

Industrial Microbiology and Biotechnology - Practicals

1. Production of Citric acid by *Aspergillus niger* and its estimation.
2. Production of Wine from Grapes.
3. Estimation of Alcohol by Specific Gravity Method.
4. Study of Fermentor - Stirred aerated fermentor, Tower fermentor, Airlift fermentor and Bubble cap fermentor.
5. Preparation of buffers - citrate & phosphate buffer.
6. Estimation of DNA by Diphenylamine method.
7. Estimation of RNA by orcinol method.
8. Isolation of genomic DNA from bacteria and separation by gel electrophoresis.
9. Demonstration of ascending & descending paper chromatography
10. Protein purification by dialysis
11. Precipitation of proteins by salting out technique
12. Photographs on Genetic Engineering.
 - a. Fundamental steps of Gene cloning.
 - b. pBR322, pUC18 & pUC19, SV40, Bacteriophage λ , T4 phage
 - c. Selection of recombinants by replica plating technique.

SCHEME OF PRACTICAL EXAMINATION:

Time: 3hrs

Max. marks: 50

- 1 Estimate the amount of Citric acid in the given sample "A".
(Performance-5, Principle-3, Procedure-3 and Result -2)

OR

Estimate the amount of DNA in the given sample "A" by Diphenylamine method. Write the principle, procedure, result, and plot the graph.

OR

Estimate the amount of RNA in the of the given sample "B" given sample "A" by orcinol method. Write the principle, procedure, result, and plot the graph.

- 13 Marks

(Performance-6, Principle-2, Procedure-2, Graph-2, Result -3. Error 0-20 %- 3Marks, 21 - 40%-2½Marks, 41 - 60% 1½Marks, 61- 80% - ½Marks, 81%and above- Nil)

- 2 Estimate the percentage of Alcohol of the given sample "B" by Specific Gravity Method.
(performance - 3 Marks, Principle-2, Procedure-2 and Result -2)

OR

Prepare citrate / phosphate buffer of the given pH of the given sample "B"
(performance - 3 Marks, Principle-2, Procedure-2 Composition - 2Marks)

- 9 Marks

Comment on D,E,F,G,H and I.

(Wine, Stirred aerated fermentor, Tower fermentor, Airlift fermentor and Bubble cap fermento,. Replica plate, charts on fundamental steps of genetic engineering, pBR322, pUC18 & 19, SV40, Bacteriophage λ , T4 phage & δ - endotoxin.)

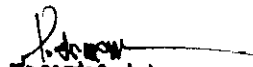
6 x 3 = 18
Marks

(Identification - 1 Mark, Reasons - 2 Marks.)

- 4 Class Record
5 Viva voce

5 Marks

5 Marks


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 ಶಿವನಗೋಟಿ, ದಾವಣಗೆರೆ-677 002.

Paper 8

Industrial Microbiology and Biotechnology

Module 1

Fundamentals of Industrial Microbiology

10Hours

Microorganisms in industry- Isolation and Screening of industrial important microorganisms.

Industrial Fermentation Process- Batch and Continuous. Surface, Submerged and Solid State Fermentation.

Fermentor- Basic structure of a typical fermentor. Types of fermentor- Stirred aerated fermentor, Tower fermentor, Airlift fermentor and Bubble cap fermentor.

Module 2

Industrial production and Downstream Processing

10Hours

Industrial production of Ethyl alcohol, Penicillin, vitamin B12, wine, citric acid.

Downstream Processing - Cell disruption, Solid-Liquid Separation, Clarification, Concentration

Module 3

Recombinant DNA Technology

10Hours

Isolation of genomic DNA & Plasmid DNA from Bacteria

Modification of ends of DNA – Homopolymer tailing, Linkers and Adaptors.

Screening & selection of recombinant host cells :
Antibiotic based selection & LacZ selection).

Transformation of recombinant into target host organism:
Physical methods –shotgun method, Microinjection. Chemical methods -- calcium chloride mediated gene transfer. Biological method – Agrobacterium mediated gene transfer.

Module 4

Biotechnology:

10Hours

A brief account insulin and microbial production of recombinant insulin,

Production of transgenic plant by using *Agrobacterium spp.*,

Production of recombinant vaccine -Hepatitis B vaccine.

Gene therapy – Definition & types.

Microbial enzymes – Amylase.

Module 5

Bioinstrumentation:

10Hours

Centrifugation: Construction & principle of centrifuge. Types of centrifuge. Applications of centrifuge.


Spectrophotometry: Construction & principle of spectrophotometer. UV spectrophotometer and its applications.

Chromatography: Definition, paper chromatography, Thin Layer Chromatography(TLC), Applications of chromatography.

Electrophoresis: Definition, Types – Agarose electrophoresis & SDA-PAGE.

Blotting techniques: Southern, Northern & Western blotting.

PCR – Principles and applications


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AGRICULTURAL MICROBIOLOGY AND FOOD MICROBIOLOGY-Practicals


1. Study of *Rhizobium* from legume root nodules – Gram staining.
2. Isolation, Identification and Culturing of *Rhizobium* and *Azotobacter*.
3. Examination of *Anabaena* in *Azolla*.
4. Study of fungi in Seeds by blotter method.
5. Study of plant diseases- Soft rot of Carrot, Downy mildew of Grapes, Coffee rust, Tikka disease of Ground nut, Sandal spike, Little leaf of Brinjal.
6. Isolation and identification of fungi from rhizosphere and rhizoplane soil by serial dilution and plate technique.
7. Study of antagonism between microorganisms by coculture method -Bacteria Vs Bacteria, Bacteria Vs Fungi, Fungi Vs Fungi, Actinomycetes Vs Bacteria and Fungi.
8. Isolation and identification of Microorganisms from healthy and infected fruits.
9. Isolation and identification of Microorganisms from canned food.
10. **Microbial Examination of Milk**
 Organoleptic test,
 Clot-on boiling test
 Alcohol test
 Sedimentation test
 Titratable acidity
 DMC
 MBRT
 Resazurin dye reduction test
 Standard Plate Count.
11. Estimation of Lactose in milk.
12. Estimation of fat in milk.
13. Study of food borne pathogens-*Staphylococcus*, *Salmonella* and *Clostridium*.

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Paper 7


AGRICULTURAL MICROBIOLOGY AND FOOD MICROBIOLOGY—Theory

Unit 1	Biofertilizers Nitrogen Fixation- Biochemistry and Physiology. Symbiotic Nitrogen Fixation- <i>Rhizobium</i> , Non- Symbiotic Nitrogen Fixation- <i>Azotobacter</i> . Biofertilizers: Definition and Types. Bacterial,- <i>Rhizobium</i> , <i>Azotobacter</i> . Mass production of Biofertilizers Biopesticides: Definition and Types- Bacterial- <i>Bacillus thuringiensis</i> , Fungal- <i>Trichoderma</i> , Viral-CPV.	10Hours
Unit 2	Phytopathology Classification of Plant diseases, Host pathogen interaction. Defence Mechanism in Plants: Structural and Biochemical. Principles of Plant disease control. Microbial Plant diseases: Bacterial blight of rice and Soft rot of Carrot; Coffee rust, Tikka disease of Ground nut; Sandal spike, Little leaf of Brinjal; Tobacco mosaic disease and Leaf curl of Tomato.	10Hours
Unit 3	Food Microbiology Food and Microorganisms- Food as substrate for microorganisms. Sources of food contamination. Food Poisoning- Food infection(<i>Staphylococcal</i> poisoning), Food intoxification (Salmonellosis) and Food toxi-infection(Botulism). Microorganisms as food-Single Cell Protein (SCP).	10Hours
Unit 4	Dairy Microbiology Physical and Chemical Properties of Milk. Types of Microorganisms in Milk-Bacteria, Molds and Yeasts. Sources of Microbial contamination of Milk. Microbial examination of Milk DMC, SPC and dye reduction tests(MBRT and Resazurin test). Biochemical activities of Microorganisms in Milk- Souring, gassy fermentation, Proteolysis, Lactic acid fermentation. Fermented Milk Products-Cheese(Cheeddar)	10Hours
Module 5	Spoilage and Preservation of food Food Spoilage-Spoilage of Canned vegetables and Meat. Food preservation- Principles of food preservation. Methods of food preservation-low temperature (freezing), high temperature, dehydration, irradiation and chemical preservatives. Preservation of Milk and Milk Products-Pasteurization, and Ddehydration.	10 Hours


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 ಬೆವಗೋಡು, ದಾವಣಗೆರೆ-577 002.

References:

1. Sullia S B. and Shantharam S. 2006. General Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
2. Alexopolous C.J. and Mims C.W. 1964. Introductory Mycology. New Age International, New Delhi.
3. Brock T.D. and Madigan M.T. 2009. Biology of Microorganisms. Prentice Hall of India
4. Mehrotra R.S. 2010. Plant Pathology. Tata McGraw Hill Book Company, New York.
5. Neelima Rajvaidya and Dilipkumar Markandey. Agricultural Applications of Microbiology. APH Publishing Corporation, New Delhi.
6. Rangaswamy, G and Bhagyaraj, D.J. 2001. Agricultural Microbiology. Prentice- Hall of India Private Ltd.
7. Pelczar M.J. Chan E.C.S and Krieg N.R. 1993. Microbiology. McGraw Hill Book Company, New York.
8. Prescott Lansing M. Harley John P. and Klein Donald A. 2008. Microbiology. WCB McGraw-Hill New York.
9. Rangaswamy, G and Mahendera. 2005. Diseases of Crop Plants in India. Prentice Hall of India Pvt. Ltd.
10. Singh, R.S. 2009. Plant Diseases. Oxford and IBH Publishing Pvt. Ltd. New Delhi.
11. SubbaRao N.S. 2001. Soil Microorganisms and Plant Growth. Oxford and IBH Publishing Company, New Delhi.


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MICROBIAL ECOLOGY – Practicals.

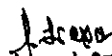
1. Study of Soil profile
2. Isolation of bacteria and fungi from soil.
3. Study of Antagonism
4. Study of carbon, nitrogen, sulphur and phosphorous cycle
5. Microscopic examination of Potable, Pond and Sewage water.
6. Study of Mycorrhizae.
7. Microbial analysis of water by MPN test.
8. Determination of BOD of potable and sewage water.
9. Study of indoor and outdoor air borne bacteria and fungi by Gravity slide method.
10. Study of indoor and outdoor air borne bacteria and fungi by Gravity plate method.
11. Study of air samplers- Vertical cylinder, Hirst spore trap, Rotorod sampler, Anderson spore trap, Burkard trap.
12. Visit to water purification plant.

SCHEME OF PRACTICAL EXAMINATION:

Time: 3hrs

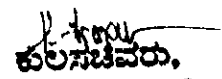
Max. marks: 50

1. Determine the BOD in the given water sample "A". Write principle, - 12 Marks
procedure and result.
(Performance-4 Marks, principle and procedure-4 Marks, Calculation and Result-4 Marks).
2. Perform the experiment with sample "B". Write principle, procedure and - 08 Marks
result.
Anabaena in *Azolla*.
Fungal culture plate, Gravity Slide.
(Minimum of 4 microorganisms should be identified).
Tikka disease of Ground nut
(Performance-6. Marks, principle and procedure-2 Marks). - 15 Marks
3. Identify and Comment on D, E, F, G and H. - 05 Marks
(Identification-1 Marks, Comment-2 Marks)
4. Class Records - 05 Marks
5. Viva-Voce


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PAPER 6(B)
MICROBIAL ECOLOGY

Module 1	Microorganisms & their natural habitats Terrestrial Environment: Soil characteristics, Soil profile, Soil formation, Soil as a natural habitat of microbes, Soil microflora Aquatic Environment: Stratification & Microflora of Freshwater & Marine habitats Atmosphere: Stratification of the Atmosphere, Aeromicroflora, Dispersal of Microbes Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body.	10Hours
Module 2	Biological Interactions Microbe-Microbe Interactions: Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation, Biocontrol agents Microbe-Plant Interactions: Phylloplane, Rhizosphere, Rhizoplane, Symbiotic Nitrogen fixation Microbe-Animal Interactions: Role of Microbes in Ruminants, Nematophagus fungi, Luminescent bacteria as symbiont	10Hours
Module 3	Biogeochemical cycles and Bioleaching Carbon cycle, Nitrogen cycle, Sulphur and Phosphorus cycle. Bioleaching (Microbial leaching) -Definition, Copper and iron leaching- Methods, Mechanism and Significance.	10Hours
Module 4	Aquatic Microbiology Definition, Types of water, Sources of water contamination. Water borne diseases -Bacterial (Cholera), Viral (Hepatitis A) and Protozoal (Amoebiasis). Microbiological Analysis of Water -Most Probable Number (MPN) test, Membrane filtration, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand(COD). Water Treatment - Treatment of Municipal water supply	10Hours
Module 5	Air Microbiology Definition, Sources of Air contamination. Air Microflora - Indoor and Outdoor. Significance of air borne microflora. Control and Management of air borne microflora. Techniques of trapping airborne microorganisms -Gravity slide, Gravity plate, Vertical cylinder, Hirst spore trap, Rotorod sampler, Anderson spore trap, Burkard trap and impingers.	10Hours


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References:

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ENVIRONMENTAL MICROBIOLOGY-Practicals

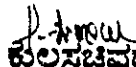
1. Study of fungi in Seeds by blotter method.
2. Isolation and identification of fungi from rhizosphere soil by serial dilution and plate technique.
3. Microscopic examination of Potable, Pond and Sewage water.
4. Microbial analysis of water by MPN test.
5. Determination of BOD of potable and sewage water.
6. Study of indoor and outdoor air borne bacteria and fungi by Gravity slide method.
7. Study of indoor and outdoor air borne bacteria and fungi by Gravity plate method.
8. Study of air samplers- Vertical cylinder, Hirst spore trap, Rotorod sampler, Anderson spore trap, Burkard trap.
9. Estimation of solids in sewage sample
10. Estimation of Carbon dioxide
11. Study of septic tank, imhoff tank, oxidation pond, trickling filter
12. Visit to water purification / treatment plant

SCHEME OF PRACTICAL EXAMINATION:

Time: 3hrs

Max. marks: 50

1. Determine the BOD in the given water sample "A". Write principle, - 12 Marks
procedure and result.
(Performance-4 Marks, principle and procedure-4 Marks, Calculation and
Result-4 Marks).
2. Perform the experiment with sample "B". Write principle, procedure and - 08 Marks
result.
Anabaena in Azolla.
Fungal culture plate, Gravity Slide.
(Minimum of 4 microorganisms should be identified).
Tikka disease of Ground nut
(Performance-6. Marks, principle and procedure-2 Marks). - 15 Marks
3. Identify and Comment on D,E,F,G and H. - 05 Marks
(Identification-1 Marks, Comment-2 Marks)
4. Class Records - 05 Marks
5. Viva-Voce



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Paper 6 (A)

ENVIRONMENTAL MICROBIOLOGY-Theory

Module 1	Soil Microbiology Soil-Definition, types, Soil profile. Interaction among microorganisms -Neutralism, Mutualism, Commensalism, Antagonism and Parasitism. Interaction between plants and microorganisms -Rhizosphere, Rhizoplane, Phylloplane and Mycorrhizae (Definition, Types and Significance). Microbes in Biogeochemical cycles -Carbon cycle, Nitrogen cycle, Phosphorus cycle.	10 Hours
Module 2	Biodegradation and Bioleaching Biodegradation Introduction, Definition, Biodegradation of cellulose, plastic, heavy metals (mercury), Chlorinated hydro carbons (DDT) Bioleaching (Microbial leaching) -Definition, Copper and iron leaching- Methods, Mechanism and Significance.	10Hours
Module 3	Aquatic Microbiology Definition, Types of water, Sources of water contamination. Water borne diseases -Bacterial (Cholera), Viral (Hepatitis A) and Protozoal (Amoebiasis). Microbiological Analysis of Water -Most Probable Number (MPN) test, Membrane filtration, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand(COD). Water Treatment - Treatment of Municipal water supply	10Hours
Module 4	Microbiology of Sewage Definition of sewage, chemical composition. Municipal sewage treatment process : Primary, Secondary (Acrobic and Anaerobic), Tertiary -chlorination. Disposal of treated sewage. (sludge as fertilizer : irrigation and dilution)	
Module 5	Air Microbiology Definition, Sources of Air contamination. Air Microflora - Indoor and Outdoor. Significance of air borne microflora. Control and Management of air borne microflora. Techniques of trapping airborne microorganisms -Gravity slide, Gravity plate, Vertical cylinder, Hirst spore trap, Rotorod sampler, Anderson spore trap, Burkard trap and impingers.	10Hours


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2. Chakraborty. 1995. Text Book of Microbiology. New Central Book Agency.
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IMMUNOLOGY & MEDICAL MICROBIOLOGY:

Practicals

1. WIDAL Test
2. VDRL Test
3. Ouchterlony Double Diffusion (ODD)
4. Demonstration of Spot ELISA
5. Pregnancy test.
6. Total count of WBC
7. Differential count of WBC
8. Determination of Blood group & Rh factor
9. Estimation of hemoglobin.
10. Demonstration of Western Blotting
11. Isolation & identification of bacteria from Ear & nose
12. Antibiotic sensitivity test
13. Detection of AFB in the sputum
15. Study of pathogenic microorganisms:
Cl.tetani, V.cholerae, C.diphtheriae, Candida albicans Plasmodium spp., & Entamoeba histolytica.

SCHEME OF PRACTICAL EXAMINATION:

Time: 3hrs

Max. marks: 50

1. Perform the experiment with the given water sample "A". Write principle, procedure and result. - 12 Marks
(Total count of WBC or Differential count of WBC).
(Performance-4 Marks, principle and procedure-4 Marks, Calculation and Result-4 Marks).
2. Perform Blood grouping for the given sample "B". Write principle, procedure and result. - 10 Marks
(Performance-4. Marks, principle and procedure-2 Marks, Result-2 Marks).
3. Identify and Comment on D,E,F,G,Hand I. - 18 Marks
(Permanent Slides, AFB, Antibiotic sensitivity test, WIDAL, VDRL, Spot ELISA).
(Identification-1 Marks, Comment-2 Marks)
4. Class Records - 05 Marks
5. Viva-Voce - 05 Marks

IMMUNOLOGY & MEDICAL MICROBIOLOGY –Theory

Marks: 80

TOTAL HOURS: 50

Module 1

Fundamentals of Immunology

10 Hours

Immunity : Definition, Types: Natural, acquired, Active & passive cells & organs of immune system

Cells: B cells, T cells, NK cells, Macrophages, Monocytes, Granulocytes (Basophils, Eosinophils & Neutrophils), Dendritic cells.

Organs: Central lymphoid organs - Bone marrow & Thymus

Peripheral lymphoid organs – Lymph nodes & spleen

Tissues – Mucosal associated lymphoid tissue (MALT) & Cutaneous associated lymphoid tissue (CALT).

Module 2

Antigen antibody reactions

10 Hours

Antigens: Definition, Properties, Types & factors influencing antigenicity.

Antibodies: Definition, Basic structure of antibody. Types, properties & functions (IgG, IgM, IgA, IgE & IgD).

Antigen antibody reactions: Types. Precipitation & agglutination.

Immunoassays- Ouchterlony Double Diffusion (ODD), Immunoelectrophoresis, and Enzyme Linked Immuno Sorbent Assay(ELISA).

Module 3

Immune response and Vaccines

10 Hours

Immune response : Cell Mediated Immunity & Humoral Mediated Immunity. Immunological Memory.

Vaccines: Definition & types – live attenuated (polio & BCG), killed (DPT), toxoid (tetanus), Recombinant (Hepatitis B), DNA Vaccine & synthetic vaccine.

Module 4

Introductin to Medical Microbiology

10 Hours

History of medical microbiology

Normal flora of human body

Pathogenicity – factors affecting pathogenicity.

Antibiotics: Definition and Classification of antibiotics on the basis of structure and mode of action. Mode of action of following antibiotics – penicillin, chloramphenicol, cycloheximide, acrycloguanosine. A brief account on development of antibiotic resistance.

Module 5

Microbial diseases

10 Hours


Important groups of pathogenic microorganisms (etioloical agent, clinical features, epidemiology, laboratory diagnosis, treatment & control)

Bacterial Diseases: Tuberculosis, Diphtheria, and Syphilis

Viral Diseases: Hepatitis B. and HIV

Fungal Diseases: Candidiasis, mycoses - Cutaneous

Protozoal Diseases: Malaria.


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