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

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**	

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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**

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