB1615.pdf
- https://www.wipo.int/edocs/pubdocs/en/intproperty/932/wipo_pub_b932ipb.pdf
- https://www.wipo.int/edocs/pubdocs/en/wipo_pub_450_2020.pdf
- https://www.rgmcet.edu.in/assets/img/departments/CIVIL/materials/R15/3-2/PESS/unit-6.pdf

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks

End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**

Name and Signature of Convener and Members of CBoS

10.6.24 10.6.24 10.6.24 DR-K-K Pattar

Dr. Nelson Kess

10-6-24

10/6/24 10/6/24 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Honors/ Honors with Research)		**Semester -VIII**		**Session: 2024-25**
1	**Course Code**	**MBSE-12 P**		
2	**Course Title**	**Lab. Course - MBSE-12**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ relate the working in a microbiology laboratory taking all safety measures ➢ develop skill to handle live cultures, disposal of infectious waste, care of the equipment and safety audit ➢ identify GMO and discuss their applications ➢ discuss case study reports		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. Laboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**		**Min. Passing marks: 20**

PART: B CONTENT OF THE COURSE

Total No. of Teaching-Learning Periods: 30Hours

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Study of components and design of a BSL-III laboratory 2. Study the examples of GMO and Indian contributions on GMO 3. Filing applications for approval from biosafety committee Filing primary applications for patents 4. Study the steps of patenting process 5. Case study on IPR	**30**
Key Words	**BSL, GMO, Patent, Case study**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Biological Safety: Principles and Practices; Diane O. Fleming, Debra L. Hunt, 4th Edition. ASM 2006
2. IPR, Biosafety and Bioethics; Shomini Parashar, Deepa Goel Pearson India 2013

Online Resources:

- https://iris.who.int/bitstream/handle/10665/337956/9789240011311-eng.pdf?sequence=1
- https://www.aphl.org/programs/preparedness/Smallpox/pdf/the-1-2-3s-of-biosafety-levels.pdf
- https://www.wipo.int/edocs/pubdocs/en/intproperty/932/wipo_pub_b932ipb.pdf
- https://www.annauniv.edu/ipr/files/downloadable/Overview%20of%20IPR.pdf

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 10.6.24 DR K.K. Patel

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Certificate/Diploma/Degree/Honors)		Semester - I	Session: 2024-25
1	Course Code	MBGE- 01 T	
2	Course Title	Introductory Microbiology and Microbial techniques	
3	Course Type	Generic Elective (GE)	
4	Prerequisite (If Any)	As per Program	
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to – ➢ relate the development and scope of Microbiology ➢ illustrate the contributions made by prominent scientists including Indian Vedic Knowledge on microbiology ➢ demonstrate the nomenclature and characteristics of different types of microorganisms ➢ identify the basic techniques in microbiology ➢ explain the methods of microbial control	
6	Credit Value	03 Credits	Credit = 15 Hours - Learning & Observation
7	Total Marks	Max. Marks: 100	Minimum Passing marks: 40

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**History and scope of microbiology** – History, development and Scope of Microbiology, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming and Edward Jenner, The Forgotten Past of Microbiology in Indian Vedic Knowledge.	12
II	**Nomenclature and General features of microorganisms** – Binomial nomenclature, principles of microbial classification, Major groups of microorganisms; General features and structure of bacteria, virus, fungi, algae and protozoa.	11
III	**Microbial culture and staining techniques** – Pure culture techniques: streaking, serial dilution and plating; types of culture media, cultivation of fungi and algae. Principle, procedure and applications of Simple staining, negative staining; Differential staining- Gram's staining, acid fast staining.	11
IV	**Microbial control** – Sterilization: Physical Agents - Heat: Boiling, Tyndallization, Steam under pressure (Autoclave), incineration, hot air Oven. Radiations: Ionizing and non-ionizing radiations. Filtration, Chemical agents - types, Disinfection, Antiseptic, Germicide, Sanitizer, Principle and application of Laminar airflow.	11
Key Words	**History and scope, Nomenclature, Pure culture technique, Microbial control**	

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10-6-24 10.6.24 10.6.24 10.6.24 Dr. Nelson Kerketta DR. K.K. Patel NAGAR Ds. Swetlana Nayak

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Microbiology: P. D. Sharma, Rastogi Publications.
2. A textbook of Microbiology: R. C. Dubey and Maheshwari, S Chand publications.
3. General Microbiology, Vol. II, C. B. Powar and Daginawala
4. Fundamentals of Microbiology and Immunology, Ajit Kr. Banerjee and Nirmalya Banerji, Central publication.

Reference Books:

1. Microbiology: Pelczar, MJ Chan ECS and Krieg NR, McGraw-Hill.
2. Microbiology: 5th Edition Prescot, M.J., Harley, J.P. and Klein, D.A. WCB Mc Graw Hill, New York.
3. Microbiology: An Introduction: Pearson Education Tortora, G.J., Funke, B.R. and Case, C.L., Singapore.
4. Fundamentals of Microbiology: VI Edition Alcomo, I.E., Jones and Bartlett Publishers. Sudbury. Massachusetts, (2001).

Online Resources – e-Resources/ e-Books and e- learning portals

- **https://www.jsscacs.edu.in/sites/default/files/Department%20Files/History%20of%20Microbiology.pdf**
- **https://www.britannica.com/science/microbiology**
- **https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7810802/**
- **https://www.slideshare.net/HarinathaReddyA/methods-for-isolation-of-pure-culture**
- **https://microbenotes-com.webpkgcache.com/doc/-/s/microbenotes.com/sterilization-physical-and-chemical-methods/**

Part – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **100 Marks**

Continuous Internal Assessment (CIA): **30 Marks**

End Semester Exam (ESE): **70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – (2): **20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

Sadhana 10.6.24

10.6.24

Roshmi 10.6.24

10.6.24

DR. L. Nelson

Dr. Nelson Xess

10/6/24

(DR - V Shanthi)

10/6/24

10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Certificate/Diploma/Degree/Honors)		Semester I		Session: 2024-25
1	Course Code	MBGE- 01 P		
2	Course Title	Lab. Course - MBGE- 01		
3	Course Type	Laboratory Course		
4	Prerequisite (If Any)	As per Program		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to – ➢ define the basic laboratory practices and safety measures in microbiology laboratory ➢ explain the principle, working and applications of laboratory Instruments ➢ select the proper culture media for microbial growth ➢ identify different microorganisms in the laboratory		
6	Credit Value	1 Credit	*Credit = 30 Hours. Laboratory or Field learning/ Training*	
7	Total Marks	Max. Marks: 50		Min. Passing marks: 20

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./ Field Training/ Experiment contents of Course	1. Good Laboratory Practices and Bio-safety in Microbiology. 2. To study the principle and applications of autoclave, incubator, BOD incubator, hot air oven, laminar air flow, light microscope. 3. Preparation of culture media (liquid & solid), sterilization and assessment of sterility 4. Isolation of microorganisms from environment by pour plate, streak plate and spread plate technique. 5. Observation of microorganisms-fungi, yeasts and algae from natural habitats. 6. Observation of bacteria by Gram staining technique.	30

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Experiments in microbiology, plant pathology and biotechnology: K R Aneja
2. Practical microbiology: R C Dubey and D K Maheshwari.

Online Resources:

- https://www.youtube.com/watch?v=IIndcMyuEXs
- https://www.youtube.com/watch?v=CbMGr9wFV2w

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10.6.24 10.6.24 10.6.24 10.6.24 DR. K. K. Patel 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART–A: Introduction				
Program: Bachelor in Life Science (Certificate/Diploma/Degree/Honors)		Semester - II		Session: 2024-25
1	Course Code	MBGE-02 T		
2	Course Title	Bacteriology, Virology and Protozoology		
3	Course Type	Generic Elective (GE)		
4	Prerequisite (If Any)	As per Program		
5	Course Learning Outcomes (CLO)	At the end of this course, the students will be able to – ➢ recall the ultrastructure of bacteria ➢ relate ecological distribution of microorganism and their significances for society ➢ illustrate the essential and current knowledge of bacteria ➢ identify virus, protozoa and archaebacteria with their special characteristics ➢ outline the beneficial & harmful behavior of viruses, bacteria, protozoan and other microbes		
6	Credit Value	03 Credits	Credit = 15 Hours - Learning & Observation	
7	Total Marks	Max. Marks: 100		Minimum Passing marks: 40

PART – B: Content of the Course

Total No. of Teaching-Learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

UNIT	TOPIC (Course Contents)	No. of Period
I	**Morphology and Ultra structure of Bacteria:** Cell size, shape and arrangements. Composition, structure and function of cell membrane, cell wall of gram-positive, gram-negative bacteria, capsule, flagella, pili, ribosomes, inclusions, endospore, plasmids.	12
II	**Eubacteria & Archaebacteria:** Gram negative- Characteristics of non-proteobacteria–*Deinococcus, Spirochetes*. Alpha proteobacteria- *Rhizobium, Agrobacterium*. Gamma proteo-bacteria- *Escherichia, Pseudomonas*. Gram positive- Characteristics of low G+C; *Bacillus, Clostridium, Staphylococcus*. High G+C: *Streptomyces, Frankia*. (General characteristics.) **Ecological significance and economic importance of Archaea:** Methanogens, thermophiles (Thermococcus, Pyrococcus) and halophiles (halobacteria and halococcus).	11
III	**Morphology, ultrastructure of viruses:** General introduction, morphology and ultra- structure of viruses, capsid, envelopes. Types of Viral genome. Viral related forms -virions, viroids, virusoids, and prions. Salient features and life cycle of viruses: Bacteriophages (T4), Plant Virus (TMV), Animal Virus (Pox virus).	11
IV	**Introduction to protozoa;** Occurrence and classification of protozoa. Structure, reproduction, life cycle and diseases caused by important protozoans - *Entamoeba, Leishmania, Trypanosoma* and *Plasmodium*	11
Key Words	**Bacteria, Archaea, Virus, Bacteriophage, Prions, Protozoan**	

Name and Signature of Convener and Members of CBoS

10/6/24 Dr. Rachana Chaudhary

Sadhana 10.6.24

10.6.24

Rashmi 10.6.24

10.6.24

10/6/24

10/6/24

10/6/24

DP-BOP Dr. Nelson Xess

Part – C: Learning Resources

Text Books, Reference Books and Others

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. A Text Book of Microbiology; R. P. Singh.
4. Fundamentals of Microbiology and Immunology, Ajit Kr. Banerjee and Nirmalya Banerji, Central publication.
5. Parasitology; H.S. Singh and P. Rastogi, First Edition, Rastogi Publications.

Reference Books:

6. Prescott's Microbiology. Wiley J M, Sherwood L M and Woolverton C J.
7. Microbiology. Pelczar M J, Chan E C S and Krieg N R.
8. General Microbiology. Stanier R Y, Ingraham J L, Wheelis M L, and Painter P R.
9. Microbiology: An Introduction. Tortora G J, Funke B R and Case C L.

Online Resources – e-Resources/ e-Books and e- learning portals

- https://www.ncbi.nlm.nih.gov/books/NBK8477_/
- https://www.britannica.com/science/archaea
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7150055/
- https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson-53.pdf
- http://ecoursesonline.iasri.res.in/Courses/Agricultural%20Microbiology/

Part- D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100 Marks**
Continuous Internal Assessment (CIA):	**30 Marks**
End Semester Exam (ESE):	**70 Marks**

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz – **(2): 20+20** Assignment/ Seminar – **10** Total Marks – **30**	Better marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **10 X 1 = 10 Mark**; **Q2.** Short answer type – **5X4= 20 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X10 = 40 Marks**	

Name and Signature of Convener and Members of CBoS

Sadhana 10.6.24 — 10.6.24 — Roshni 10.6.24 — 10.6.24 — Dr. Nelson Xess — 10/6/24 Dr. Rahasi Chaudhary — 10/6/24 — 10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Certificate/Diploma/Degree/Honors)		**Semester - II**		**Session: 2024-25**
1	**Course Code**	**MBGE-02 P**		
2	**Course Title**	**Lab. Course - MBGE-02**		
3	**Course Type**	**Laboratory Course**		
4	**Prerequisite (If Any)**	**As per Program**		
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ culture microorganisms and get the knowledge about their morphological features ➢ illustrate different staining procedures ➢ identify bacteria and protozoa from different samples ➢ get practice of identification of colonies on different culture media		
6	**Credit Value**	**1 Credit**	***Credit = 30 Hours. İaboratory or Field learning/ Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min. Passing marks: 20**	

PART – B: Content of the Course

Total No. of learning-Training/ Performance Periods: 30 Periods (30 Hours)

Module	**Topics (Course contents)**	**No. of Period**
Lab./ Field Training/ Experiment contents of Course	1. Isolation and characterization of bacteria by colony characteristics. 2. Growth on simple media – Nutrient agar and Nutrient broth 3. Growth on complex media – Blood agar, Chocolate agar, Maconkey's, and EMB agar. 4. Differential Staining Techniques: Gram staining and acid-fast staining 5. Special Staining Techniques: Negative staining and Endospore staining 6. Study of cytopathic effects of viruses using photographs. 7. Observation of protozoa from different samples.	**30**
Key Words	**Isolation, Identification, Staining Techniques, Cytopathic effects, Protozoa**	

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Laboratory Manual of Microbiology and Biotechnology: Aneja K. R
2. Practical Microbiology: R. C. Dubey and D. K. Maheshwari.
3. Laboratory Manual in Microbiology: P. Gunasekaran.

Online Resources:

- **https://books.google.co.in/books?id=Wh9OTbjcsfUC&printsec= age&q&f=false**

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by course teacher as per lab. status**

Name and Signature of Convener and Members of CBoS

10/6/24 10/6/24 10-6-24 10.6.24 10.6.24 10.6.24 DR-10-6-24 Dr. Nelson Kerketta DAGAL

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction			
Program: Bachelor in Life Science (Certificate/Diploma/Degree)		**Semester - II/ IV/V/VI**	**Session: 2024-25**
1	**Course Code**	**MBSEC-01**	
2	**Course Title**	**Mushroom Cultivation**	
3	**Course Type**	**Skill Enhancement Course (SEC)**	
4	**Prerequisite (If Any)**	**As per Program**	
5	**Course Learning Outcomes (CLO)**	**At the end of this course, the students will be able to –** ➢ explain nutritional and medicinal values of mushroom ➢ relate the types of mushrooms and their spawn preparation ➢ examine the methods of cultivation and economic aspects ➢ attain expertise using different Agro-residues for cultivation of mushrooms ➢ observe post-harvest management of mushrooms	
6	**Credit Value**	**02 Credits (1C + 1C)**	***Credit = 15 Hrs. Theoretical Learning and = 30 Hrs. Laboratory or field learning/ Training***
7	**Total Marks**	**Max. Marks: 50**	**Minimum Passing marks: 20**

PART – B: Content of the Course

Total No. of Teaching-Learning Periods:
Theory – 15 Periods (15 Hrs.) and Lab. or Field Learning / Training 30 Periods (30 Hours)

Module	**Topics (Course Contents)**	**No. of Period**
Theory Contents	**Introduction and Life cycle:** Classification and identification of edible and nonedible mushrooms. Nutritional and medicinal value of mushroom, Scope of mushroom cultivation. Taxonomic position and Life cycle of mushroom. Types of mushrooms; Button mushroom (Agaricus biporus), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajor kaju*) and paddy straw mushroom (*Volvariella volvacea*). (Observation). **Principles and Requisites:** Sterilization and disinfection of substrates, growth medium, isolation, spawn production and maintenance. (Observation) **Techniques of Cultivation:** Structure and construction of low-cost mushroom huts, layout of Traditional and Green house method. Maintenance of proper condition in mushroom huts, Composting, bed and polythene bag preparation, Spawning-casing-cropping. (Observation).	**15**
Lab./Field Training Contents	1.Preparation of laboratory Glassware (Chemical washing, cleaning and drying). 2.Basic information about autoclave, hot air oven, laminar air flow 3.Sterilization and sanitation of mushroom house, instruments etc. 4.Identification of edible and poisonous mushrooms. 5.Preparation of Mother Culture. Spawn- media preparation, Inoculation, and incubation. 6.Preparation of different types of bed for cultivation. 7.Cultivation of Mushroom using compost/ paddy straw/agricultural wastes. 10.Harvesting and post-harvest management of crops. (Observation & Practice)	**30**
Key Words	**Mushroom, Spawning, Compost, Harvesting**	

Name and Signature of Convener and Members of CBoS

10/6/24 20/6/24 10.6.24 10.6.24 10.6.24 Dr. Nelson Dr. Swetha

Part – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. Nita Bhal. (2000). Hand book on Mushrooms. 2nded. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Tewari, S. C., Pankaj Kapoor, (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
3. Biotechnology, V. Kumaresan.

Reference Books:

1. Stamets, Paul, and J.S. Chilton. 1983. The Mushroom Cultivator. Agarikon Press, Olympia, WA. 415 p.

Online Resources – e-Resources/ e-Books and e- learning portals

- **https://nios.ac.in/media/documents/vocational/mushroom_production_(revised)(618)/Lesson-01.pdf**
- **https://agriportal.cg.nic.in/horticulture/PDF/Download/Mushroom%20Project_Part%201.pdf**
- **http://nhb.gov.in/pdf/Cultivation.pdf**

PART: D ASSESSMENT AND EVALUATION

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks

End Semester Exam (ESE):	**Laboratory/ Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work – 20 Marks** **B. Spotting based on tools & technology (written) - 10 Marks** **C. Viva-voce (based on principle/ technology) – 05 Marks**	**Managed by Coordinator as per skilling**

Name and Signature of Convener and Members of CBoS

10.6.24 10.6.24 10.6.24 DR-K-V-Reddy Dr. Nelson Xess

10/6/24 10.6.24 NAGAL Ds. Swethana Nayak

10/6/24

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF MICROBIOLOGY
COURSE CURRICULUM

PART – A: Introduction				
Program: Bachelor in Life Science (Diploma/Degree)		Semester - III/IV		Session: 2024-25
1	Course Code	MBVAC-01		
2	Course Title	Microbes and Human Health		
3	Course Type	Value Added Course (VAC)		
4	Prerequisite (If Any)	As per Program		
5	Course Learning Outcomes (CLO)	**At the end of this course, the students will be able to –** ➢ define the basic concept of Infection and disease ➢ explain various serological tests ➢ illustrate the basic knowledge of Immune status of human body ➢ identify various infectious diseases		
6	Credit Value	02 Credits	*Credit = 15 Hours - Learning & Observation*	
7	Total Marks	Max. Marks: 50		Minimum Pass marks: 20

PART – B: Content of the Course

Total No. of Teaching-Learning Periods: (01 Hr. per Period) - 30 Periods (30 Hours)

Unit	Topics (Course contents)	No. of Periods
I	**Infection & Disease:** Difference between infection and disease, Important terminologies along with suitable examples; primary infection, secondary infection, contagious infection, nosocomial infections, clinical infection, subclinical infection, zoonoses, vector borne infection. Epidemic, endemic and pandemic diseases.	08
II	**Routes of entry and transmission of disease:** Portal of entry, Portal of exit, Reservoir, susceptible host. Direct contact, indirect contact, Airborne, vector borne, blood borne, non-contact vehicle transmission. Exposure, risk and standard precautions, expanded precautions. Control of routes of transmission.	08
III	**Serological reactions:** Basic concept of serological reactions, blood cell counting, Agglutination, precipitation. Blood group determination, Widal test, VDRL test. Total RBC count, Total leucocyte count, Platelet count, Differential count, Estimation of haemoglobin.	07
IV	**Viral and Bacterial infection:** Common water borne infections, air borne infections; their causes, sign & symptoms, pathogenesis, diagnosis, treatment and prevention.	07
Key Words	**Infection, Disease, Virulence, Pathogenesis**	

Name and Signature of Convener and Members of CBoS

Ranjit 10/6/24 — Abell 10/6/24 — Rashmi 10.6.24 — Rashmi 10.6.24 — 10.6.24 — DR. K.K. Pathy — Dr. Nelson Xess — S. NAGAL (Dr. S. Nagal)

PART – C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. A Text Book of Microbiology; Dubey & Maheshwari.
2. General Microbiology; Vol I & II, Powar C.B. and Daginawala H.I., Himalayn Pub. House, Bombay.
3. Text book of Microbiology; Ananthanarayan R. and Paniker C.K.J. (2009). 8th edition, University Press Publication
4. A Text Book of Microbiology; P. Chakraborthy, 3rd Edn, New Central book Agency (P) Ltd, Kolkata, India 2005.

Reference Books:

1. Preventive and Social Medicine, Park and Park

- https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBMA1302.pdf
- https://www.news-medical.net/health/Modes-of-Transmission.aspx
- https://courses.lumenlearning.com/suny-microbiology/chapter/how-pathogens-cause-disease/

PART – D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment (CIA): 15 Marks
End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	**Internal Test/ Quiz – (2): 10 & 10** **Assignment/ Seminar + Attendance: 05** **Total Marks: 15**	Better Marks out of the two Test/ Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Two Section – A & B** Section A: **Q1.** Objective **05 X 1 = 05 Mark**; **Q2.** Short answer type – **5X2 = 10 Marks** Section B: Descriptive answer type qts., **1 out of 2** from each unit – **4X05 = 20 Marks**	

Name and Signature of Convener and Members of CBoS

10/6/24 10.6.24 10.6.24 10.6.24 10/6/24

(Dr. Swetlana Nagal) 10/6/24 (DR. V. Shanthi) 10-6-24

Dr. Nelson Xess