

Devi Ahilya Vishwavidyalaya, Indore

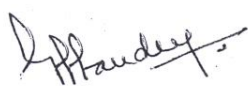
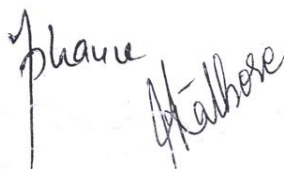
Syllabus for B.Sc. Part-I, II and III

(Optional Subject-Industrial Microbiology)

2016-2017 onwards

| Semester | Course title | Distribution of marks | | | |
|---|--|-----------------------|-------------|----------------|-------|
| | | CCE | Theory Exam | Practical Exam | Total |
| Sem-I | General Microbiology | 15 | 85 | 50 | 150 |
| Sem-II | Microbial Physiology and Biochemistry | 15 | 85 | 50 | 150 |
| Sem-III | Immunology and Bacterial Genetics | 15 | 85 | 50 | 150 |
| Sem-IV | Environmental and Applied Microbiology | 15 | 85 | 50 | 150 |
| Sem-V | Fermentation Technology | 15 | 85 | 50 | 150 |
| Sem-VI | Food and Pharmaceutical Microbiology | 15 | 85 | 50 | 150 |
| Sem-VI | Project Work | | | | 100 |
| Theory- 60 lectures/paper (1 lecture = 40 minutes) | | | | | |

| Scheme of practical examination in each semester | | |
|--|---------------------|----------|
| Total Marks- 50 | 1. Major exercise | 12 Marks |
| | 2. Minor exercise | 10 Marks |
| | 3. Minor exercise | 10 Marks |
| | 4. Spotting | 08 Marks |
| | 5. Viva-voce | 05 Marks |
| | 6. Practical record | 05 Marks |


Devi Ahilya Vishwavidyalaya, Indore
B.Sc. Part- I (Industrial Microbiology) Semester-I

| Semester-I | General Microbiology | CCE- 15 Marks End Exam. - 85 Marks |
|-----------------|--|---------------------------------------|
| Unit-I | History and Scope of Microbiology Contributions of Pioneers- Anton von Leeuwenhoek, Robert Koch, Edward Jenner, Louis Pasteur, Alexander Fleming and Joseph Lister Discovery of microbial world : Theories of biogenesis and abiogenesis Major branches of Microbiology Beneficial and harmful activities of microbes Difference between prokaryotic and eukaryotic microorganisms | 12 lectures |
| Unit-II | Taxonomy and Morphology of Bacteria Classification systems of prokaryotes- Haeckel's three kingdom concept, Whittaker's five-kingdom classification system, Woese's three-domain system. General principles of bacterial nomenclature. Introduction to Bergey's manual. Size, shape and arrangement of bacterial cells. Structure, chemical composition and functions of components in bacterial cell: Cell wall, cell membrane, capsule, endospore, flagella, pili, chromosomal & extrachromosomal material, cell inclusions | 12 lectures |
| Unit-III | Eucaryotes, Acaryotes and Bacteria with unusual properties General characters and economic importance of eucaryotes-Fungi (Yeast and Molds), Algae and Protozoans. Viruses- Classification and structure of viruses. Introduction to virioids and prions. Bacterial viruses -Structure of bacterial viruses, Multiplication of bacterial viruses- lytic and lysogenic cycles. Bacteria with unusual properties-Rickettsia, Chlamydia, Mycoplasma, Archaeobacteria, Cyanobacteria. | 12 lectures |
| Unit-IV | Microscopy and Staining Techniques Principle, construction, working and applications of: <ul style="list-style-type: none"> • Bright field microscopy • Dark field microscopy • Fluorescence microscopy • Electron microscopy Stains and Staining Techniques: <ul style="list-style-type: none"> • Definitions of stain, Types of stains • Principles of staining techniques for following: <ul style="list-style-type: none"> i. Monochrome and Negative staining ii. Differential Staining (Gram & Acid Fast) iii. Special staining (endospore, cell wall, capsule, flagella, metachromatic granules) Wet mount and hanging drop preparations. | 12 lectures |
| Unit-V | Control of Microorganisms Definition of sterilisation, disinfection, antiseptic, sanitation, bactericidal bacteriostatic. Physical methods of control- temperature, radiation, dessication, osmotic pressure, filtration. Chemical methods of control- Phenol, alcohol, halogens, heavy metals, detergents, quaternary ammonium compounds and gaseous chemosterilizers. | 12 lectures |

Recommended Books

1. Microbiology-Pelczar MJ, Chan ECS & Kreig NR, 5th edition (Tata McGraw-Hill, New Delhi)
2. Fundamentals of Microbiology-Frobisher M, Hinsdill RD, Crabtree KT & Goodheart CR, 9th edition (W.B. Saunders Co.)
3. Fundamental Principles of Bacteriology -Salle AJ, 7th edition (Tata McGraw-Hill, New Delhi),
4. Microbiology- Prescott LM, Harley JP & Klein DA, 7th edition (Wm. C. Brown Publishers, USA)
5. Elementary Microbiology-Modi, HA (Vol. I & II), 1st edition (Akta Pakashan, Nadiad)
6. A Handbook of Elementary Microbiology-Modi, HA, 1st edition (Shanti Pakashan, Rohtak)
7. Textbook of Microbiology -Dubey RC & Maheshwari DK, 2nd edition (S Chand & Co. New Delhi)
8. Essentials of Practical Microbiology- Patel B & Phanse N, 1st edition (Print Care, Indore)
9. Solutions to Practical Microbiology- Patel B & Phanse N, 2nd edition (Print Care, Indore)

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B.Sc. Part- I (Industrial Microbiology) Semester-I

General Microbiology

List of Practicals

1. Principles, working knowledge of Instruments like Autoclave, Incubator, Hot air oven, Microscope, Refrigerator, Colony counter, Laminar Air Flow, Colorimeter, Centrifuge
2. Neutralization, cleaning and sterilization of glassware.
3. Measurement of microorganisms.
4. Preparation of stains.

Staining Techniques-

5. Monochrome staining
6. Negative staining
7. Gram Staining
8. Cell wall staining
9. Capsule staining
10. Metachromatic granule staining
11. Endospore staining.
12. Identification of some common fungi.

Scheme of Practical Examination- Semester -I

M.M. 50 (4 Hrs.)

| | | |
|-------|---|------|
| Ex.1 | Perform Gram staining of given bacterial culture. | [12] |
| Ex.2 | Perform Structural / Special Staining (Cell wall staining, Capsule staining, Metachromatic Granule staining, Endospore staining). | [10] |
| Ex.3 | Perform wet mount of given fungal culture | [10] |
| Ex.4 | Spotting. | [08] |
| Ex. 5 | Viva-Voce. | [05] |
| Ex. 6 | Practical Record. | [05] |

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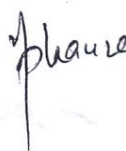
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B.Sc. Part- I (Industrial Microbiology) Semester-II

| Semester-II | Microbial Physiology and Biochemistry | CCE- 15 Marks End Exam. - 85 Marks |
|--|--|---------------------------------------|
| Unit-I | Cultivation and preservation of bacteria Nutritional types of bacteria. Bacteriological media and its types. Cultivation of aerobic and anaerobic microbes. Pure culture and cultural characteristics. Maintenance and preservation of cultures. | 12 lectures |
| Unit-II | Bacterial growth Growth curve of bacteria. Batch, continuous, synchronous and diauxic growth. Factors affecting microbial growth. Growth of microbes in extreme environments Quantitative measurement of bacterial growth by cell mass, cell number and cell activity. | 12 lectures |
| Unit-III | Enzymes General characters, classification and nomenclature of enzymes. Factors affecting enzyme activity. Mechanism of enzyme action. Regulation of enzyme activity-Feedback inhibition, Precursor activation, Energy- link control Applications of enzymes. | 12 lectures |
| Unit-IV | Chemistry of Biomolecules General properties, classification and functions of – • Carbohydrates • Lipids • Proteins • Amino acids | 12 lectures |
| Unit-V | Microbial Metabolism Metabolism of carbohydrates- energy production by aerobic processes, anaerobic processes; bacterial photosynthesis Metabolism of proteins-proteolysis, transamination, deamination Metabolism of lipids- Beta oxidation of fatty acids | 12 lectures |
| Recommended Books | | |
| <ol style="list-style-type: none"> 1. Microbiology- Pelczar MJ, Chan ECS & Kreig NR, 5th edition (Tata McGraw-Hill, New Delhi) 2. Fundamentals of Microbiology- Frobisher M, Hinsdill RD, Crabtree KT & Goodheart CR, 9th edition (W.B. Saunders Co.) 3. Fundamental Principles of Bacteriology-Salle AJ, 7th edition (Tata McGraw-Hill, New Delhi), 4. Microbiology- Prescott LM, Harley JP & Klein DA , 7th edition (Wm. C. Brown Publishers, USA) 5. Elementary Microbiology -Modi, HA (Vol.I), 1st edition (Ekta Pakashan, Nadiad) 6. A Handbook of Elementary Microbiology-Modi, HA, 1st edition (Shanti Pakashan, Rohtak) 7. A Textbook of Microbiology- Dubey RC & Maheshwari DK, 2nd edition (S Chand & Co. New Delhi) 8. Lehniger-Principles of Biochemistry-Nelson DL & Cox MM, 4th edition (CBS Publishers) 9. Microbial Physiology- Moat AG, Foster JW & Spector MP, 4th edition (John Wiley & Sons) 10. Fundamentals of Biochemistry- Jain JL, Jain S & Jain N, 8th edition (S Chand & Co. New Delhi) 11. Biochemistry- Satyanarayana U, 4th edition (Elsevier, India) 12. Essentials of Practical Microbiology-Patel B & Phanse N, 1st edition (Print Care, Indore) 13. Experiments in Biotechnology- Nighojkar S & Nighojkar A, 1st edition (Satprachar Press, Indore) | | |



P. Phanse



Phanse



Phanse



Phanse

B.Sc. Part- I (Industrial Microbiology) - Semester-II
Microbial Physiology and Biochemistry
List of Practicals

1. Preparation of culture media like nutrient agar and its uses.
2. Growth of microorganisms on agar slants, stab and in broth.
3. Isolation of microorganisms by streak plate method.
4. Isolation of microorganisms by pour plate method.
5. Qualitative detection of carbohydrates.
6. Qualitative detection of proteins.
7. Qualitative detection of lipids.
8. Effect of environment on bacterial growth : Temperature.
9. Effect of environment on bacterial growth : Osmotic pressure.
10. Effect of environment on bacterial growth : pH
11. The oligodynamic action of heavy metals on bacterial growth.
12. Demonstration of extracellular enzyme production by microbes
13. Effect of pH on enzyme activity
14. Effect of temperature on enzyme activity

Scheme of Practical Examination- Semester-II

M.M. 50 (3+3 Hrs.) (2days)

| | | |
|-------|--|------|
| Ex.1 | a) Effect of temperature on bacterial growth b) Effect of pH on bacterial growth c) Effect of temperature on enzyme activity d) Effect of pH on enzyme activity | [12] |
| Ex.2 | Perform isolation of microorganisms by streak plate / pour plate method. | [10] |
| Ex.3 | Qualitative analysis of biomolecules – Carbohydrates/ Proteins / Lipids | [10] |
| Ex.4 | Spotting | [08] |
| Ex. 5 | Viva-Voce | [05] |
| Ex. 6 | Practical Record | [05] |

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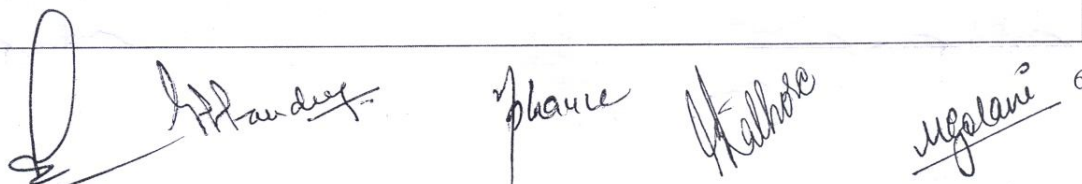
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Devi Ahilya Vishwavidyalaya, Indore
B.Sc. Part- II (Industrial Microbiology) Semester-III

| | | |
|---------------------|--|---|
| Semester-III | Immunology and Bacterial Genetics | CCE- 15 Marks End Exam. - 85 Marks |
| Unit-I | <p>Components of Immune System Organs and cells involved in immune response. Antigen – properties and types, Adjuvants. Immunoglobulin – structure and types. Primary and secondary responses. Complement – components and biological activities.</p> | 12 lectures |
| Unit-II | <p>Antigen – Antibody Reactions Antigen and antibody reactions – agglutination, precipitation. immunofluorescence, ELISA, RIA. Hypersensitivity – Immediate and delayed type. Autoimmune diseases.</p> | 12 lectures |
| Unit-III | <p>Fundamentals of Genetics Genotype and Phenotype. Evidence for DNA as genetic material Structure and types of DNA and RNA. Genetic code. DNA Replication.</p> | 12 lectures |
| Unit-IV | <p>Mutation Spontaneous and induced mutations Molecular basis of mutation – types of mutations. Types of bacterial mutants and their isolation. Mutagenic agents – Physical: mechanism of mutagenesis by UV and ionizing radiations. Chemical mutagenesis: Base analogues (5BU, 2AP), nitrous acid, hydroxyl amine, alkylating agents</p> | 12 lectures |
| Unit-V | <p>Genetic Recombination Transformation – Competence, process of transformation Conjugation – F factor, characters of donor and recipient. steps in conjugation, formation of Hfr and F prime cells, sexduction Transduction – Generalized and specialized transduction, abortive transduction. Types and functions of transposons and plasmids</p> | 12 lectures |

Recommended Books

1. Kuby Immunology- Kindt TJ, Goldsby RA, Osborne BA, 6th edition (WH Freeman & Co. New York)
2. Text book of Microbiology- Ananthnarayan R and Panikar CKJ, 8th edition, (Univ Press Pvt Ltd, Hyderabad)
3. Text book of Microbiology- Chakraborty P, 1st edition (New Central book agency Pvt Ltd.)
4. Fundamental Immunology- Paul WE, 7th edition (Lippincott Williams & Wilkins, USA)
5. Fundamentals of Immunology- Coleman RM, Lombord MF and Sicard RE, 2nd edition (WMC Brown, USA)
6. Immunology- Weir DM and Steward J, 8th edition (Topley & Wilson, UK)
7. Immunology- Rao CV, 2nd edition (Narosa Publishing House, New Delhi)
8. Genetics- Russel JP, 2nd edition (Scott, Foresman & Company, USA)
9. Principles of Genetics- Gardner JE, Simmons JM & Snustad PD, 8th edition (John Wiley & Sons, Canada)
10. Concepts of Genetics- Klug WS & Cummings MR, 10th edition (Benjamin Cummings, USA)
11. Microbial Genetics- Freifelder D, 2nd edition (Jones & Bartlett, Boston) Microbiology – A
12. Microbiology -A Practical Approach- Patel B & Phanse N, 2nd edition (Print Care, Indore)
13. Experiments in Biotechnology- Nighojkar S & Nighojkar A, 1st edition (Satprachar Press, Indore)



B.Sc. Part- II (Industrial Microbiology) Semester-III

Immunology and Bacterial Genetics

List of Practicals

1. Determination of Blood Group
2. Estimation of hemoglobin
3. Total count of blood cells-WBC, RBC
4. Differential WBC count
5. Flocculation reaction- VDRL test
6. Agglutination reaction- Widal test.
7. Isolation of bacterial genomic DNA.
8. Isolation of plasmid DNA.
9. UV as a mutagenic agent.
10. Replica plate technique.
11. Isolation of antibiotic resistant mutants by gradient plate technique.

Scheme of Practical Examination- Semester- III

M.M. 50 (3+3 Hrs.) (2days)

| | |
|--|------|
| Ex.1-Isolation of bacterial genomic /plasmid DNA/Replica plate technique//UV as mutagenic agent. | [12] |
| Ex.2- Serological tests- VDRL/Widal | [10] |
| Ex.3 -Total count of RBC/Total count of WBC/Differential WBC count/Hb estimation. | [10] |
| Ex.4 -Spotting. | [08] |
| Ex.5 -Viva Voce. | [05] |
| Ex.6 -Practical Record. | [05] |

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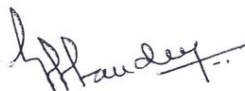
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B.Sc. Part- II (Industrial Microbiology) Semester-IV

| Semester-IV | Environmental and Applied Microbiology | CCE- 15 Marks End Exam. - 85 Marks |
|--|---|---------------------------------------|
| Unit-I | Microbiology of water and waste-water Microbiological examination of water and waste-water. Water borne diseases. Water purification. Treatment of waste-water – Primary, secondary, advanced and final treatments, solid processing. Eutrophication. | 12 lectures |
| Unit-II | Microbiology of air Air borne diseases. Analysis of air. Aeromicroflora of different habitats. Aeroallergens. Control of microorganisms in air. | 12 lectures |
| Unit-III | Microbiology of soil and plant pathology Estimation of soil microflora. Interactions among soil microflora. Biogeochemical cycles – Nitrogen, Carbon and Sulfur cycles. Symptoms, transmission and control of plant diseases. | 12 lectures |
| Unit-IV | Microbial fertilizers Nitrogen fixation by symbiotic and non-symbiotic microorganisms. Mass cultivation of <i>Rhizobium</i> and <i>Azotobacter</i> . Use of blue-green algae as biofertilizers. Phosphate solubilizing microorganisms. | 12 lectures |
| Unit-V | Applications of microorganisms Microbial leaching of copper and uranium. MEOR-biorecovery of petroleum. Bioremediation, Biodeterioration – petroleum products, leather, textile and paper. Applications of biosensors and biopolymers. | 12 lectures |
| Recommended Books | | |
| <ol style="list-style-type: none"> 1. Fundamental Principles of Bacteriology -Salle AJ, 7th edition (Tata McGrawhill, NewDelhi) 2. Microbiology-Pelczar MJ, Chan ECS&Kreig NR, 5th edition (Tata McGraw-Hill, NewDelhi) 3. A Textbook of Microbiology- Dubey RC & Maheshwari DK, 2nd edition(S Chand & Co. New Delhi) 4. Environmental Microbiology-Sharma PD, Alpha Science International 5. Introduction to Environmental Microbiology-Michael R, 1st edition (Prentice Hall) 6. Introduction to soil microbiology-Alexander M, 2nd edition (John Wiley and Sons NewYork) 7. Soil Microbiology- Subba Rao NS, 4th edition (Oxford and IBH, Publishing Co. New Delhi) 8. Principles of Plant Pathology- Manners JG, 2nd edition (Cambridge University Press) 9. Plant Pathology- Agrios GN, 2nd edition (Academic Press, Inc.) 10. Biofertilizers in agriculture and forestry- Subba Rao NS (Oxford and IBH, Publishing Co. New Delhi) 11. Bioremediation-Baker KH and Herson DS(Mc Graw Hill, New York) 12. Microbiology – A Practical Approach-Patel B & Phanse N, 2nd edition (Print Care, Indore) | | |




B.Sc. Part- II (Industrial Microbiology) Semester-IV
Environmental and Applied Microbiology

List of Practicals

1. Qualitative and quantitative examination of water.
2. Qualitative and quantitative examination of sewage.
3. Estimation of soil microflora (Bacteria, Yeast and Molds).
4. Isolation of *Azotobacter*.
5. Isolation of *Rhizobium* from root nodules.
6. Isolation of phosphate solubilizing microorganisms
7. Estimation of air micro-flora
8. Isolation of *Xanthomonas citri* from citrus canker.
9. Isolation and identification of fungal plant pathogens.

Scheme of Practical Examination- Semester- IV

M.M. 50 (3+3 Hrs.) (2days)

| | |
|---|------|
| Ex.1 – MPN of water/MPN of sewage/Membrane filtration technique. | [12] |
| Ex.2 – Standard plate count (bacterial) of soil /water/sewage. | [10] |
| Ex.3 – Isolation of <i>Azotobacter</i> / <i>Rhizobium</i> /Phosphate solubilizers/ <i>Xanthomonas citri</i> . | [10] |
| Ex.4 – Spotting. | [08] |
| Ex.5 – Viva Voce. | [05] |
| Ex.6 – Practical Record. | [05] |

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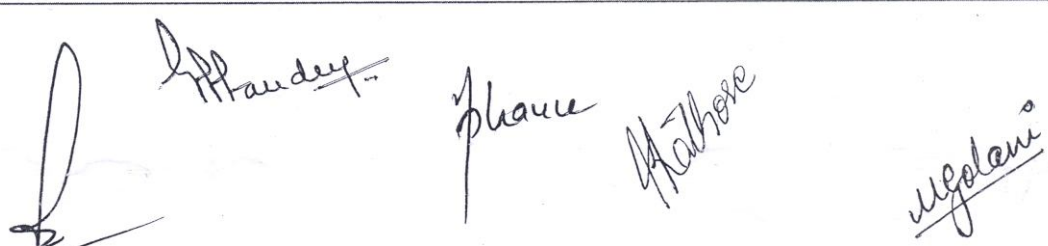
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B.Sc. Part- III (Industrial Microbiology) Semester-V

| Semester-V | Fermentation Technology | CCE- 15 Marks End Exam. - 85 Marks |
|--|---|---------------------------------------|
| Unit-I | Fundamentals of Industrial Fermentations General concepts of industrial microbiology. Primary screening methods for isolation of industrially important organisms. Secondary screening methods. Regulatory mechanisms in microbes and strain development strategies. | 12 lectures |
| Unit-II | Fermentor Design Design of typical batch fermentor. Factors affecting fermentor design. Types of fermentations – Batch and continuous fermentations. Surface, solid state and submerged fermentation Monitoring and control of-agitation, aeration, pH, temperature and dissolved oxygen. Industrial sterilization of media and air. | 12 lectures |
| Unit-III | Scale up and Down stream processing Inoculum development. Scale up of fermentation process. Raw material for media preparation. Harvesting and recovery of intracellular and extracellular products. | 12 lectures |
| Unit-IV | Industrial production – I Production of antibiotics- Penicillin and semi-synthetic penicillins. Production of enzymes- Amylase, cellulose and protease. Immobilized enzymes – Methods of immobilization and their applications. | 12 lectures |
| Unit-V | Industrial production – II Production of solvent- Ethanol. Production of Vitamins- Cyanocobalamine. Production of Organic Acids- Citric acid. Production of Amino Acids- Glutamic Acid. | 12 lectures |
| Recommended Books | | |
| <ol style="list-style-type: none"> 1. Textbook of Industrial Microbiology-Patel AH, 1st edition (Macmillan India Ltd, Madras) 2. Industrial Microbiology-Cassida LE, 4th edition (Wiley Eastern Ltd, New Delhi) 3. Principles of Fermentation Technology-Stanbary FP, Whitaker A and Hall JS, 2nd edition, (Elsevier, Delhi) 4. Fermentation Technology- Modi HA, 1st edition (Pointer Publisher, Jaipur) 5. Biotechnology -Industrial Microbiology- Crueger W & Crueger A, 2nd edition(Panima Publisher, Delhi) 6. Industrial Microbiology- Prescott SC & Dunn CG, 4thedition (Agrobios India, Jodhpur) 7. Industrial Microbiology: Fundamentals and Applications- Agarwal AK & Parihar P, 1st edition(AgrobiosIndia, Jodhpur) 8. Industrial Microbiology: An Introduction- Waites MJ, Morgan NL, Rockey JS, Higton G, 1st edition (Blackwell Science Ltd., UK) 9. Microbiology – A Practical Approach-PatelB &Phanse N, 2nd edition (Print Care, Indore) | | |



B.Sc. Part- III (Industrial Microbiology) Semester-V
Fermentation Technology

List of Practicals

1. Screening of antibiotic producing microorganisms.
2. Primary screening of amylase producing microorganisms.
3. Primary screening of protease producing microorganisms.
4. Primary screening of cellulase producing microorganisms.
5. Primary screening of organic acid producing microorganisms.
6. Production of enzymes –amylase, protease and cellulase.
7. Production of ethanol.
8. Production of citric acid.
9. Sugar estimation by Cole's method.
10. Demonstration of working of fermentor.

Scheme of Practical Examination- Semester- V

M.M. 50 (3+3 Hrs.) (2days)

| | |
|--|------|
| Ex.1 – Production of amylase/ citric acid | [12] |
| Ex.2 – Primary screening of antibiotic producers/organic acid producers. | [10] |
| Ex.3 – Primary screening of enzyme producers (amylase/cellulase/protease). | [10] |
| Ex.4 – Spotting. | [08] |
| Ex.5 – Viva Voce. | [05] |
| Ex.6 – Practical Record. | [05] |

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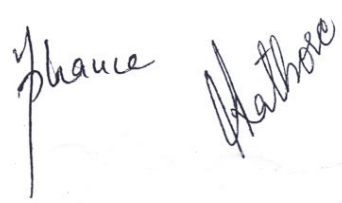
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B.Sc. Part- III (Industrial Microbiology) Semester-VI

| Semester-VI | Food and Pharmaceutical Microbiology | CCE- 15 Marks End Exam. - 85 Marks |
|-------------|---|---------------------------------------|
| Unit-I | Microbiology of Food Microbiological examination of food and milk. Food and milk-borne diseases. Food intoxications. Spoilage of food – fresh food, canned food, vegetables and milk products. | |
| Unit-II | Food Preservation Principles of food preservation - asepsis, removal of microorganisms, anaerobic conditions, high and low temperatures and drying. Chemical preservatives and food additives. Food packaging. | |
| Unit-III | Government regulations Good manufacturing practices. Food and drugs administration, Indian pharmacopeia and standards. Recombinant DNA and Biosafety guidelines. IPR(Intellectual property rights)-Patents. | |
| Unit-IV | Pharmaceutical Industry Formulation units and Active Pharmaceutical Ingredient manufacture Units (API) Departments in a pharmaceutical company - Raw material, Production, Research and development, Quality assurance, Quality Control, Marketing and Sales. QC Tests - Sterility testing, Microbial Limit Test (MLT) for pharmaceutical products, Pyrogen testing (LAL test), Water analysis and Area monitoring. | |
| Unit-V | Microbiological Assays Bioassay of growth supporting substances- Amino acids and Vitamins. Bioassay of growth inhibiting substances- Antibiotics. Minimum inhibitory concentration. Phenol coefficient of antimicrobial substances. | |

Recommended Books

1. Pharmaceutical Microbiology-Essentials for Quality Assurance and Quality Control- Sandle T, (Woodhead Publishing, Elsevier)
2. Pharmaceutical Microbiology- Hugo NB & Russel AD, 8th edition (Wiley Blackwell)
3. Pharmaceutical Microbiology-Harris M (Baillière, Tindall and Cox, London)
4. Textbook of Industrial Microbiology-Patel AH, 1st edition (Macmillan India Ltd, Madras)
5. Industrial Microbiology-Cassida LE, 4th edition (Wiley Eastern Ltd, New Delhi)
6. Principles of Fermentation Technology-Stanbary FP, Whitaker A and Hall JS, 2nd edition, (Elsevier, Delhi)
7. Industrial Microbiology- Prescott SC & Dunn CG, 4th edition (Agrobios India, Jodhpur)
8. Industrial Microbiology: An Introduction- Waites MJ, Morgan NL, Rockey JS, Highton G, 1st edition (Blackwell Science Ltd., UK)
9. Food Microbiology-Frazier CW and Westhoff CD, 4th edition (Tata McGrawhill, New Delhi)
10. Food Microbiology-Adams RM and Moss OM, 3rd edition (RSC publisher)
11. Introductory Food Microbiology-Modi HA, 1st edition, (Aavishkar Publishers, Jaipur)
12. Modern Food Microbiology-Jay JM, 5th edition (Aspen Publishers, Maryland)









B.Sc. Part- III (Industrial Microbiology) Semester-VI

Food and Pharmaceutical Microbiology

List of Practicals

1. Determination of MIC.
2. Sterility testing of pharmaceutical products-injectables, eye and ear drops.
3. Microbial Limit Test- Tablets and syrups.
4. Area monitoring.
5. Determination of Phenol coefficient of Dettol / Phenyl / Hand-wash.
6. Bioassay of Penicillin.
7. Qualitative and quantitative examination of Food.
8. Qualitative and quantitative examination of Milk.

Scheme of Practical Examination- Semester- VI

M.M. 50 (3+3 Hrs.) (2days)

| | |
|---|------|
| Ex.1 – Microbial assay of Antibiotics/Phenol coefficient/MIC. | [12] |
| Ex. 2- Qualitative and Quantitative analysis of food/milk. | [10] |
| Ex.3 – MLT- Total aerobic bacterial count/ MLT-For specific pathogens/Area Monitoring | [10] |
| Ex.4 – Spotting. | [08] |
| Ex.5 – Viva Voce. | [05] |
| Ex.6 – Practical Record. | [05] |

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