SHIVAJI UNIVERSITY, KOLHAPUR.

New Syllabus For

B.Sc.Part - III

INDUSTRIAL MICROBIOLOGY

Syllabus to be implemented from June, 2012 onwards.

Shivaji University, Kolhapur

Revised Syllabus For Bachelor of Science Part - III : Industrial Microbiology

1. TITLE : Industrial Microbiology

2. YEAR OF IMPLEMENTATION: Revised Syllabus will be implemented from June 2012 onwards.

3. PREAMBLE:

This syllabus is framed to give sound knowledge with understanding of Industrial Microbiology to undergraduate students at third year of three years of B.Sc. degree course.

Students learn Industrial Microbiology as a separate subject from B.Sc. I. The goal of the syllabus is to make the study of Industrial Microbiology popular, interesting and encouraging to the students for higher studies including research.

The new and updated syllabus is based on a basic and applied approach with vigour and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of industries and research.

The syllabus is prepared after discussion at length with number of faculty members of the subject and experts from industries and research fields. The units of the syllabus are well defined, taking into consideration the level and capacity of students.

4. GENERAL OBJECTIVES OF THE COURSE / PAPER :

1) To make the students knowledgeable with respect to the subject and its practicable applicability.
2) To promote understanding of basic and advanced concepts in Industrial Microbiology
3) To expose the students to various emerging areas of Industrial Microbiology
4) To prepare students for further studies, helping in their bright career in the subject.
5) To expose the students to different processes used in industries and in research field.
6) To develop their ability to apply the knowledge of Industrial Microbiology in day to day life.
7) To prepare the students to accept the challenges in life sciences.
8) To develop skills required in various industries, research labs and in the field of human health.

5. DURATION : The course shall be a full time course.

6. PATTERN: Pattern of Examination will be Semester.

7. MEDIUM OF INSTRUCTION : The medium of instruction shall be in English.

8. STRUCTURE OF COURSE :

1) B.Sc.III : Total Number of Papers - 8

Sr. No.	Subjects	Marks
	SEMISTER V	
1.	Paper - IX	40+10
2.	Paper - X	40+10
3.	Paper - XI	40+10
4.	Paper - XII	40+10
	SEMISTER VI	
5.	Paper – XIII	40+10
6.	Paper – XIV	40+10
7.	Paper – XV	40+10
8.	Paper - XVI	40+10
	PRACTICALS	
5.	Practical - I	50
6.	Practical - II	50
7.	Practical - III	50
8.	Practical - IV	50
Total		600

2) Structure and Titles of Papers of B.Sc.III Industrial Microbiology Course :

Semester-V

Paper IX : Environmental Microbiology

Paper X : Basic techniques of Biotechnology

Paper XI : Microbial productions of metabolites and bioinsecticides

Paper XII : Quality assurance and quality control of fermented products.

Semester-VI

Paper XIII : Environmental pollution and control

Paper XIV : Applications of Biotechnology

Paper XV : Microbial fermentations, Foods and Biofuels

Paper XVI : Industrial management, Government laws and regulations.

9. SCHEME OF TEACHING AND EXAMINATION:

[The scheme of teaching and examination should be given as applicable to the course / paper concerned.]

Sr. No.	Subject/Paper	Teaching Scheme (Hrs/week)			
		L	T	P	Total
1	Paper – IX and X	3			
2	Paper – XI and XII	3			
3	Paper – XIII and XIV	3			12
4	Paper – XV and XVI	3			
5	Practical I			5	
6	Practical II			5	20
7	Practical III			5	
8	Practical IV			5	
	Total				32

10. SCHEME OF EXAMINATION : For B.Sc. Part – III

- The examination shall be conducted at the end of each term (semester). Practical exams will be conducted annually at the end of second term.
- Each Theory paper shall carry 40 - marks. Each paper will have 10 internal marks.
- The evaluation of the performance of the students in theory papers shall be on the basis of Semester Examination of 400 marks and the practicals will be evaluated for 200 marks
- Question Paper will be set in view of the in accordance with the entire Syllabus and preferably covering each unit of syllabi.

11. EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS

Sr. No.	Paper No. and Title of the old paper	Paper No and Title of the New Paper
1	SEMESTER-V Paper-V :Section-I Environmental Microbiology	Paper IX:Environmental Microbiology
	Section-II Bioremidiation of wastes and pollutants	Paper X:Basic techniques of biotechnology
2	Paper-VI: Section- I Basics techniques of biotechnology	Paper XI: Microbial productions of metabolites and bioinsecticides
	Section-II: Applications of biotechnology	Paper XII: Quality assurance and quality control of microbial products
3	Paper-VII:Section-I Quality assurance in Industrial products.	Paper XIII:Environmental pollution and control
	Section: II Industrial management, Government Laws and regulations.	Paper XIV: Applications of biotechnology
4	Paper: VIII,Section-I Fermentation technology-part-I	Paper XV: Microbial fermentations, Foods and Biofuels
	Section-II.Fermentation technology,Part-II	Paper XVI: Industrial management, Government Laws and regulations.
5	Practical - Old	Practical- New

12. OTHER FEATURES :

(A) LIBRARY : Reference and Text Books, Journals and Periodicals, Reference Books for Advanced studies. - List Attached

(B) SPECIFIC EQUIPMENTS : Necessary to run course. - OHP, Computer, L.C.D., Projector

(C) LABORATORY SAFETY EQUIPMENTS :

1) Fire extinguisher
2) First aid kit
3) Fumigation chamber
4) Stabilized power supply
5) Insulated wiring for electric supply.
6) Good valves, distribution pipes & regulators for gas supply.
7) Operational manuals for instruments.
8) Emergency exits.

SHIVAJI UNIVERSITY, KOLHAPUR

B.Sc. III : Industrial Microbiology

(Revised Syllabus From June, 2012)

THEORY

Paper– IX : Environmental Microbiology

UNIT – I

Soil Environment: **10 Lectures**

- Introduction, physical, chemical, microbiological characters.
- Microbial interactions in soil
- Soil humus

UNIT – II **10 Lectures**

Role of Microorganisms in Elemental Cycles :

a) Carbon cycle,

b) Nitrogen cycle,

c) Sulfur cycle,

d) Phosphorus cycle

UNIT – III **10 Lectures**

Petroleum and Marine Microbiology :

A) Petroleum Microbiology : Types of compounds in petroleum, products of compounds in petroleum, Microorganisms in hydrocarbon system, role of microorganisms in hydrocarbon degradation.

B) Marine Microbiology : Characters of marine environment, characters of marine microorganisms, role of marine microorganisms

UNIT – IV **10 Lectures**

Role of microorganism in Bioleaching and Textile Industry :

A. Bioleaching of elements – Introduction, microorganisms involved, chemistry of microbial leaching and beneficiation, leaching methods – Laboratory and in situ leaching of copper and uranium.

B. Textile Industry – Introduction, types of microorganisms found on textile fibres,conditions favoring the action of microorganisms, types of destruction caused by microorganisms (cotton and wool), Prevention of growth of microorganisms.

Paper – X: Basic Techniques of Biotechnology

UNIT – I **10 Lectures**

Basic Concept of Genetic Engineering :

A) Introduction

B) Tools of genetic engineering

a) Cutting and joining enzyme.

b) Cloning Vectors – Plasmids, phage, cosmids, and artificial chromosomes.

c) Cloning organisms.

UNIT – II **10 Lectures**

Techniques of Genetic Engineering :

A) Isolation of DNA

B) Construction of rDNA – Genomic library, cDNA library

C) Insertion of foreign DNA into a vector – Use of restriction enzymes, linkers, Homopolymer tails, adaptors, polylinkers.

D) Transfer of recombinant DNA in Bacterial Cell – Transformation, transfection

E) Selection of recombinants (Bacteria) - Direct selection of recombinants, Blue white screening methods.

UNIT – III **10 Lectures**

Techniques in Molecular Biology:

A) Blotting Techniques

a) Southern blotting b) Northern blotting

c) Western blotting d) Dot-blot technique

B) Techniques of Detection and Analysis of Nucleic Acid

a) Radioactive labeling – Nick translation

b) Non Radioactive labeling – Horse Radish peroxide (HRP) method

C) DNA sequencing – Sanger's method

UNIT – IV **10 Lectures**

Protein Engineering, Immobilization and PCR:

A) Protein Engineering: Definition, methods and application.

B) Immobilisation of Enzymes and Whole cells: Methods, Advantages, Application.

C) PCR – Requirements, working, different types of PCR's, PCR product analysis, advantages & disadvantages, applications.

Paper –XI : Microbial Production of Metabolites and Bioinsecticides

UNIT – I **10 Lectures**

Microbial production of nucleosides and nucleotides :

i) Introduction

ii) Classification of methods for production of 5' IMP and 5'GMP

iii) Production of 5'IMP and 5'GMP by fermentation.

UNIT – II **10 Lectures**

Microbial production of Vitamins:

1) Vitamin B_{12} - Organisms used, production method- process, recovery and assay.

2) Vitamin C - Organisms used, production method, process, recovery and assay.

UNIT – III **10 Lectures Microbial**

Production of Antibiotics : Organism used, production process and recovery of- 1) Bacitracin & 2) Chloramphenicol

UNIT – IV **10 Lectures**

Production of Bioinsecticides :

1. Introduction
2. Candidate Microorganisms
3. Production
4. Safety
5. Effectiveness
6. Advantages
7. Disadvantages

Paper – XII : Quality Assurance and Quality Control in Industrial Products

UNIT – I **10 Lectures**

Industrial Rules and standards as per IP, BP, USP, PFA :

Indian Pharmacopoeia :

i) Introduction

ii) Concept of pharmacopoeia

iii) Concept of regulatory authorities

iv) Types of pharmaceutical products

iv) Microbiological Q.C

UNIT – II **10 Lectures**

Detection of Compounds using Indian Pharmacopoeia:

A. Detection of Ascorbic acid tablets

B. Detection of Vit. B_{I2}

C. Detection of Antibiotics - penicillin and streptomycin

UNIT – III **10 Lectures** **Quality**

Control Tests of Pharmaceutical Products

i) Sterility test

ii) Pyrogen test

iii) Toxicity test

iv) Carcinogenicity test

iv) Mutagenicity test

v) Allergy test

UNIT – IV **10 Lectures**

International Standards as per WHO, ISI, Biosafety and Validation

A) Introduction of WHO, ISI standards.

B) Concept of validation.-validation of moist heat sterilization in pharmaceuticals

Paper XIII : Environmental Pollution and Control

UNIT – I **10 Lectures**

a) Environmental Monitoring

b) Biosafety in Laboratories and Pharmaceutical Industries.

UNIT – II **10 Lectures Waste water pollution and treatment :**

a) Characteristics of Waste Water

b) Treatment Procedures

i. Physical treatment – Sedimentation, screening and removal of oil and grease.

ii. Biological treatment - Septic tank, trickling filter, activated sludge, oxidations ponds,anaerobic digestion.

iii. Chemical treatment – Root zone technology, disinfection.

UNIT – III **10 Lectures**

A. Characteristics and treatment of wastes of –

1) Sugar Industry 2) Distillery and 3) Dairy Industry

B. Eutrophication – Classification of lakes, consequences and control.

UNIT – IV **10 Lectures**

Environmental Pollution and E.I.A.

A. Environmental Monitoring and Bioburden Tests

B. Environmental impact assessment: Concept

Paper-XIV Applications of Biotechnology

UNIT – I **10 Lectures**

Applications in Agriculture and Environments:

A) Applications of Genetic Engineering in Agriculture

a) Transgenic plants – concepts, methods for raising transgenic plants and applications.

b) Transgenic animals – Concepts, methods for raising transgenic animals and applications.

B) Applications of genetic engineering in Environment

a) Concept of GMM's & its uses.

UNIT – II **10 Lectures**

Applications in Industry and Diagnostic Techniques

A) GEM's in Industry - Pharmaceutical industry, food industry etc.

B) Diagnostic Techniques:

- Detection of pathogens, proteins, genetic disorders.
- Forensic applications of biotechnology – DNA fingerprinting

UNIT – III **10 Lectures**

Production of Monoclonal Antibodies and Recombinant Vaccines.

A) Production of monoclonal antibodies - Definition, production, applications.

B) Recombinant Vaccines - Definition, recombinant vector vaccines, DNA vaccines, Multivalent subunit vaccines, minicell vaccines, conjugate vaccines.

UNIT – IV **10 Lectures Production**

of rDNA Products and Hazards of Biotechnology

A) rDNA Products: Insulin, Somatostatin, interferons, abzymes, immunotoxins

B) Hazards of Biotechnology

Paper- XV: Microbial fermentations, Foods and Biofuels

UNIT – I **10 Lectures**

A) Production of SCP

i) Introduction

ii) Production – Algae, Bacteria

iii) Product quality and safety

iv) Merits & demerits.

B) Production of Mushrooms

i) Mushroom production

ii) Spawn production

iii) Mushroom harvesting

C) Probiotics

i) History

ii) Common properties of probiotics

iii) Example of probiotic microorganism

iv) Use of probiotics

UNIT – II **10 Lectures**

A) Microbial Production of distilled beverages gen and whisky

a) Production of distilled beverages

i) Introduction

ii) Processing

iii) Plant

iv) Product

B) Vinegar Production

i) Acetic acid bacteria

ii) Mechanism of acetic acid fermentation

iii) Commercial Vinegar production

iv) Grades of vinegars

vi) Processing of vinegar

vii) Uses of vinegar

UNIT – III **10 Lectures**

Microbial Production of Exopolysaccharides and Mushrooms.

i) Introduction

ii) Nature of Microbial polysaccharides

iii) Mechanism of synthesis

iv) Xanthan gum production

v) Dextran gum

vi) Applications of xanthan and dextran gums

UNIT – IV **10 Lectures**

Production of biofuels

A) Ethanol- Microrganism used, fermentation condition, recovery, ethanol production.

B) Biogas - Biomass used, Microbiology, biochemistry of biogas production, models used for generation of biogas, uses of biogas.

Paper-XVI : Industrial Management, Government Laws and Regulations

UNIT – I **10 Lectures**

Enterpreneurship - Principles of management, management meaning and importance,Concept of Enterpreneurship.

UNIT – II **10 Lectures Concepts**

of Management:

i. Planning meaning and importance

ii. Organizing - Meaning and process of organization

iii. Communication – Meaning and process control techniques.

iv. Personal Management – Man power planning

v. Purchase and store management – Concept of quotation, tenders, comparative statement,inspection and quality control, store management.

vi. Concept of marketing – Basic Concepts, Costing, Pricing

vii. Financial management – Fund raising, costing and pricing.

UNIT – III **10 Lectures**

IPR , National and International Scenario :

-Patent, Biopatent, Copyright, Trade secret, Trademark, Geographical Indications, Designs, its basic concepts and laws relating to its infringement

-IPR and WIPO, TRIPS

UNIT – IV **10 Lectures Laws**

related to industrial regulation and taxation :

A) Industrial development and regulation act-

-Object

-Licensing of industries

-Circumstances when license not required

B) Basic concept of taxation -

-Principle of taxation

-Direct and indirect tax

-Excise , sales MVAT

PRACTICAL COURSE

Practical I :

Major Experiments :

1) Estimation of TS, TSS, TVS, TDS from sewage and industrial effluent.

2) Estimation of BOD of industrial effluents

3) Determination of COD of industrial effluents.

4) Determination of MIC of Cu, using suitable microbes

5) Determination of MIC of Cr, using suitable microbes.

6) Isolation of hydrocarbon degrading microorganisms.

7) Isolation of plastic degrading microorganisms

Minor Experiments :

1) Determination of oil and grease from industrial waste.

2) Estimation of TS, TSS, TVS, TDS from sewage and industrial effluent.

3) Bacteriological analysis of potable water MPN

4) Presumptive test.

5) confirmed and completed tests.

6) Estimation of chlorine dose of potable water.

Practical II :

Major Experiments :

1) Isolation of genomic DNA from bacteria

2) Isolation of genomic DNA yeast.

3) Isolation of plasmid DNA from bacteria

4) Transformation in E. coli.

5) Isolation of Vit B12 requiring mutantsof E. coli using UV

6) Preparation of TAB vaccine.

7) Demonstration of DNA amplification by PCR.

8) Identification of protein by western hybridization.

Minor Experiments :

1) Electrophoresis of plasmid DNA by Agarose gel electrophoresis.

2) Electrophoresis of protein by PAGE

7) Isolation of Lac negative mutants of E. coli using UV

3) Estimation of DNA by diphenylamine method.and Estimation of RNA by orcinol method.

4) Preparation of protoplast of bacterial cells and Protoplast fusion of bacterial cells.

Practical III :

Major Experiments :

1) SPC and identification of pathogens from - Formulation syrup

2) SPC and identification of pathogens from Tooth paste

3) SPC and identification of pathogens from Tablets

4) Bioassay of Vit. B12

5) Bioassay of Penicillin

6) Cultivation of edible mushrooms

7) Production and estimation of alkaline protease.

Minor Experiments :

1) Chemical assay-Vit C.
2) Chemical assay Penicillin
3) Isolation of amino acid producers
4) Quantification of amino acids

Practical IV :

1) Compulsory on Job training in Industry / Institute for minimum period of one week and submission of report.
2) Project work

Reference Books:

BOOK	AUTHOR
SOIL MICROBIOLOGY	N.S.SUBBARAO
SOIL MICROBIOLOGY	ALEXANDER
NATURE AND PROPERTIES OF SOIL	BRADY
MODERN SOIL MICROBIOLOGY	D.V.EALASJAN
METHODS IN ENVIORNMENTAL ANALYSIS –WATER SOIL AND AIR	P. K. GUPTA
AQUATIC ECOLOGY	R.RAGOTHAMAN
WATER,ENVIRONMENT AND POLLUTION	KUMAR
AIR,ENVIRONMENT AND POLLUTION	S .S.PUROHIT
MICROBIOLOGY	PELCHZAR
MICROBIAL BIOGEOCHEMISTRY	ZAJIC
WATER AND WASTE WATER TECHNOLOGY	HAMMER AND HAMMER
ECOLOGY, ENVIRONMENT AND POLLUTION	PUROHIT AND RANJAN
WASTE WATER TREATMENT	RAO AND DATTA
ENVIRONMENTAL CHEMICAL HAZARDS	KUMAR
AN INTRODUCTION TO AIR POLLUTION	TRIVEDI AND GOEL
ENVIRONMENTAL AND METAL POLLUTION	KHAN
ENVIRONMENTAL POLLUTION	KATYAL AND SATAKE
ECOLOGY OF POLLUTED WATER VOLUME 1	KUMAR
AIR POLLUTION	RAO
AEROBIOLOGY	TILAK
ENVIRONMENTAL POLLUTION	PUROHIT AND AGARWAL
GENE BIOTECHNOLOGY	S.N.JOGDAND
PRINCIPLES OF GENE MANIPULATION	PRIMROSE,TWYMAN AND OLD
BIOTECHNOLOGY- FUNDAMENTALS AND APPLICATIONS	S.PUROHIT
GENETIC ENGINEERING AND ITS APPLICATIONS	P.JOSHI
BIOTECHNOLOGY-FUNDAMENTALS AND APPLICATIONS	NAIDU
TEXTBOOK OF BIOTECHNOLOGY	CHATWAL
BIOTECHNOLOGY	DUBEY
RECENT TRENDS IN BIOTECHNOLOGY	V. S. HARIKUMAR
BIO-TECHNOLOGY- FUNDAMENTALS AND APPLICATIONS	S. S. PUROHIT.
PROTEIN BIOTECHNOLOGY	HAZARE
BIOTECHNOLOGY	BARNUM
PHARMACOLOGY & PHARMACOTHERAPEUTICS	R.S.SATOSKAR
PHARMACEUTICAL MICROBIOLOGY	W.B.HUGO
PHARMACEUTICAL MICROBIOLOGY	PUROHIT,SALUJA AND KAKRANI
PHARMACEUTICAL MICROBIOLOGY	HUGO AND RUSSEL
PHARMACEUTICAL MICROBIOLOGY	S. S. PUROHIT, RAJIV RAJAN.
INDIAN PHARMACOPEIA	
PREVENTION OF FOOD ADULTERATION ACT 1954 AND	

COMMON NATURE OF QUESTION FOR THEORY PAPER MENTIONED SPERATELY:

Practical Examination

A) Exam will be conducted on 3 consecutive days for not less than 6 hours on each day.

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 guidelines laid down from time to time by Academic Council on the recommendation of Board of studies and has been recorded his/her observations in the laboratory journal and written a report on each exercise performed. Every journal is to be checked and signed periodically by a member teaching staff and certified by the Head of the Department at the end of staff and certified by the Head of the Department at the end of the year. Candidates are to produce their journal at the time of practical examination. Candidates have to visit the least Two (2) places of Microbiological interest (Pharmaceutical industry, Dairy, Research institutes etc.) and submit the report of their visit at the time of examination.

C) Each candidate must undergo on job training in an industry / institute for minimum 1 week and submit the report.

D) The candidates are required to undertake a project and submit the project report.

Nature Of Question Paper And Distribution Of Marks For B.Sc. III Industrial Microbiology Practical Examination

PRACTICALS I, II, & III

Q.1 MAJOR EXPERIMENT	**25**
Q.2 MINOR EXPERIMENT	15
Q.3 JOURNAL	05

PRACTICAL IV :

1. PROJECT	**30**
2. ON JOB TRAINING	**15**

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STUDY TOUR **20**

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List of the minimum equipments and related requirements for B.Sc. III Industrial Microbiology.

1) Replica plating units of genetics experiments: Two
2) Rotary shaker for fermentation experiments: One
3) Centrifuge (High Speed): One
4) Hot plate: One
5) Hot air oven: One
6) Bacteriological Incubator: One
7) Spectrophotometer (UV and Visible): One
8) Research Microscope: One for each student
9) Separate room for fine instruments of size 9'x15' feet dimension
9) A separate culture room of at least 9' x 9' feet dimension
11) Electrophoresis assembly: Two
12) Laminar air flow cabinet: one
13) Distillation assembly: One (Glass)
14) Reflux assembly: Four
15) Colony counter: One
16) Refrigerator: One
17) Laboratory Scale Fermentor: One

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