<table>
<thead>
<tr>
<th>Semester-I</th>
<th>Nomenclature</th>
<th>Max. Marks</th>
<th>(Ext. + Int.)</th>
<th>Hours</th>
</tr>
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<tbody>
<tr>
<td>IMB Paper-1 101</td>
<td>Fundamentals of Industrial Microbiology</td>
<td>50</td>
<td>(40+10)</td>
<td>3 hrs</td>
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<tr>
<td>IMB Paper-1 102</td>
<td>Microbial Biochemistry</td>
<td>50</td>
<td>(40+10)</td>
<td>3 hrs</td>
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<td>Paper-III</td>
<td>Practical (Continued)</td>
<td></td>
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<tr>
<td>Semester-II</td>
<td>Nomenclature</td>
<td>Max. Marks</td>
<td>(Ext. + Int.)</td>
<td>Hours</td>
</tr>
<tr>
<td>IMB Paper-201</td>
<td>Basic Microbial Techniques</td>
<td>50</td>
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<td>3 hrs</td>
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<tr>
<td>IMB Paper-202</td>
<td>Microbial Genetics</td>
<td>50</td>
<td>(40+10)</td>
<td>3 hrs</td>
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<tr>
<td>IMB Paper-203</td>
<td>Practical (based on theory papers of I &amp; II\textsuperscript{nd} semesters)</td>
<td>100</td>
<td></td>
<td>6 hrs</td>
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<td>Total</td>
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<tr>
<td>B.Sc.-II</td>
<td>Nomenclature</td>
<td>Max. Marks</td>
<td>(Ext. + Int.)</td>
<td>Hours</td>
</tr>
<tr>
<td>IMB Paper-301</td>
<td>Microbial Physiology</td>
<td>50</td>
<td>(40+10)</td>
<td>3 hrs</td>
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<tr>
<td>IMB Paper-302</td>
<td>Environmental Microbiology-I</td>
<td>50</td>
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<td>3 hrs</td>
</tr>
<tr>
<td>Paper-III</td>
<td>Practical (Continued)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semester-IV</td>
<td>Nomenclature</td>
<td>Max. Marks</td>
<td>(Ext. + Int.)</td>
<td>Hours</td>
</tr>
<tr>
<td>IMB Paper-401</td>
<td>Food Microbiology</td>
<td>50</td>
<td>(40+10)</td>
<td>3 hrs</td>
</tr>
<tr>
<td>IMB Paper-402</td>
<td>Environmental Microbiology-II</td>
<td>50</td>
<td>(40+10)</td>
<td>3 hrs</td>
</tr>
<tr>
<td>IMB Paper-403</td>
<td>Practical (based on theory papers of III\textsuperscript{rd} &amp; IV\textsuperscript{th} semesters)</td>
<td>100</td>
<td></td>
<td>6 hrs</td>
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<tr>
<td>Total</td>
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<td>300</td>
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</table>

Job Summer Training (One Month) in an Institute/Industry (Summer Vacations)

B.Sc.-III

| Semester-V | Nomenclature                              | Max. Marks | (Ext. + Int.) | Hours |
| IMB Paper-501 | Agricultural Microbiology                | 50         | (40+10)       | 3 hrs |
| IMB Paper-502 | Fermentation Technology                 | 50         | (40+10)       | 3 hrs |
| Paper-III   | Practical (Continued)                    |            |               |       |
| Semester-VI | Nomenclature                              | Max. Marks | (Ext. + Int.) | Hours |
| IMB Paper-601 | Microbial Biofertilizer                  | 50         | (40+10)       | 3 hrs |
| IMB Paper-602 | Microbial Biotechnology                 | 50         | (40+10)       | 3 hrs |
| IMB Paper-603 | Practical (based on theory papers of Vth & VIth semester) | 70       |               | 6 hrs |
| IMB Paper-604 | Evaluation & Viva-voce of ‘job summer training’ report | 30       |               |       |
| Total       |                                          | 300        |               |       |

Grand Total 900

Practical Examinations will be held at the end of Semesters II, IV & VI
B.Sc I\textsuperscript{st} Semester (Industrial Microbiology)

IMB-101 Fundamentals of Industrial Microbiology

Max Marks: 50
(Ext. 40 + Int. 10)
Time: 03 Hrs.

Instructions for the Paper-setters
- Nine questions of equal marks should be set.
- Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
- Eight questions, two questions from each unit (I, II, III, IV) should be set.

Instructions for the Candidates
- Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
- All questions will carry equal marks.

Unit-I
Scope and Historical Development in Microbiology
Introduction, scope and historical development of Microbiology (discovery era, transition period, golden age and microbiology in the twenty first century). Applied branches of Microbiology and industrial importance of microorganisms in various industries.

Biology of Microorganisms
Morphology and characteristics of various groups of prokaryotic and eukaryotic microorganisms (Bacteria, Archaea, Fungi, Viruses, Protozoa and Algae). Carl Woese three Domain system of classification. Simple and differentiating staining of bacteria (simple, Gram, endospore, capsule, flagella and negative) and fungi (molds and yeast).

Unit-II
Fundamentals of Nutrition and Culture Techniques
Nutritional requirements and nutritional types of microorganisms. Aseptic techniques and isolation of pure cultures (Pour plate, spread plate, streak plate, and serial dilution agar plate method).

Unit-III
Culture Media and Preservation of Cultures
Sterilization techniques used in industrial microbiology (physical and chemical). Culture media-preparation and types. Maintenance and Preservation of pure cultures, Sources of obtaining cultures of industrial importance.

Text and Reference Books:
B.SC 1st SEMESTER (INDUSTRIAL MICROBIOLOGY)

IBM-102 MICROBIAL BIOCHEMISTRY

Max Marks: 50
(Ext. 40+ Int. 10)
Time: 03 Hrs.

INSTRUCTIONS FOR THE PAPER-SETTERS

- Nine questions of equal marks should be set.
- Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
- Eight questions, two questions from each unit (I, II, III, IV) should be set.

INSTRUCTIONS FOR THE CANDIDATES

- Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
- All questions will carry equal marks.

UNIT-I

Cell and its macromolecules: - Cellular organization of prokaryotes & eukaryotes and their macromolecules.
Water: - Structure, hydrogen bonding, solvent properties, ionization and fitness of the aqueous environment for living organisms.

UNIT-II

Carbohydrates: - Classification, physical and Chemical Properties of Carbohydrates, Structure and properties of Starch, Cellulose, Glycogen.
Lipids: - Classification, structure and functions. Physical and chemical properties of lipids.
Nucleic acids: - Structure, types and functions of DNA & RNA

UNIT-III

Amino acids and proteins

UNIT-IV

Enzymes
Classification, coenzymes, cofactor, isozymes. Thermodynamics explanation of enzyme catalysis, reaction orders. Derivation of Michaelis Menton kinetic equation. Competitive, uncompetitive and noncompetitive inhibition.

Text and Reference Books:

- Jain, J.L.: General Biochemistry- S. Chand & Co.
B.Sc II\textsuperscript{nd} SEMESTER (INDUSTRIAL MICROBIOLOGY)

IBM- 201 BASIC MICROBIAL TECHNIQUES

Max Marks: 50
(Ext. 40+ Int. 10)
Time: 03 Hrs.

INSTRUCTIONS FOR THE PAPER- SETTERS

\begin{itemize}
  \item Nine questions of equal marks should be set.
  \item Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
  \item Eight questions, two questions from each unit (I, II, III, IV) should be set.
\end{itemize}

INSTRUCTIONS FOR THE CANDIDATES

\begin{itemize}
  \item Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
  \item All questions will carry equal marks.
\end{itemize}

UNIT -I

Microscopy & Micrometry

Simple Microscopy, Dark Field Microscopy, Phase Contrast Microscopy, Fluorescence and Electron Microscopy (TEM and SEM).
Calibration of ocular micrometer and measurement of microorganisms. Isolation & cultivation of microorganisms.

UNIT-II

Chromatography Techniques


UNIT- III

Instruments -Basic Principles and Usage

pH-Meter- Basic Principle, working and application.
Colorimetry, Spectrophotometry- Basic Principle, laws of absorption and absorption spectrum. The chromophore concept. The instrumentation of UV, visible and infrared spectrophotometry and its application.
Centrifugation- relative Centrifugation force, instrumentation and its application.

UNIT- IV

Fermentation and fermentor

Concept of fermentation and discovery of fermentation. Fermentor-its parts & function. Types of fermentor-batch, continuous and fed batch.

Text and Reference Books:

\begin{itemize}
  \item Aneja, K.R. : Experiments in Microbiology, Plant Pathology and Biotechnology, New Age International Publishers, New Delhi
  \item Sawhney, S.K. & Singh, Randhir. : Introductory Practical Biochemistry, Narosa Publishing House, New Delhi
  \item Welson and Goulding.: Tools and techniques in Biology
\end{itemize}
B.SC II\textsuperscript{nd} SEMESTER (INDUSTRIAL MICROBIOLOGY)

IBM- 202 MICROBIAL GENETICS

Max Marks: 50
(Ext. 40+ Int. 10)
Time: 03 Hrs.

INSTRUCTIONS FOR THE PAPER- SETTERS

\begin{itemize}
  \item Nine questions of equal marks should be set.
  \item Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
  \item Eight questions, \textit{two} questions from each unit (I, II, III, IV) should be set.
\end{itemize}

INSTRUCTIONS FOR THE CANDIDATES

\begin{itemize}
  \item Candidates will be required to attempt \textit{five} questions in all, selecting \textit{one} question from each unit (I, II, III, IV) and the compulsory question 1.
  \item All questions will carry equal marks.
\end{itemize}

UNIT-I

\textbf{Nucleic acids:} - DNA as genetic material, structure of DNA, Watson & Crick model of DNA. Conformational flexibility of DNA, DNA replication (conservative and semi conservative).

UNIT-II


UNIT- III


UNIT-IV

\textbf{Genetic Recombination and extra-chromosomal inheritance}

Text and Reference Books:

\begin{itemize}
  \item Dubey, R.C. & Maheshwari.: A Text book of Microbiology. S. Chand & Co.
  \item Powar,C.B.& Daginawala, H.F.: General Microbiology Vol.1, Himalaya Publishing House, Bombay
\end{itemize}
List of practicals based on theory papers (IMB 101, 102, 201, 202) of Semesters 1st and 2nd

SEMESTER-I

1. Laboratory rules.
3. Preparation of culture media: Nutrient agar, Potato dextrose agar, Czapek-Doxy agar.
4. Preparation of agar plates, agar slants and deep tubes.
5. Study of
   (a) Pour plate.
   (b) Spread plate.
   (c) Streak plate.
6. Standard plate count
7. Staining techniques: -
   (a) Preparation of bacterial smear
   (b) Simple staining
   (c) Gram staining
   (d) Negative staining
   (e) Endospore staining.
8. Staining and examination of common molds and yeasts of industrial significance.
9. Staining and examination of Cyanobacteria or algae from fresh water.
10. Examination of a protozoan.

SEMESTER –II

1. Separation of amino acids by paper chromatography
2. Separation of amino acids and lipids by thin layer chromatography
5. Protein estimation by colorimeter by Folin-ciocalteu reagent.
6. Estimation of DNA.
7. Estimation of RNA.
8. Calibration of an ocular micrometer.
UNIT- I
Microbial Growth:- Definition of growth, Mathematical nature and expression of growth, Generation time, Growth curve in bacteria, Measurement of Growth (cell number, cell mass and cell constituent), Effect of environment on the microbial growth, (temperature, pH and oxygen).

UNIT-II
Membrane Transport Process:- Different models of cell membrane, Biochemical properties of cell membrane, Functions of cell membrane, Types of cellular transport (diffusion, gaseous exchange, osmosis, plasmolysis, active & passive transport, group translocation).

UNIT-III
Bacterial Photosynthesis:- Classification of photosynthetic bacteria (Oxygenic & anoxygenic photosynthetic bacteria), Photosynthetic structure, Photosynthetic pigments, Photosynthetic electron transport system, Mechanism of Photosynthesis (Cyclic & Non cyclic).

UNIT-IV
Metabolic Pathways:- Respiratory Pathways (Glycolysis, Entner Daudoroff pathway, Pentose phosphate pathway, Krebs cycle), Calvin cycle, Substrate level & oxidative phosphorylation, Fermentation process & products.

Text & Reference Books:
- Purohit: Microbiology: Fundamentals & applications
- Pelczar, Reid & Chan.: Microbiology
- Lehninger: Principles of Biochemistry
- Moat & Foster: Microbial physiology & Metabolism
- Dubey & Maheshwari: A Text book of Microbiology
B.SC IIIrd SEMESTER (INDUSTRIAL MICROBIOLOGY)

IMB 302-ENVIRONMENTAL MICROBIOLOGY

Max. Marks: 50
(Ext.-40+Int.-10)
Time: 3 Hours

INSTRUCTIONS FOR THE PAPER- SETTERS

● Nine questions of equal marks should be set.
● Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
● Eight questions, two questions from each unit (I, II, III, IV) should be set.

INSTRUCTIONS FOR THE CANDIDATES

● Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
● All questions will carry equal marks.

UNIT-I
Soil Microbiology:
Major contributions of soil microbiologists, Soil as dynamic ecosystem & Diversity of soil microflora, Microbial flora of soil, Interaction among soil microorganisms (Neutralism, commensalism, mutualism, antagonism, competition, parasitism and predation).

UNIT-II
Biogeochemical cycles:
Factors affecting soil microflora (moisture, oxygen, pH, temperature), Biogeochemical cycles (carbon, nitrogen, sulphur, phosphorus, oxygen cycle).

UNIT-III
Air Microbiology:
Sampling of air microflora, Biodiversity in Air, Outdoor and indoor microflora, Allergic disorders by air microflora, Enumeration of microflora of air (Liquid and solid impingement devices).

UNIT-IV
Water Microbiology:
Types of water (atmospheric, surface & stored), Effect of aquatic environment (temperature, light, pressure, pH, turbidity & inorganic and organic constituents), Biodiversity of aquatic environments (freshwater & marine microbiology).

Text & Reference Books:

- Atlas, R.M. & Bartha,R: Microbial ecology- Fundaments & applications, Benjamin/Cummings
- Coyne,M.S. :Soil microbiology : An Exploratory Approach, Delimer
B.SC 1Vth SEMESTER (INDUSTRIAL MICROBIOLOGY)

IMB 401 FOOD MICROBIOLOGY

Max. Marks: 50
(Ext.40+Int.-10)
Time: 3 Hours

INSTRUCTIONS FOR THE PAPER- SETTERS

● Nine questions of equal marks should be set.
● Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
● Eight questions, two questions from each unit (I, II, III, IV) should be set.

INSTRUCTIONS FOR THE CANDIDATES

● Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
● All questions will carry equal marks.

UNIT- I

Food Spoilage:
Microbes in food, Extrinsic and intrinsic factors affecting microbial growth in foods, Microbial spoilage of foods (General account).Microbial spoilage of specific food- Milk & milk products, Fruits & vegetables, Cereals & cereal products, Meat & meat products, Canned foods.

UNIT- II

Food Microbiology:
Significance of food microflora, constituents of foods, classification of foods, Preservation of foods, Aseptic handling, Use of temperature, dehydration, lyophilization, osmotic pressure, radiations canning , chemical preservatives

UNIT-III

Food Borne Diseases:
Food poisoning (Food intoxication & food infections), Bacterial food poisonings (Botulism, Staphylococcus & E.coli. ), Fungal food poisonings (Aspergillus, Penicillium & Claviceps ).

UNIT-IV

Microbiological Production of Food:
Fermented dairy products (yoghurt, butter milk & cheese), Fermented bakery products (bread), Fermented beverages (beer and wine), Single cell proteins, Probiotics & Prebiotics

Text & Reference Books:

➢ Frazier: Food Microbiology
➢ Adams & Moss: Food Microbiology
➢ James Jay : Food Microbiology
B.SC IVth SEMESTER (INDUSTRIAL MICROBIOLOGY)

IMB 402 ENVIRONMENTAL MICROBIOLOGY II

Max. Marks: 50
(Ext.40+Int.-10)
Time: 3 Hours

INSTRUCTIONS FOR THE PAPER-SETTERS

● Nine questions of equal marks should be set.
● Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
● Eight questions, two questions from each unit (I, II, III, IV) should be set.

INSTRUCTIONS FOR THE CANDIDATES

● Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
● All questions will carry equal marks.

UNIT-I

Microbiology of Domestic & Waste water:
Sewage/ waste water (physical, chemical & microbiological characteristics) BOD and COD, Water treatment (primary treatment, secondary treatment, tertiary treatment, water purification methods.

UNIT-II

Water and disease transmission
Water pollution, Brief account of water borne diseases, Water quality assays and public health (Standard plate count, most probable number procedure, membrane filter method), Coliforms as indicator organisms.

UNIT-III

Solid waste disposal:
Solid processing (landfills, composting & anaerobic sludge digestion), effect on public health and microbial pathogens in municipal solid waste, Green house gases.

UNIT-IV

Biodegradation of Environmental pollutants:
Alkyl benzyl sulphonates, Oil pollution, Regulation for disposal of biohazardous materials

Text & Reference Books:

List of practicals based on theory papers (IMB 301, 302, 401, 402) of Semesters IIIrd and IVth

SEMESTER-III

1. Determination of bacterial and fungal growths.
2. Effects of temperature on the growth of bacteria (TDP & TDT)
3. Effect of pH on growth of bacteria.
4. Effect of atmospheric oxygen (air) on growth of bacteria.
5. Isolation and enumeration of microorganisms from soil by different techniques.
6. Isolation of *Azotobacter* from soil.
7. Study of indoor and outdoor microflora.
8. Isolation of microorganisms from water.

SEMESTER- IV

1. Isolation and Identification of Microorganisms from spoiled foods (Bread, fruits, meat & cake).
2. To study Litmus milk reactions.
4. Isolation of *Lactobacilli* and *Streptococci* from curd.
5. Wine and sauerkraut production in the Lab.
6. Detection of coliforms in water by multiple tubes fermentation test (Presumptive, confirmed completed test).
7. IMVIC test for faecal bacteria.
8. Determination of BOD of water.
B.S.C Vth SEMESTER (INDUSTRIAL MICROBIOLOGY)

IMB-501 AGRICULTURAL MICROBIOLOGY

Max Marks: 50
(Ext. 40+ Int. 10)
Time: 03 Hrs.

INSTRUCTIONS FOR THE PAPER-SETTERS

● Nine questions of equal marks should be set.
● Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
● Eight questions, two questions from each unit (I, II, III, IV) should be set.

INSTRUCTIONS FOR THE CANDIDATES

● Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
● All questions will carry equal marks.

UNIT-I
Development of soil microbiology emphasizing the contributions of M.W.Beijerinck and S.Winogradsky.
Diversity of soil microorganisms, Major soil borne diseases of plants and their transmission.
Fungi as saprotrophs and pattern of colonizers on a plant tissue.

UNIT-II
Biodegradation of cellulose, hemicellulose, lignin and pectin.
Biodegradation of pesticides and biodeterioration of useful products.

UNIT-III
Major types of symptoms, Koch’s postulates, mode of infection, classification of plant diseases.
Disease cycle and control of following diseases caused by viruses, bacteria and fungi (White rust of crucifers, red rot of sugarcane, potato blights, citrus canker, bacterial blight of paddy and tobacco mosaic virus).

UNIT-IV
Principle of biological control, mechanism of action of biocontrol agents.
Classification and advantages of biopesticides.
Major commercial biopesticides based on fungi, bacteria and viruses (in brief).

Text and Reference Books:

- Coyne, M. Soil Microbiology; An Exploratory Approach, Delmar.
B.SC Vth SEMESTER (INDUSTRIAL MICROBIOLOGY)

PAPER-502 FERMENTATION TECHNOLOGY

Max Marks: 50
(Ext. 40+ Int. 10)
Time: 03 Hrs.

INSTRUCTIONS FOR THE PAPER-SETTERS

● Nine questions of equal marks should be set.
● Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
● Eight questions, two questions from each unit (I, II, III, IV) should be set.

INSTRUCTIONS FOR THE CANDIDATES

● Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
● All questions will carry equal marks.

UNIT-I

History and Scope of fermentation technology.
Industrial Microorganisms: Desirable characteristics and selection of industrial Microorganism, Isolation of suitable industrial microorganisms from natural habitat, Culture Collection Centres, Strain improvement and maintenance.

UNIT-II

Biology of industrial Microorganisms: Cell growth, Microbial growth kinetics, factors affecting growth, Basic nutrition, Primary metabolism, Secondary Metabolism, Regulation of Metabolism.
Fermentation Media: Media composition, Media sterilization, Contamination, Inoculum media, Media economics, Screening for fermentation media

UNIT-III

Fermentation system: Batch and continuous fermentation system, immobilized cell reactor system, solid state fermentation reactors.

UNIT-IV

Fermentor design: Basic design of Fermentor, Construction of bioreactors,, Requirements of aseptic operation, Aeration and mixing, Type of Fermentors stirrer tank bubble column and airlift, Instrumentation and control.
Scale up study: Product recovery, scale up of fermentation, Down-stream processing, Product development, Regulation and safety.

Text and Reference Books:

- Waites M.J. et al.: Industrial Microbiology, Blackwell Science Ltd.
- Prescott and Dunn’s.: Industrial Microbiology, AVI Publishing Co. USA.
B.SC VI\textsuperscript{th} SEMESTER (INDUSTRIAL MICROBIOLOGY)

PAPER-601 MICROBIAL BIOFERTILIZERS

INSTRUCTIONS FOR THE PAPER- SETTERS

- Nine questions of equal marks should be set.
- Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
- Eight questions, two questions from each unit (I, II, III, IV) should be set.

INSTRUCTIONS FOR THE CANDIDATES

- Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
- All questions will carry equal marks.

UNIT-I

\textbf{Rhizosphere:} Rhizosphere concept, R:S values, Mycorhizosphere, Actinorhizae, Significance of rhizosphere microflora, Isolation of rhizosphere microflora.

UNIT-II

\textbf{Biofertilizers:} - General account about the microorganisms used as biofertilizers, Basic concept of nitrogen fixation process.

\textbf{Mycorrhizal Biofertilizer:} - Types of mycorrhizal association, taxonomy, occurrence and distribution, collection of VAM, inoculum production of VAM, phosphorus nutrition.

UNIT-III

\textbf{Bacterial Biofertilizers:} Taxonomy, physiology and mass cultivation of Rhizobium Frankia, Azospirlluim, Azotobacter and Cyanobacteria.

UNIT-IV

\textbf{Production and Quality Control in Biofertilizers:} Isolation and identification of different nitrogen fixing microbes, assessment of nitrogen fixing ability of different strains under controlled and field conditions. Direct and indirect methods, culture production, storage, culture, carrier, packing, quality control, ISI standards, inoculum requirements, packing, marketing and storage and methods of application.

Text and Reference Books:

- Sperut and Spernt.: Nitrogen Fixation
INSTRUCTIONS FOR THE PAPER-SETTERS

● Nine questions of equal marks should be set.
● Question 1 consisting of number of short answer type questions (having no internal choice) spread over the whole syllabus should be compulsory.
● Eight questions, two questions from each unit (I, II, III, IV) should be set.

INSTRUCTIONS FOR THE CANDIDATES

● Candidates will be required to attempt five questions in all, selecting one question from each unit (I, II, III, IV) and the compulsory question 1.
● All questions will carry equal marks.

UNIT-I

Microbial Products: - Application of microbial biotechnology, production of primary and secondary metabolites of industrial significance, A brief discussion about production of industrial products such as

Fuels: Ethanol, Methane
Alcoholic beverages: Beer, Wine.

UNIT-II

Organic acids: Citric acid, Lactic acid
Antibiotics: Penicillin, Streptomycin
Amino acids: Glutamic acid, Lysine
Enzymes: Protease, Amylase and Lipases

UNIT-III

Bioconversions: A brief account of steroid biotransformation.
Microbial Foods: Single cell proteins.
Sewage waste water treatment: Technique and plants.
Biogas production

UNIT-IV

Biodegradation of xenobiotic compounds.
Microbial technology in agriculture- Bioinsecticides, Bioherbicides, Biofungicides.
Biotechnology of mushroom cultivation.

Text and Reference Books:

- Prescott and Dunn’s: Industrial Microbiology, AVI Publishing Co. USA.
List of practicals based on theory papers (IMB 501, 502, 601, 602) of Semesters V<sup>th</sup> and VI<sup>th</sup>

**V<sup>th</sup> SEMESTER**

1. Isolation of antibiotic producing microorganisms from soil.
2. Isolation of soil microflora (bacteria and fungi) by serial dilution agar plate method.
3. Study and identification of viral, bacterial and fungal diseases of plants.
4. Isolation of a plant pathogenic bacterium or fungus from diseased tissues.
5. Demonstration of microbial antagonism in the laboratory.
6. Demonstration of degradation of cellulose by a mold/ bacterium in the lab.
7. Study of some common molds and bacteria from soil.

**VI<sup>th</sup> SEMESTER**

1. Production of wine from grapes in the laboratory.
2. Demonstration of mushroom production (White button mushroom).
3. Isolation of *Azotobacter* from soil.
4. Isolation of *Rhizobium* from legume root nodules.
5. Preparation of biofertilizer from *Azotobacter* and *Rhizobium* in the laboratory.
6. Demonstration of nodulation ability of rhizobia by inoculation of the legume seeds.
7. Culturing and identification of a yeast (*Saccharomyces cerevisiae*) in the lab.
8. Demonstration of amylolytic and proteolytic activity by a mold/bacterium.
9. Production of penicillin in the laboratory.
10. Demonstration of antibiotic sensitivity test.
11. Primary screening of amylase producing bacteria from soil.