

THEORY PAPER
III B.Sc. Microbiology (SEP-2024)
V- SEMESTER
THEORY PAPER-VA: Agricultural Microbiology
TOTAL HOURS: 56

Course learning objectives:

- a. To acquire knowledge of the importance of microorganisms in agriculture
- b. To learn the interaction between plant and microbes
- c. To study the pathogens which cause diseases in plants
- d. To study the biological methods of controlling the plant diseases

Course outcome: At the end of the course the student will be able to:

- a. Understand the importance and applications of microorganisms in agriculture
- b. Gain a preliminary idea of interaction between plant and microbes
- c. Understand the diseases caused by viruses, bacteria, mycoplasma and fungi in plants
- d. Understand the control and management of plant diseases by means of biological agents

Content	56 Hrs.
Unit-1. Microbes in sustainable agriculture	14 Hrs.
Rhizosphere and Rhizoplane microorganisms, Biofertilizers- Definition, types- Nitrogen fixing, phosphate solubilizing and VAM. Mass production, mode of applications, advantages and limitations of bacterial inoculants (<i>Rhizobium</i> , <i>Azotobacter</i> , <i>Azospirillum</i> , <i>Cyanobacteria</i> , <i>Azolla</i>) : PSB, Cyanobacteria, PGPR. Biological Nitrogen fixation.	
Unit 2: Plant microbe interactions and disease development	14 Hrs.
Plant microbe interactions: Types of interactions- Positive, Negative interactions. Plant disease development, disease cycle, Role of metabolites (Toxins, hormones, enzymes) in Disease development. Defense mechanisms (Structural and Biochemical). Preexisting and induced defenses. Effect of pathogens on plant physiological functions- Photosynthesis, translocation of water and nutrients, respiration, transcription, translation and cell membranes	
Unit 3: Plant diseases	14 Hrs.
Study of symptoms, etiology, epidemiology and management of diseases caused by fungi (Tikka disease of groundnut, Downy mildew of maize/sorghum, blast disease of paddy, Red rot of sugarcane, Rust of wheat and Coffee rust), Bacteria (Citrus canker, Bacterial blight of rice, Angular leaf spot of cotton, Mycoplasma (Sandal spike, Grassy shoot of sugarcane,), viruses (Bean Mosaic Virus, Tobacco Mosaic Virus, Bunchy top of banana, Papaya ring spot)	

Unit 4: Plant disease management	14 Hrs.
<p>Quarantines and inspections, Cultural methods- Host eradication, Crop rotation, sanitation, polythene traps and mulches. Physical methods- Control by heat treatment, soil sterilization, hot water treatment of propagative organs, drying, radiation and refrigeration. Chemical- Foliar spray and dust, soil treatment, seed treatment, fumigation, disinfection, control of vectors. Biological- disease resistance, crop protection, antagonistic organisms. Biocontrol: Biopesticides--bacterial, viral and fungal - mode of action, Microbial biopesticide, (<i>Bacillus thuringiensis</i>, NPV, <i>Tricoderma</i>)</p>	

Internal Assessment

Sl No	Continuous Assessment Programme/ Internal assessment	Maximum marks
1	Two session tests with proper record for assessment	10
2	Assessment of skill development activities/ seminars/ Group discussion/Assignment etc., with proper record	5
3	Attendance with proper record	5
	Total marks	20

Attendance marks break-up 75% - 00 Marks 75-80% - 01 mark 80-85 % - 2 Marks 85-90% -3 Marks 90-95% -4 Marks 95-100% - 5 Marks

PRACTICAL- V: Agricultural Microbiology , Food and Dairy Microbiology **Practical Content**

1. Isolation and cultivation of *Rhizobium* from legume root nodule and observation of bacterioids.
2. Isolation and examination of *Azotobacter*, *Azospirillum*, and phosphate solubilizing bacteria (PSB).
3. Examination of *Anabaena* *Azolla*.
4. Study of blast of rice, citrus canker.
5. Study of tikka disease of groundnut.
6. Study of coffee rust, red rot of sugarcane
7. Demonstration of charts/photographs related disease and biocontrol agents
8. Isolation and identification of microbes from infected fruits and vegetables.
9. Study of foodborne pathogens-*Clostridium*, *Staphylococcus*, *Salmonella* and *Aspergillus*
10. Detection of Aflatoxin by TLC
11. Bacterial examination of milk by SPC
12. Reductase tests- MBRT/ Resazurin

13. Estimation of fat content in milk by Gerber's method
14. Estimation of titrable acidity in milk
15. Production of yogurt
16. Significant microbes in food and dairy- *Lactobacillus*, *Streptococci*, *Rhizopus*,
Penicillium, *Alternaria*
17. Field visit: A report on the agriculture field visit

Internal Assessment for Practical

Attendance : 05 marks

Record/ Journal: 05 marks

III BSc., V SEMESTER PRACTICAL – V Agricultural Microbiology

TIME: 3 HOURS

MAX MARKS: 40

SCHEME OF EXAMINATION

1. Isolation Rhizobium from root nodules/ Examination of *Anabena*
Azolla/titrable acidity/ percentage of fat 12 marks
2. Identify and give etiological significance of pathogen: tikka disease/ coffee rust
/red rot of sugarcane/ citrus canker/ Blast of rice/ Perform
SPC/MBRT/Resusarin test 8 marks
3. Comment on C, D, E, F G and H 15marks
4. Viva –voce 05 marks

NOTE: candidates should submit evaluated class records without which he/she will not be allowed

References:

1. Agrios , G N (1997). Plant pathology, 4th Ed, Academic Press
2. Alexander, A.M. (1987). Introduction to soil Microbiology, 5th ed., John Wiley andsons.
3. Atlas, R. M. and Bartha, R. (1993). Microbial Ecology: Fundamentals and applications, 3rded., Benjamin and Cummings Pub. Co., NewYork.
4. Daniel EnvironmentalMicrobiology.
5. Grant, W.D. and P.E, Long: (1981). Environmental Microbiology, Thomson LithoLtd.
6. Mehrotra, R.S., Plant Pathology, Tata Mc Graw Hill Pubilications Limited, NewDelhi.
7. Michael, J. Pelczar, Jr.E.C.S. Chan, Moel: Microbiology, Mc Graw Hill Book Company, NewYork).
8. Mitchell, R. (1992). Introduction to Environmental Microbiology, Prentice Hall Inc, EnglewoodCliffs.
9. Powar and Daginwala (1996). General Microbiology, Vol 1. Himalaya Publishing House, Bombay.
10. Powar and Daginwala (1996). General Microbiology, Vol 2. Himalaya Publishing House, Bombay.
11. Rangaswamy, G. and Bagyaraj, D.J. (2001), Agricultural Microbiology, 2nd ed., Prentice Hall of India Pvt. Ltd., NewDelhi.

Question paper pattern for B.Sc. Microbiology

_____semester B.Sc. Examination 2026-27

Semester Scheme New SEP syllabus 2024-25

MICROBIOLOGY

Paper: _____

Paper Code: _____

Time 3 hrs.

Maximum marks: 80

Instructions to candidates:

1. All the sections are compulsory.
2. Draw neat and labelled diagrams wherever necessary

Section- A

Answer all the following:

10x2=20

- 2.
- a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
 - h.
 - i.
 - j.

Section- B

Answer any SIX of the following:

6x5=30

2. From Unit I
3. From Unit I
4. From Unit II
5. From Unit II
6. From Unit III
7. From Unit III
8. From Unit IV
9. From Unit IV

Section- C

Answer any THREE of the following: 3x10=30

10. From Unit I
11. From Unit II
12. From Unit III
13. From Unit IV


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Blue print Question paper pattern for VI Semester

UNIT	HOURS ALLOTTED	2 MARKS QUESTIONS	5 MARKS QUESTIONS	10 MARKS QUESTIONS	TOTAL MARKS
I	14	3	2	1	26
II	14	3	2	1	26
III	14	2	2	1	24
IV	14	2	2	1	24
TOTAL	56 HRS	10Q=20	8 Q=40	4Q= 40	
		Answer all	Answer any 6	Answer any 3	
		2X10=20	5X6=30	10X3=30	80

THEORY PAPER
SEMESTER V
24-MCT-MB V: THEORY PAPER VB: FOOD AND DAIRY MICROBIOLOGY
TOTAL HOURS: 56 HOURS

COURSE LEARNING OBJECTIVES:

- a. To provide knowledge on the different aspects of microbial growth in foods causing the fermentation and their role in spoilage of foods
- b. To explain the principles and methods of food preservation
- c. To acquaint students with the food sanitation and regulations for quality assurance
- d. To acquire knowledge about the public health significance of dairy and its products, concepts to avoid spoilage and enhance the shelf life of the products

COURSE OUTCOME: At the end of the course the student will be able to:

- a. Understand the association of microbes, in foods and their importance in the keeping quality of foods
- b. Appreciate the techniques of preservation and the importance of packaging for the keeping quality of foods
- c. Understand microorganisms used as foods and the food safety protocols involved for quality assurance
- d. Understand the properties and types of milk, fermented food and dairy products

UNIT I: MICROBES AND THEIR INTERACTION WITH FOOD	14 HRS
<ol style="list-style-type: none"> a. Microbes as food: Food as a substrate for microorganisms. Intrinsic and extrinsic parameters affecting the growth of microbes. Consortium of microorganism and their sources (Bacteria, yeasts and molds) b. Food Contamination and spoilage: Sources of contamination, types of spoilage of cereals, vegetables, fruits, fish, seafoods and canned foods c. Food borne infections and intoxications- <i>Staphylococcus, Clostridium botulinum, Bacillus, Salmonella, Listeria, Brucella, Mycotoxins</i>. Food outbreaks d. Fermented foods: Fermented vegetables – Sauerkraut, pickles Meat-sausage Beverages- kombucha, soma. Traditional fermented Indian foods- Idli, dosa, dhokla. Prebiotics, probiotics, synbiotics, nutraceuticals 	
UNIT II: FOOD PRESERVATION AND FOOD SAFETY	14 HRS
<ol style="list-style-type: none"> a. Food Preservation: Principles of food preservation, methods of food preservation- Physical (high temperatures, canning, low temperature, dehydration, irradiation) Chemical (Class I and class II), biopreservation. b. Food Packaging Materials: Types, properties & benefits (plastics, glass, metals, paper and cardboard, edible, Biodegradable packaging) c. Quality testing of foods: rapid microbiological methods-examination of faecal <i>Streptococci</i> 	
UNIT III: FOOD BIOTECHNOLOGY	14 HOURS

<p>a. Single cell protein-<i>Spirulina, Saccharomyces</i>, SCO-fungal lipids, Mushroom production. Fungal foods-microbial production of flavours, natural food colour (from bacteria, fungi and algae), enzymes for food processing (protease, invertase, lipase), sweeteners, food waste management</p> <p>b. Food sanitation and safety: good hygiene practices, food safety laws and standards-International- HACCP, ISO9000series, FSSAI, FDA,FAO, GMP and GLP. Indian standards- PFAA, FPO, MPO, CSO, Agmark, Bureau of IndianStandards. Food testing laboratories in India</p>	
<p>UNIT IV: DAIRY MICROBIOLOGY</p>	<p>14 HOURS</p>
<p>a. Microorganisms and milk: Physical and chemical properties of milk, types of microorganisms in milk, sources of microbial milk contamination- milch animal, utensils and equipment's, water, milking environment, personnel and packing material</p> <p>b. Microbiological analysis of milk- Rapid platform tests- organoleptic, clot on boiling (COB), titrable acidity, alcohol test, DMC, Sedimentation test. Standard Plate Count (SPC), reductase test-MBRT, resazurin test</p> <p>c. Preservation of milk: pasteurisation, dehydration and sterilization</p> <p>d. Fermentation in milk: souring, lactic acid fermentation, colour and flavour fermentation, gassy fermentation and proteolysis</p> <p>e. Fermented milk products: Yogurt: types and production, Cheese (Cheddar & Cottage), tofu, acidophilus milk, buttermilk</p>	

References

- 1) Betty C. Hobbs, Food Microbiology, Arnold-Heinemann Publishing Private Limited, New Delhi.
- 2) FrazierandWasthoff,FoodMicrobiology,TataMcGraw-HillPublishingCompany, Limited, New Delhi.
- 3) HammerB.W.andBabal,DairyBacteriology,PrenticeHali Incorporated, London.
- 4) JayJ.M. ModernFood Microbiology,CBS PublishersandDistributors,New York.
- 5) PrescottLansingM.HarleyJohnP.andKleinDonaldA.Microbiology, WCB, McGraw-Hill, New York.
- 6) SalleA.J.FundamentalPrinciplesofBacteriology,TataMcGraw-HillPublishing, Company Limited, New Delhi.
- 7) VarnamA.H.andEvansM.G.FoodbornePathogens,WolfePublishing House,London.

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SEP BSc-V Semester: Elementary Research Methodology
(for Biochemistry, Biotechnology, Botany, Chemistry, Electronics, Environmental Science, Food Technology, Microbiology, Zoology)

Subject	Elementary Research Methodology	Semester	V
Number hr/week	2 hours	Total hours	32
Duration of the exam	2 hours	Credits	2

Learning Outcomes:

After the completion of this course the learner will be able to:

- Describe the basic concepts of research and its methodologies.
- Identify the appropriate research topics and set up hypothesis.
- Perform literature survey using library (print) and internet (online) sources.
- Design experiments/surveys, collect data and and represent data in table and figure forms.
- Analyze data with appropriate software tools, internet results and draw conclusions.
- Write scientific report/ review and prepare seminar/ conference presentations oral or poster.
- Understand the methods of citations and referencing styles, check plagiarism.
- Identification of lacuna (finding gap-areas), hypothesis formulation, framing objectives, and preparation of questionnaire.

Unit-1	<p>Scientific Methods and Research: Concept, Definitions of research; Purpose, importance, steps levels and rigor of research; different paradigms of research.</p> <p>Types of Research: Fundamental/Applied research, Descriptive/Analytical research, Quantitative /Qualitative research, Conceptual/Empirical research, Diagnostic/Hypothesis testing research, Conclusion oriented/Decision oriented research, Theoretical / Action research, Longitudinal /Cross sectional research</p> <p>Research Question: Introduction, types and identification; Research Problem: Definition, identification of problem, ways of understanding problem, criteria of a good problem, guidelines for selecting meaningful problem; Research Objective: Definition, broad and specific objectives, goals;</p> <p>Research Hypothesis: Meaning of research hypothesis, sources of hypothesis, qualities of workable hypothesis, utilities of hypothesis;</p>	8 h
Unit-2	<p>Introduction and review of sampling: Definition, needs, steps; Definitions of population, sample, sampling unit, sampling frame, sampling error and non sampling error; Steps in sampling; Fundamentals, characteristics, advantages and disadvantages of sampling.</p> <p>Types of sampling: Probability (simple, stratified, systematic, cluster and multistage –in brief), Process of selecting random sample; non probability sampling (convenience, purposive, quota, snowball, self selecting); Advantages and disadvantages (brief discuss only)</p> <p>Size of sample: Factor affecting size of sample, Testing the reliability of sample, Methods of estimating sample size, Process of selecting random sample</p>	8 h

Unit-3	<p>Designing of research work: Introduction, Purposes, Characteristics of a research design, Principles of designing a research, conceptual framework and its operationalization, Sectors of research design, Research methods as research designing, similarities and differences between Research design and research method. Conventional research method: Principle and Importance conventional methods, Scientific methods as conventional methods, Characteristic of a scientific method; Aspects of scientific Method, Evolution of scientific Studies Steps in scientific methods,</p>	8 h
Unit-4	<p>Historical Research Method: Nature and Steps in Historical method, Importance and fundamentals of Historical method, Sources of Historical data, Limitations.</p> <p>Experimental Research Method: Introduction, Types of experiments, steps in experimental research, Problems in experimentation; Ex-post facto research: definition and technique.</p> <p>Survey Research Method: Introduction, and Importance of survey method, Comparison of survey method with other methods; Objectives of social and survey and technical survey, types of social and technical survey, Steps in social and technical surveys, Pilot survey</p> <p>Case study: Introduction, Types of case studies: Exploratory and Hypothesis testing; Steps in case studies, Sources of case data, limitations.</p> <p>Analysis of data- introduction, data analysis tools.</p> <p>Project time line, literature review and references, research report structure, plagiarism.</p>	8 h


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THEORY PAPER
III B.Sc. Microbiology (SEP-2024)

VI- SEMESTER

THEORY PAPER 24- MC-VIA: Immunology and Medical Microbiology

TOTAL HOURS: 56

Course learning objectives:

- a. To acquire knowledge of the basic concepts of immunology and medical microbiology
- b. To learn the antigen antibody reactions and hypersensitivity reactions
- c. To study the importance of host-pathogen interactions and diseases caused
- d. To study the viral, fungal and protozoan diseases and chemotherapy

Course outcome: At the end of the course the student will be able to:

- a. Understand the basic concepts of immunology and medical microbiology
- b. Gain a preliminary understanding of antigen antibody reactions and hypersensitivity reactions
- c. Understand the host pathogen interactions and pathogenic bacterial infections, symptoms, diagnosis and their treatment
- d. Understand the disease caused by viruses, fungi and protozoa.

Content	56 Hrs.
Unit 1 :Basic concepts of immunology	14 Hrs.
<p>Immune system:Immunity-Definition and types. Cells and organs of immune system: B and T Lymphocytes, Natural killer (NK) cells, Granulocytes(Neutrophils, Eosinophils and Basophils), Monocytes and macrophages, Dendritic cells and Mast cells. Primary lymphoid organs- Bone marrow and Thymus. Secondary lymphoid organs-Spleen and Lymph nodes. Lymphoid tissues- MALT and GALT.</p> <p>Antigen and Antibody:Antigen- Definition, types, properties - Immunogenicity and antigenicity, epitopes, haptens. Degree of foreignness, molecular weight, degradability. Adjuvants and their importance. Antibody: Definition, Basic structure of Immunoglobulin, Structure and function of different types of antibodies (IgG, IgA, IgM, IgD and IgE). Antigenic determinant on immunoglobulins: Isotype, allotype and idiotype.</p>	
Unit 2: Antigen-antibody interactions	14 Hrs.
<p>Antigen-antibody reactions: Definition, salient features, antibody affinity and avidity, cross reaction. Agglutination reactions: Hemagglutination-blood grouping, Immunoprecipitation, immunodiffusion and immunoelectrophoresis. complement fixation test. Immunotechniques:ELISA, Radioimmunoassay and Immunofluorescence.</p> <p>Hypersensitive reactions:Classification, antibody mediated hypersensitivity; Type I (IgE), Type II (IgG and IgM-ADCC), Type III (Antigen-antibody complex), and Cell mediated hypersensitivity Type IV (DTH). Autoimmune diseases. Immunoprophylaxis-Vaccines-Types of vaccine. National Immunization Schedule.</p>	

Unit 3: Host-pathogen interaction and Medical Bacteriology	14 Hrs.
<p>Hostpathogeninteraction: Hostpathogeninteraction: Definitions-Infection, Invasion,Pathogenicity,Virulence,Attenuation, Exaltation, Toxigenicity, Carriers andtheir types. Infection-types of infection, modes of transmission of infection, portal of entry of pathogen.Samplecollection,transportanddiagnosis.</p> <p>MedicalBacteriology: Symptoms,modeof transmission,prophylaxisandcontrol of<i>Streptococcuspyogenes,Haemophilusinfluenzae,Mycobacteriumtuberculosis. Escherichiacoli,Salmonellatyphi,Vibriocholerae,Treponema pallidum,Staphylococcus aureus,Clostridiumtetani.</i></p>	
Unit 4: Medical Virology, Parasitology and Mycology and Chemotherapy	14 Hrs.
<p>Medical Virology Parasitology and Mycology: Symptoms, mode of transmission, prophylaxis and control of Polio, Hepatitis-B, Rabies, Dengue, AIDS, and Chikungunya. Malaria, Amoebic dysentery. Fungal infections: Cutaneous mycoses- Tinea infections, Systemic mycoses -Histoplasmosis, opportunistic - Candidiasis</p> <p>Antimicrobial agents: General characteristics and mode of action Antibacterial agents: Inhibitor of nucleic acid synthesis; Inhibitor of cell wall synthesis; Inhibitor of cell membrane function; Inhibitor of protein synthesis; Inhibitor of metabolism. Mechanism of action of antifungal agents: Amphotericin B, Fluconazole; Antiviral agents: Acyclovir, Azidothymidine. Antibiotic resistance</p>	

Internal Assessment

Sl No	Continuous Assessment Programme/ Internal assessment	Maximum marks
1	Two session tests with proper record for assessment	10
2	Assessment of skill development activities/ seminars/ Group discussion/Assignment etc., with proper record	5
3	Attendance with proper record	5
	Total marks	20

Attendance marks break-up 75% - 00 Marks 75-80% - 01 mark 80-85 % - 2 Marks 85-90% -3 Marks 90-95% -4 Marks 95-100% - 5 Mark

References:

1. Ananthanarayan, R. and Paniker, C.K.J. (2009). Textbook of Microbiology. 8th edition, University Press Publication.
2. Brooks, G.F., Carroll, K.C., Butel, J.S., Morse, S.A. and Mietzner, T.A. (2013). Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Delves, P., Martin, S., Burton, D. and Roitt, I. M. (2006). Roitt's Essential Immunology. 11th edition Wiley Blackwell Scientific Publication, Oxford.
4. Glodsky Richard A., Kindt Thomas J. and Osborne Barbara A., Kuby Immunology, W. H. Freeman and Company New York.
5. Jawetz, Melnick, Adelberg, Medical Microbiology, Prentice Hall Inc, London.
6. Jayaram Panicker, C.K. (1993). Text Book of Medical Parasitology Jaypee Brothers, Medical Publishers, New Delhi.
7. Mackie and Mc catney, Medical Microbiology I and II. Charchill Livingston, 14th ed.
8. Madigan, M. T., Martinko, J. M., Dunlap, P. V. and Clark, D. P. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.
9. Murphy, K., Travers. P. and Walport M. (2008). Janeway's Immunobiology. 7th edition Garland Science Publishers, New York.
10. Richard, C. and Geiffrey, S. (2009). Immunology. 6th edition. Wiley Blackwell Publication.
11. Roitt, I.M., Essentials of Immunology, ELBS, Blackwell Scientific Publishers, London.
12. Stanbury, P.T. and Whitaker, (1984). Principles of Fermentation Technology, Pergamomg Press, New York.
13. Tizard, I.R. (1998). Immunology An Introduction, 2nd ed. W.B. Saunders, Philadelphia.
14. Willey, J. M., Sherwood, L. M. and Woolverton, C. J. (2013). Prescott, Harley and Klein's Microbiology. 9th edition, McGraw Hill Higher Education.

Question paper pattern for B.Sc. Microbiology

_____ semester B.Sc. Examination 2026-27

Semester Scheme New SEP syllabus 2024-25

MICROBIOLOGY

Paper: _____

Paper Code: _____

Time 3 hrs.

Maximum marks: 80

Instructions to candidates:

1. All the sections are compulsory.
2. Draw neat and labelled diagrams wherever necessary

Section- A

Answer all the following:

10x2=20

- 1-
- a.
 - b.
 - c.
 - d.
 - e.
 - f.
 - g.
 - h.
 - i.
 - j.

Section- B

Answer any SIX of the following:


6x5=30

2. From Unit I
3. From Unit I
4. From Unit II
5. From Unit II
6. From Unit III
7. From Unit III
8. From Unit IV
9. From Unit IV

Section- C

Answer any THREE of the following: 3x10=30

10. From Unit I
11. From Unit II
12. From Unit III
13. From Unit IV


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Blue print Question paper pattern for VI Semester

UNIT	HOURS ALLOTE	2 MARKS QUESTIONS	5 MARKS QUESTION	10 MARKS QUESTIONS	TOTAL MARKS
I	14	3	2	1	26
II	14	3	2	1	26
III	14	2	2	1	24
IV	14	2	2	1	24
TOTAL	56 HRS	10Q=20	8 Q=40	4Q= 40	
		Answer all	Answer any 6	Answer any 3	
		2X10=20	5X6=30	10X3=30	80

THEORY PAPER
SEMESTER V
24-MCT-MB VI: VIB-THEORY PAPER: INDUSTRIAL MICROBIOLOGY AND BIOTECHNOLOGY
TOTAL HOURS: 56 HOURS

COURSE LEARNING OBJECTIVES:

- a. To provide knowledge of the microorganisms exploited for production of important products
- b. To provide knowledge of fermentation, types of bioreactors and their applications
- c. To familiarise students with the fundamentals and advanced aspects of genetic engineering
- d. To provide knowledge of biotechnology for the improvement of plants and animals

COURSE OUTCOME:

- a. Able to analyse the kinetics and product formation under different culture conditions
- b. Understand the strategies for bioprocesses operations and select the appropriate methods of product purification
- c. Understand the concepts of genetic engineering
- d. Apply knowledge using plants and animals as expression system for production of bioactive compounds at industrial scale

UNIT I: INTRODUCTION	14 HRS
<ol style="list-style-type: none"> a. Microorganisms in industry: History, scope and development of industrial microbiology. Isolation, screening and preservation of industrially important microorganisms. b. Industrial fermentation: Types- batch, continuous, surface, submerged and SSF. Media components and formulation, strategies for media formulation. Natural and synthetic media. Inoculum preparation. Role of antifoam agents, precursors, inducers, inhibitors and buffering agents. c. Fermenter: Basic structure, design and components of bioreactor. Types- stirred aerated fermenter, tower fermenter, airlift fermenter and bubble cap fermenter. 	
UNIT II: INDUSTRIAL PRODUCTION AND DOWNSTREAMING	14 HRS
<ol style="list-style-type: none"> a. Commercial Products- Alcohol and alcoholic beverages- beer & wine, Organic acids- citric acid, vitamins- B 12, Antibiotic- penicillin, Enzymes- Amylase b. Down streaming processing: steps involved in extraction and purification of products. Filtration, disintegration of cells, purification and concentration methods-Chromatographic techniques- affinity column, TLC, HPLC, ion exchange c. Enzyme immobilization: Methods, advantages and applications of enzyme immobilization 	
UNIT III: GENETIC ENGINEERING	14 HRS
<ol style="list-style-type: none"> a. Tools for genetic engineering- Restriction enzymes -types, mode of action, nomenclature, and applications in genetic engineering, DNA modifying enzymes and their applications- DNA polymerases, methylases, 	

<p>transferases, kinases, phosphates and DNA ligases</p> <p>b. Cloning vectors: Salient features, plasmids- properties, types pBR322, pUC 18 series. Bacteriophages- λ and M13, cosmids, BACs, YACs.</p> <p>c. DNA transfer methods: Microinjection, Electroporation, liposome mediated DNA transfer. Identification and selection of recombinants. DNA hybridisation, DNA sequencing</p>	
UNIT IV: BIOTECHNOLOGY	14 RS
<p>a. Microbial biotechnology: Microbial insecticides, microbial pharmaceutical therapeutics- enzymes, monoclonal antibodies, hormones. Molecular diagnostics and bioremediation and biomass utilization</p> <p>b. Plant biotechnology: Principle, production and development of pest and disease resistant plants, nutritional improvement, edible vaccines</p> <p>c. Animal Biotechnology: Cloning strategies, methods and applications of transgenic animals, mammalian cell culture; brief account of gene therapy</p>	

PRACTICAL-VI: IMMUNOLOGY AND MEDICAL MICROBIOLOGY, INDUSTRIAL MICROBIOLOGY AND BIOTECHNOLOGY

4 HOURS/ WEEK Total Units: 15

1. Identification of human blood groups
2. Perform WBC count of the given blood sample using haemocytometer
3. Demonstration of Widal test/HCG/RPR/VDRL test
4. Perform immunodiffusion by Ouchterlony method
5. Study of skin microflora by swab method
6. Demonstration of antibiotic sensitivity test by Kirby-Bauer method
7. Study of the diseases with the help of photographs: Typhoid, Cholera, Bacterial pneumonia, Tuberculosis, Syphilis, Tetanus, Polio, Rabies, Chikungunya, AIDS, Histoplasmosis, Candidiasis
8. Production and estimation of citric acid by *Aspergillus niger* by titrimetric method
9. Production of wine from grapes
10. Estimation of alcohol content by specific gravity method
11. Production and estimation of amylase from fungi
12. Study of fermenters-Stirred aerated fermenter, tower fermenter, airlift fermenter, and bubble cap fermenter
13. Isolation of mutations in bacteria by UV light
14. Resolution and visualization of DNA by agarose gel electrophoresis
15. Study of cloning techniques through charts and illustrations
16. Visit to an Industry/ Institution

Internal assessment for practical paper

- Attendance 05 Marks
- Record/Journal 05 Marks

10 Marks

Practical VI: Immunology & Medical Microbiology, Industrial Microbiology and Biotechnology

- | | |
|--|-----------|
| 1. Estimate the percentage of citric acid/ alcoholic content/
Identification of human blood groups/WBC count using hemocytometer of the
given sample A | 12 |
| 2. Measure the activity of the given enzyme amylase /Widal test / HCG test/
VDRL test of the sample B | 08 |
| 3. Identify & Comment on C, D, E, F & G | 15 |
| 4. Viva-voce | |
| 05 | |

Scheme of Valuation

- | | |
|--|-----------|
| 1. Citric acid/alcohol content/Blood group/WBC count
Performance-3, principle-3, procedure-3, comment-3 | 12 |
| 2. Any enzyme (Amylase)/WIDAL/HCG/VDRL
Performance-3, principle-3, graph & comment-3 | 08 |
| 3. C, D, E, F & G (Charts, Demonstrations, illustrations)
Identification-1, comment-2 | 15 |
| 5. Viva-voce | 05 |

References

- 1) Casida L.E. Industrial Microbiology, Wiley Eastern Limited, New Delhi.
- 2) Prescott S.C. and Dunn C.C. Industrial Microbiology, Tata McGraw-Hill Publishing Company limited, New Delhi.
- 3) Stanbury, P.F. Whitaker A and Hall S.J. Principles of Fermentation Technology, Elsevier Science limited Aditya Books Private Limited, New Delhi.
- 4) Waites Michael J. Morgan Neil L. Rockey John S. And Gray Higton.
- 5) Industrial Microbiology-An Introduction, Blackwell | Science. Delhi.
- 6) McNeill Bn Harve. Fermentation practical approach Press
- 7) McNeill Band Harve/L.M. Fermentation- A Practical Approach, IRL Press, New York
- 8) Glick B R, Pasternak J J, Patten C L, (1994) Molecular Biotechnoss, Washlogy- Principles and Applications of recombinant DNA 4 th Edition (ASM Press)

AEDP: PROJECT/INTERNSHIP/DISSERTATION/SWAYAM

Max Marks: 50

1. Students must undertake any ONE of the above module individually or in a group (max of 4)
2. Submission and presentation of the same module undertaken during the examination
3. The evaluation shall be done both by the external and internal examiners

Scheme of Valuation

Performance: 20 Marks

Submission of report: 10 Marks

Presentation & Defence: 10Marks

Internals: 10 Marks