

SU/BOS/Science/481

Date: 01/07/2023

To,

The Principal, All Concerned Affiliated Colleges/Institutions Shivaji University, Kolhapur	The Head/Co-ordinator/Director All Concerned Department (Science) Shivaji University, Kolhapur.
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Subject: Regarding syllabi of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

Sir/Madam,

With reference to the subject mentioned above, I am directed to inform you that the university authorities have accepted and granted approval to the revised syllabi, nature of question paper and equivalence of B.Sc. Part-II (Sem. III & IV) as per NEP-2020 degree programme under the Faculty of Science and Technology.

B.Sc. Part-II (Sem III & IV) as per NEP-2020			
1.	Mathematics	8.	Chemistry
2.	Statistics	9.	Sugar Technology (Entire)
3.	Physics	10.	Microbiology
4.	Astrophysics	11.	Industrial Microbiology
5.	Zoology	12.	Electronics
6.	Botany	13.	Geology
7.	Plant Protection		

This syllabus, nature of question and equivalence shall be implemented from the academic year 2023-2024 onwards. A soft copy containing the syllabus is attached herewith and it is also available on university website www.unishivaji.ac.in)

The question papers on the pre-revised syllabi of above-mentioned course will be set for the examinations to be held in October /November 2023 & March/April 2024. These chances are available for repeater students, if any.

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking you,


Dy Registrar
Dr. S. M. Kubal

Copy to:

1	The Dean, Faculty of Science & Technology	8	P.G. Admission/Seminar Section
2	Director, Board of Examinations and Evaluation	9	Computer Centre/ Eligibility Section
3	The Chairman, Respective Board of Studies	10	Affiliation Section (U.G.) (P.G.)
4	B.Sc. Exam/ Appointment Section	11	Centre for Distance Education

SHIVAJI UNIVERSITY, KOLHAPUR.



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CHOICE BASED CREDIT SYSTEM

**Syllabus For
B.Sc. Part-II**

INDUSTRIAL MICROBIOLOGY

(Faculty of Science and Technology)

SEMESTER III AND IV

(Syllabus to be implemented from June, 2023 onwards as per NEP 2020)

SY B.Sc. Microbiology Syllabus level-5

SEMESTER- III

Course V C-9 (DSC 5)

Microbial Production of Fermented Foods

Credits - 2; Total hours - 30

Course Outcomes and Objectives:

- 1) To learn the basics of common fermented food
- 2) To understand the role of microorganism in production of fermented foods
- 3) To study typical fermentation process of alcoholic beverages
- 4) To understand the concept of spoilage and preservation of fermented foods

Credit I	Industrial production of fermented foods	No. of hours: 15
	A) Dairy Product 1. Cheese 2. Yoghurt 3. Curd 4. Butter B) Alcoholic Beverages 1. Wine- a) Red Table Wine b) Sparkling Wine-Champagne 2. Beer: - a) Ale b) Lager C) Pickles 1. Sauerkraut 2. Cucumber 3. Olives	
Credit II	Spoilage of Fermented Foods and its Preservation	No. of hours: 15

	A) Spoilage of Dairy Product 1. Cheese 2. Yoghurt 3. Curd 4. Butter B) Spoilage of Alcoholic Beverages 1. Wine 2. Beer C) Spoilage of Pickles 1. Sauerkraut 2. Cucumber 3. Olives D) Preservation of 1. Dairy Product 2. Alcoholic Beverages 3. Pickles	
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SEMESTER- III

Course VI C9-(DSC -6)

Quality Control of Food Products

Credits - 2; Total hours - 30

Course Outcomes and Objectives:

- 1) To learn the techniques of microbiological quality control of food
- 2) To understand the basic concepts of quality assurance of food products
- 3) To make the students aware of GMP and GLP
- 4) To understand the knowledge of hazard analysis

Credit I	Quality Control of Food Products	No. of hours: 15
	A) Need of microbiological quality control of food B) Microbiological analysis of food products 1. SPC 2. Detection for the presence of i) Pathogenic bacteria. <i>a. E. coli</i> <i>b. Staph. aureus</i> <i>c. Shigella</i> <i>d. Pseudomonas</i> <i>e. Salmonella</i> ii) Yeast and mold	
Credit II	Introduction to Quality Assurance of Food Products	No. of hours: 15

	<p>A) Basic concepts of</p> <ol style="list-style-type: none"> 1. Regulation as per PFA, FDA, FPO. 2. Standards & Norms as per ISO, BIS, AGMARK <p>B) Introduction of GMP, GLP</p> <p>C) Introduction to HACCP (Hazard Analysis Critical Control Points).</p> <p>D) TQMS (Total Quality Management System) of milk and milk products-</p> <ol style="list-style-type: none"> 1. Raw material acceptance 2. Process control 3. Packaging 4. Finished product storage 5. Transport and Distribution <p>E) ICMSF (International Commission on the Microbiological Specification of Foods)</p> <ol style="list-style-type: none"> 1. Introduction 2. ICMSF–Sampling plans <ol style="list-style-type: none"> a) The two-class plan b) The three-class plan 	
<p style="text-align: center;">SEMESTER- IV</p> <p style="text-align: center;">Course VII C-5 (DSC 7)</p> <p style="text-align: center;">Fermentation Technology</p> <p style="text-align: center;">Credits - 2; Total hours - 30</p> <p>Course Outcomes and Objectives:</p> <ol style="list-style-type: none"> 1) To study industrial production of microbial primary metabolites 2) To study industrial production of microbial secondary metabolites 		
Credit I	<p>Industrial Production:</p> <p>Raw materials, Microorganisms, Production process, Recovery and Applications of</p>	No. of hours: 15
	<p>A) Antibiotics</p> <ol style="list-style-type: none"> 1. Streptomycin 2. Tetracycline 3. Rifampicin <p>B) Organic Acids</p> <ol style="list-style-type: none"> 1. Lactic Acid 2. Citric Acid 	

Credit II	Industrial Production: Raw materials, Microorganisms, Production process, Recovery and Applications of	No. of hours: 15
	A) Amino acids <ol style="list-style-type: none"> 1. Lysine 2. Glutamic Acid B) Enzymes <ol style="list-style-type: none"> 1. Amylase 2. Lipase 3. Protease 	

<p align="center">SEMESTER- IV</p> <p align="center">Course VIII C-5 (DSC-8)</p> <p align="center">Industrial Production of Biofertilizers</p> <p align="center">Credits - 2; Total hours - 30</p> <p>Course Outcomes and Objectives:</p> <ol style="list-style-type: none"> 1) To make the students aware of organic farming 2) To understand the concept of N₂ fixing and phosphate solubilizing biofertilizers 		
Credit I	Nitrogen fixing biofertilizers	No. of hours: 15
	A) Concept and its need in organic farming B) Rhizobium Biofertilizer <ol style="list-style-type: none"> 1. Characteristics 2. Host-Rhizobium interaction 3. N₂ fixation in root nodules 4. Production 5. Methods of application C) Azotobacter Biofertilizer <ol style="list-style-type: none"> 1. Characteristics 2. N₂ fixation process 3. Production 4. Methods of application D) Azospirillum Biofertilizer <ol style="list-style-type: none"> 1. Characteristics 	

	2. Association with plants 3. Production 4. Methods of application	
Credit II	Phosphate Solubilizing Biofertilizers	No. of hours: 15
	A) VAM Biofertilizer 1. Characteristics and types of association 2. Production 3. Methods of application B) PSB Biofertilizer (Phosphate Solubilising Bacteria) 1. Mechanism of phosphate solubilisation 2. Production 3. Methods of application C) Quality control of Biofertilizers as per FCO (Fertilizer Control Order) 1. Introduction of FCO specifications for biofertilizers 2. Sampling procedure 3. Method of analysis 4. Standards of biofertilizers 5. Biostability of product biofertilizer	

<p align="center">PRACTICAL COURSE III(DSC-5+DSC-6)</p> <p align="center">Credits - 4; Total hours -60</p> <p>Course Outcomes and Objectives:</p> <ol style="list-style-type: none"> 1. To learn the techniques of isolation of bacteria from spoiled foods 2. To make the students aware of food poisoning and food infection 		
Credit I	1) Production of sauerkraut 2) SPC of sauerkraut 3) SPC of buttermilk, cheese	No. of hours: 15
Credit II	1) Isolation of bacteria from spoiled milk 2) Isolation of bacteria from spoiled cheese 3) Isolation of bacteria from spoiled wine 4) Isolation and identification of Lactic acid bacteria from curd	No. of hours: 15
Credit III	1) Rapid detection of food pathogens- <i>E. coli</i> and <i>Staphylococcus</i> from given food sample 2) Detection for the presence of <i>E. coli</i> and <i>Staphylococcus aureus</i> in butter	No. of hours: 15

Credit IV	1) Detection for the presence of <i>Pseudomonas</i> from given food sample 2) Detection for the presence of <i>Salmonella</i> from given food sample 3) Detection for the presence of yeast and molds from given food sample	No. of hours: 15
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<p align="center">PRACTICAL COURSE IV(DSC-7+DSC-8)</p> <p align="center">Credits - 4; Total hours -60</p> <p>Course Outcomes and Objectives:</p> <ol style="list-style-type: none"> 1. To understand the upstream and downstream processing in industrial microbiology 2. To study the techniques for estimation of fermented food products 3. To learn the techniques of isolation of bioinoculants 		
Credit I	1) Isolation of lipolytic, proteolytic producing microorganisms from suitable source 2) Production, extraction, purification of citric acid 3) Production of amylase by a surface culture method 4) Production of protease by submerged culture method	No. of hours: 15
Credit II	1) Estimation of following fermentation products by suitable assay method a) Antibiotics- Streptomycin & Tetracycline by Diffusion assay method b) Organic Acids- Lactic Acid & Citric Acid by titration method c) Enzymes- Amylase (DNSA method)	No. of hours: 15

	2) Immobilization of Amylase by using sodium alginate method 3) Assay of protease (Folin Ciocalteu Method)	
Credit III	1) Isolation of <i>Azotobacter</i> from soil 2) Isolation of <i>Azospirillum</i> from soil 3) Isolation of Rhizobium from root-nodules	No. of hours: 15
Credit IV	1) Isolation of Phosphate solubilizing bacteria from soil 2) Determination of heterocyst frequency of blue-green algae 3) Microbial limit test for PSB market fertilizer product	No. of hours: 15

LIST OF REFERENCE BOOKS FOR THEORY & PRACTICAL

1. Food Microbiology by Frazier.
2. Food Microbiology by H. A. Modi. (Vol. I&II)
3. Industrial Microbiology by A. H. Patel.
4. Industrial Microbiology by Prescott & Dunn.
5. Soil Microbiology by Subbarao.
6. Agriculture Microbiology by Rangaswamy.
7. Methods in Food and Dairy Microbiology by Harrigon.
8. Biofertilizers- Vyas & Vyas (Ekta Publication).
9. Bacteriological Techniques- F. K. Baker
10. Milk & milk products- Winton & Winton
11. Pharmaceutical Microbiology- Hugo & Russell.
12. Citric acid Biotechnology- J. Achrekar.
13. Enzyme Biotechnology- G. Tripathi.
14. Bio fertilizers- Arun Sharma.
15. Industrial Microbiology- Agrawal / Parihar
16. Biotechnology- S. S. Purohit.

17. Agriculture Microbiology- G. Rangaswami & D. J. Bagyaraj
18. Text-book of Biotechnology- G. R. Chhatwal.
19. Pharmaceutical Biotechnology- Purohit / Kakrani / Saluja.
20. Practical Microbiology- R. C. Dubey and D. K. Maheshwari
21. Experimental Microbiology- Rakesh J. Patel & Kiran R. Patel. (Vol. I & II)
22. Fertilizer Control Order-1985 amended up to June, 2011
23. Practical Biochemistry by Plummer.

THEORY EXAMINATION

Nature of Question paper		40 Marks
Q. 1 Multiple choice questions (8- Questions)	----	8 marks
Q. 2 Attempt any two of the following.		
(Essay type/Broad answer questions)	----	16 marks
Q. 3 Write short notes (any four)	----	16 marks

PRACTICAL EXAMINATION

- (A) The practical examination will be conducted on two consecutive days not less than 6 hrs on each day of the practical examination.
- (B) Each candidate must produce a certificate from the Head of the Department in his /her college, stating that he / she has completed in a satisfactory manner the practical course on the lines laid down from time to time by Academic Council on the recommendations of Board of Studies and that the journal had been properly maintained. Every candidate must have recorded his / her observations in the laboratory journal and have written a report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of the year. Candidates must produce their journals at the time of practical examinations
- (C) Study tour- Candidates must visit at least two industries (Food / agro / biofertilizer/ pharma /dairy) and must submit report of visit duly signed by competent authority at the time of practical exam.

Nature of question paper and distribution of marks for practical examination:

Q.1 Estimation of Lactic acid / Citric acid from fermentation broth	10
Q.2 Isolation of Azotobacter / Rhizobium / PSB from soil	15
OR	
Isolation of bacteria from spoiled Food	
Q.3 Bioassay of Streptomycin / Tetracycline	20
Q.4 Assay of Amylase / Protease	10
Q.5 SPC OR Detection of presence of <i>E. coli</i> / <i>Staph.</i> / <i>Pseudomonas</i> from given food sample	15
Q.6 Spotting	10
Q.7 Tour report	10
Q.8 Journal	10
TOTAL	100