

## B.SC. INDUSTRIAL MICROBIOLOGY

### Scheme of Examination (Old)

#### B.Sc.-I

##### Semester-I

Paper No.	Nomenclature	Max. Marks	(Ext. + Int.)	Hours
Paper-I	Fundamentals of Industrial Microbiology	50	(45+5)	3 hrs
Paper-II	Microbial Biochemistry	50	(45+5)	3 hrs
Paper-III	Practical (Continued)			

##### Semester-II

Paper-I	Basic Microbial Techniques	50	(45+5)	3 hrs
Paper-II	Microbial Genetics	50	(45+5)	3 hrs
Paper-III	Practical	100		3+3 hrs (in 2 days)

#### B.Sc.-II

##### Semester-III

Paper-I	Microbial Physiology	50	(45+5)	3 hrs
Paper-II	Environmental Microbiology-I	50	(45+5)	3 hrs
Paper-III	Practical (Continued)			

##### Semester-IV

Paper-I	Food Microbiology	50	(45+5)	3 hrs
Paper-II	Environmental Microbiology-II	50	(45+5)	3 hrs
Paper-III	Practical	100		3+3 hrs (in 2 days)

On the job summer training (One Month)

#### B.Sc.-III

##### Semester-V

Paper-I	Agricultural Microbiology	50	(45+5)	3 hrs
Paper-II	Fermentation Technology	50	(45+5)	3 hrs
Paper-III	Practical (Continued)			

##### Semester-VI

Paper-I	Microbial Biofertilizer	50	(45+5)	3 hrs
Paper-II	Microbial Biotechnology	50	(45+5)	3 hrs
Paper-III	Practical	70		3+3 hrs (in 2 days)
Paper-IV	Submission and evaluation of 'on the job summer training' report	30		

**Grand Total 900**

- Practical Examination will be held at the end of Semester II, IV & VI

**B.Sc. V<sup>th</sup> SEMESTER (INDUSTRIAL MICROBIOLOGY)**  
**PAPER-I AGRICULTURAL MICROBIOLOGY**

Max Marks: 50  
(Ext. 45+ Int. 05)  
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:**

Aneja, K.R. *et al.*: A Text book of Basic and Applied Microbiology, New Age International Publishers, New Delhi.  
Mehrotra, R.S.and Aggarwal, A. Plant Pathology, Tata McGrawHill, New Delhi  
Aneja.K.R and Mehrotra R.S: Fungal Diversity & Biotechnology, New Age International Publishers, New Delhi.  
Coyne, M.Soil Microbiology; An Exploratory Approach, Delmar.  
Whipps, J.M and Lumsden, R.D. Biotechnology of Fungi for Improving Plant Growth. Cambridge University Press.  
Singh. J and Aneja, K.R. From Ethnomycology to Fungal Biotechnology. Kluwer Academic/ Plenum Publishers, USA.

## B.Sc. V<sup>th</sup> SEMESTER (INDUSTRIAL MICROBIOLOGY)

### PAPER-II FERMENTATION TECHNOLOGY

Max Marks: 50  
(Ext. 45+ Int. 05)  
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:

Aneja.K.R *et al.*: A Text book of Basic and Applied Microbiology, New Age International Publishers, New Delhi.

Aneja.K.R and Mehrotra R.S.: Fungal Diversity & Biotechnology, New Age International Publishers, New Delhi.

Waites M.J. *et al.*: Industrial Microbiology, Blackwell Science Ltd.

Casida L.E.: Industrial Microbiology, New Age International Publishers, New Delhi.

Prescott and Dunn's.: Industrial Microbiology, AVI Publishing Co. USA

Glazer A.N and Nikaido, H.: Microbial Biotechnology, W.N. Freeman and Co.

## B.Sc. VI<sup>th</sup> SEMESTER (INDUSTRIAL MICROBIOLOGY)

### PAPER-I MICROBIAL BIOFERTILIZERS

Max Marks: 50  
(Ext. 45+ Int. 05)  
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

**Rhizosphere:** Rhizosphere concept, R:S values, Mycorrhizosphere, Actinorhizae, Significance of rhizosphere microflora, Isolation of rhizosphere microflora.

#### UNIT-II

**Biofertilizers:** - General account about the microorganisms used as biofertilizers, Basic concept of nitrogen fixation process.

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

#### UNIT-III

**Bacterial Biofertilizers:** Taxonomy, physiology and mass cultivation of Rhizobium, Frankia, Azospirillum, Azotobacter and Cyanobacteria.

#### UNIT-IV

**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: -

Alexander, M. Introduction to Soil Microbiology. Wiley, New York.

Aneja *et al.*: A Text book of Basic and Applied Microbiology, New Age International Publishers, New Delhi.

Sperut and Spemt.: Nitrogen Fixation

## B.Sc. VI<sup>th</sup> SEMESTER (INDUSTRIAL MICROBIOLOGY)

### PAPER-II MICROBIAL BIOTECHNOLOGY

Max Marks: 50  
(Ext. 45+ Int. 05)  
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

**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:

Aneja.K.R *et al.*: A Text book of Basic and Applied Microbiology, New Age International Publishers, New Delhi

Aneja.K.R and Mehrotra R.S.: Fungal Diversity & Biotechnology, New Age International Publishers, New Delhi

Waites M.J. *et al.*: Industrial Microbiology, Blackwell Science Ltd.

Casida L.E: Industrial Microbiology, New Age International Publishers, New Delhi

Prescott and Dunn's.: Industrial Microbiology, AVI Publishing Co. USA

Glazer A.N and Nikaido H.: Microbial Biotechnology, W.N. Freeman and Co.

## B.Sc. V<sup>th</sup> and VI<sup>th</sup> SEMESTER (INDUSTRIAL MICROBIOLOGY)

### PAPER-III PRACTICAL

MM. 70  
Time: 6Hours

#### List of practicals based on theory papers of Semesters Vth & VIth

#### 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.