

4. Survey by Plane Table-(a) Radiation method. (b) Intersection method (c) Resection method.
5. Preparation and interpretation of village landuse map on the basis of a field study.

**NOTE:** As per decision of academic council in its meeting held on 16-1-1990, maximum number of examinees in Geography practical examinations up to B.A./B.Sc. level shall not exceed 40 examinees per day vulgaris, Tests:

#### **DISTRIBUTION OF MARKS FOR PRACTICAL EXAMINATION**

1. Statistical Maps & Diagrams	5 Marks
2. Distribution of Density maps	5 Marks
3. Statistical methods	5 Marks
4. Surveying	5 Marks
5. Field Study	5 Marks
6. Practical records and Viva-Voce	5 Marks
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Total : 30 Marks	
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#### **BOOKS RECOMMENDED:**

1. Alexander John: Economic Geography.
2. Jones C.F. & Darkenwold G.G.: Economic Geography.
3. Guha J.L. & Chatteraj P.R. : A New Approach to Economic Geography (A study of Resources) The World press Pvt. Ltd.
4. Russell Smith: Industrial and Commercial Geography. Holt Rinehort, New York.
5. Shaw E.B.: World Economics Geography, John Willey.
6. Van Royen & Bengston: Fundamentals of Economic Geography Prentice Hall, New Delhi.

#### **HUMAN GEOGRAPHY**

1. Money D.C. : Introduction to Human Geography, University Tutorial, Press London.
2. Davis D.H. : The Earth and Man.
3. James Preston: A Geography of Man, Blaisdell Publication Co.
4. White and Renner: College geography.
5. Hintington. E.: Principles of Human Geography, John Willey.
6. R.L. Singh: Elements of Practical Geography.

7. Singh R.N.: Map work and Practical Geography.
8. Mark House & Wilkinson: Map and diagrams.

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#### **5. MICROBIOLOGY**

**(Implemented from the Session 2005-06)**

The Examination in Microbiology shall comprise of two theory papers and one practical. Each theory paper is divided into five units. There shall be one question from each unit with internal choice. Examinee shall attempt all five questions. Theory paper shall be of three hours duration and carry 60 marks each. Practical examination (each batch of 16 students) will last for at least two consecutive days with minimum four working hours each day. The syllabus is based on six theory periods and six practicals per week.

#### **PAPER-V**

#### **ENVIRONMENTAL MICROBIOLOGY AND BIOINSTRUMENTATION**

##### **Unit-I Microbial Associations and Air Microbiology**

- A Microbial Associations : Definition and examples of positive (Mutualism, Commensalism, Synergism), negative (Antagonism, Competition, Parasitism ) and neutral association.
- B Air Microbiology
  - a) The atmosphere and its layers.
  - b) Different types of microorganisms in air.
  - c) Techniques for microbiological analysis of air :
    - i) Solid impingement devices
    - ii) Liquid impingement devices.
  - d) Airborne diseases : Etiology, symptoms and prevention.
  - e) Control of microorganisms in air.

##### **Unit-II Microbiology of Soil.**

- a) Microorganisms in soil.
- b) Rhizosphere.
- c) Decomposition of plant and animal residues in soil.
- d) Definition, formation, function and microbiology of humus and compost.
- e) Biological nitrogen fixation : Types of nitrogen fixing microorganisms, factors affecting and mechanism of symbiotic and non-symbiotic nitrogen fixation. Process of nodulation, nitrogenase complex, recombinant DNA and nitrogen fixation, legume inoculants.

- f) Cycles of elements in nature :
- i) Carbon cycle : CO<sub>2</sub> fixation, organic carbon degradation.
  - ii) Nitrogen cycle : Proteolysis, amino acid degradation, Nitrification, Denitrification, Degradation of nucleic acids.
  - iii) Sulphur cycle
  - iv) Phosphorus cycle.
  - v) Biofertilizers, biological pest control.

**Unit III A) Water Microbiology**

- a) Planktons : Definition, types, factors affecting growth of planktons, methods of enumeration, beneficial and harmful activities of planktons.
- b) Control of plankton problems
- c) Eutrophication and its control.

**B) Assessment of Water Quality and Treatment**

Bacteriological analysis of water:

- i) Significance of bacteriological analysis of water.
- ii) Collection and handling of water sample from various sources.
- iii) Indicators of excretal pollution.
- iv) Multiple tube dilution technique, MPN.
- v) IMViC classification of coliform.
- vi) Membrane filter technique for coliform and faecal Streptococci.
- vii) ICMR and WHO Bacteriological standards of drinking water.

**Unit IV A) Water Treatment**

- a) Self purification of water : Various zones and factors responsible for self purification.
- b) Treatment of water : Aeration, Coagulation, Flocculation, Sedimentation and Filtration.
- c) Slow and Rapid sand filters : Construction, mechanism of filtration, differences.
- d) Methods of chlorination : Plain, super chlorination, ammonia-chlorine treatment, Break-point chlorination

**B) Waste Water Treatment**

- a) Aims of sewage treatment, composition of sewage.
- b) Municipal sewage treatment plant.
- c) Preliminary treatment (seiving and Grit chamber)
- d) Primary treatment(sedimentation)

- e) Secondary treatment (Aerobic)
  - i) Trickling filter
  - ii) Activated sludge process
  - iii) Oxidation pond
- f) Anaerobic sludge digestion
- g) Domestic sewage treatment by septic tank and Imhoff tank.
- h) Concept of COD,BOD.
- i) Outline of bio-gas production

**Unit V Bio-Instrumentation**

- a) Spectroscopy- Definition, Principle, types (UV&IR) & its applications.
- b) Electrophoresis- Definition, Principle, types (Paper&Gel) & its applications.
- c) Chromatography- Definition, Principle, types (Paper&TLC) & its applications.
- d) Isotopic Tracer Techniques- Definition, Principle & applications.

**Paper- VI**

**INDUSTRIAL FERMENTATION, FOOD MICROBIOLOGY AND METABOLISM**

**Unit- I Fermentation in General.**

- a) Definition and scope of Industrial microbiology and biotechnology.
- b) Important classes of industrial microorganisms.
- c) Fermentation :- Definition and types ( batch and continuous, aerobic and anaerobic, surface and submerged fermentations )
- d) Production strains
- e) Screening :- Definition, Primary screening ( crowded plate technique, auxonography, enrichment culture technique, use of indicator dyes ), secondary screening.
- f) Scale up process :- Definition and significance.
- g) Inoculum buildup : Spore and vegetative inoculum.
- h) General layout of fermentation plant :- Fermentation equipment and its uses.
- i) Raw materials :- Composition and uses. Saccharine, starchy,

cellulose raw materials, hydrocarbon and vegetable oils, nitrogenous material ( corn steep liquor ).

- j) Antifoam agents.
- k) Sterilization of media :- Batch and continuous sterilization.
- l) Detection and assay of fermentation products.

**Unit-II Industrial Productions.:** Microorganisms, raw material, inoculum buildup, fermentation conditions, recovery, uses and mechanism of the following products.

- a) Ethyl-alcohol : From molasses and waste sulphite liquor.
- b) Beer.
- c) Wine ( Red table and White table ).
- d) Acetone- Butanol from corn.
- e) Baker's yeast : From molasses, Definition of compressed and active dry yeast.
- f) Single cell protein : From bacteria, yeast and algae.
- g) penicillin.
- h) Vinegar ( Orlean's process and Fring's generator ).
- i) Amylase : Bacterial and fungal.

### Unit-III Microbiology of Milk

- a) Definition
- b) Composition and types of milk.
- c) Sources of microorganisms in Milk.
- d) Types of microorganisms in milk.
- e) Pasteurization of milk : LHT, HTST, UHT. Phosphatase test.
- f) Grades of milk.
- g) Concentrated milk and milk powder.
- h) Preparation of fermented milk products, butter and cheese.

### Unit-IV Food Microbiology

- a) Sources of contamination of fresh food.
- b) Microbial spoilage of foods.
- c) Preservation of foods :- Low and high temperature, dehydration, high osmotic pressure, chemical preservation, radiations and canning.
- d) Fermented foods : Idli, pickles and sauerkraut.
- e) Food poisoning : Food infection and food intoxication.

### Unit-V Enzymology and Metabolism

- A Enzymology :

- a) Nature and Definition.
- b) Classification and nomenclature of enzymes.
- c) Terminologies used in enzymology :- Enzyme, active site, substrate, co-enzyme, co-factor, prosthetic group, holoenzyme, apoenzyme, activation energy, isoenzyme, allosteric enzyme, inhibitors, immobilised enzymes.

### B Metabolism :

- a) General strategies of metabolism.
- b) EMP pathway, TCA cycle.
- c) Oxidative phosphorylation and Electron transport chain.
- d) Beta-Oxidation.
- e) General concept of Respiration and Fermentation.

### PRACTICALS :

1. A) Microbiological Examination of milk.
  - a) Plate Count, b)Methelyne blue reduction Test. c) Phosphatase test d) Test for coliform bacteria. e) Estimation of fat in milk.
- B) Demonstration of microbes in Curd.
2. Bacteriological analysis of water and Waste Water.
  - a) Standard plate Count.
  - b) Multiple tube dilution technique (MPN for Coliform)
    - i) Presumptive test ii) Confirmatory test iii) Completed test.
  - c) IMViC test for coliform
  - d) Multiple tube dilution technique for faecal strepto cocci.
  - e) Membrane filter technique for coliforms & faecal streptococci.
  - f) BOD estimation.
  - g) Isolation of Bacteriophage from Sewage.
  - h) Determination of Chlorine demand and residual chlorine.
3. A) Laboratory Scale production, recovery & Quantitative estimation of following Products.
  - a) Ethyl alcohol. b) Citric Acid c) Amylase
- B) Immobilisation of Yeast.
4. Microbiological Examination of egg, Vegetables, fruits and Canned Foods by
  - a) Plate Count b) Test for Coliform bacteria. c) Yeast & Molds.
5. a) Enumeration of Soil micro-organisms.
  - b) Isolation of *Azotobacter* & *Rhizobium* from Soil.

6. Milk testing for Adulteration.
7. Effect of Ultra-violet/Filtration on micro-organism present in water.
8. Separation of amino acids and sugars by paper chromatography.
9. Educational tour (Every student shall attend the Excursion and shall submit a report of field studies).

#### Distribution of Marks For Annual Practical Examination

1. Phosphatase/Methylene blue reduction test	....	03
Curd microbiology/Estimation of fat in milk.		
2. MPN/IMViC/BOD/MFT/Standard test for coliform	....	03
3. SPC of Milk/Foods/Fruits/Canned food	....	05
4. Estimation of Alcohol/Citric Acid/Isolation of <i>Azotobacter/Rhizobium</i> /Paper Chromatography	....	05
5. Spotting	....	05
6. Viva	....	04
7. *Co-curricular activity report	....	03
8. Class record	....	02

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Total Marks: 30

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\*"Co-curricular Activity Report" which mean the report on the activity such as Seminar, Study Tour, Industrial visit to Research Institute, Group Discussion, Excursion Tour to be submitted by the students at the time of practical examination.

#### BOOKS RECOMMENDED FOR PAPER-V

1. Introduction to Soil Microbiology : Alexander Martin
2. Soil Microbiology : Subbaroa N.S.
3. Introduction to environmental Microbiology : Mitchell, Ralph
4. Sewage & Waste treatment : Hammer
5. Water Pollution : Zajic J.E.
6. Water Pollution Microbiology : Mitchell R.
7. Air Pollution : Perlins H.L.
8. Aquatic Microbiology : Stainner & Shewan
9. Introduction to Waste Water Treatment processes : Ramalhr R.S.

#### BOOKS RECOMMENDED FOR PAPER-VI

1. Food Microbiology : Fazier W.C. & Westhoff D.C.
2. Fermented Foods (Vol.7) : Rose A.A.
3. Industrial Microbiology : Prescott S.C. & Dunn C.G.
4. Industrial Microbiology : Miller B.M. & W. Litsky
5. Industrial Microbiology : A.H. Patel
6. Microbial Technology : Pepller H.J. (Vol. I & II)
7. Industrial Microbiology : Casida L.E.
8. Principles of Fermentation Technology Allan. : Stanbury, Peter F. & Whitaker
9. Outlines of Dairy Bacteriology : Sukumar De
10. Modern Food Microbiology : Jay, Mames M.
11. Principles of Industrial Microbiology : Rhodes & Fletcher.
12. Industrial Fermentation : Under Kofler & Hick. Vol. I & II
13. Dairy Microbiology : Foster Etal
14. Industrial Microbiology : Rose

#### BOOKS RECOMMENDED FOR PRACTICALS

1. Microbes in Action : Seely, Wander Mark Taraporewala, Bombay.
2. Manual of Microbiological Methods : A.J. Salle
3. Microbiological Methods : Collins
4. Difco Manual.

**List of Instruments/Equipments with specification required for B.Sc.I, II and Final Microbiology Laboratory.**

Sr. No.	Name	Make	Specification	Quantity
1.	Autoclave a a.Portable	Yarco/Wiswo or any std.make	Pressure gauge 0-30 psi Size 350*325 mm. Double walled Non- Electrical	1.
2.	b.Vertical	Wiswo/Yarco	Electrically operated or anv std. make coil 2000 watts. Double walled mild steel body.	1.
3.	Hot-air oven	Yarco/tempo/ Lab.Hosp or any make	Double walled. Thermostat. Temp regulator. Size 45*45*45 cm.	2.
4.	Incubator	Yarco/Tempo/lab. Hosp. or any std make	Double walled Insulated temp. Temp regulator size temp. upto 60c with thermostat sensitivity +0.5 c Size 45*45*45 cm	2.
5.	Refrigerator	Godrej/Kelvinator /BPL/std. and std. or make.	Double/Triple door with 250/300 lit. capacity having separate freezer.	1.
6.	Serological water bath	Yarco/Tempo/lab Hosp or and std. size	Double walled-Thermo regulated Max. Temp upto 80c 12*12*12"with Cover.	1.
7.	Magnetic stirrer with hot plate.	Yarco/tempo/ lab Hosp./or any std.make	2 Lit Capacity with 500 wt. Remi temp. regulated hot plate	1.
8.	Cyclo-Mixer	Remi/tempo/or anv std. make	For one test tube only	1.
9.	Centrifuge	Remi/R-8c/yarco or any std make	with replaceable swing out retorheads one to hold 8-16 tubes of 15 ml capacity Another head to hold 4 tubes of 50-100ml capacity	1.
10.	pH Meter	Systronics/Elico J.Mitra/or any std. make	Digital with glass electrade pH scale from 0 to 14. Resistant to temp. change.	1.
11.	Colorimeter.	Erma/Elicol systronics or anv.std.make	Digital-signal cell with either glass or quartz cuvetters visible range with coloured filters.	1.

12.	Distillation Assembly	Remi/Tempo/lab Hosp or any std. make.	2 litres/hr.capacity with metal condensor.	1.
13.	Single pan Electrical balance	Systronics/K.Roy contac or any. std.make	Digital 125 gram capacity sensivity 0.01 gm	1.
14.	Mixer	Sumit/Hyoti/or any.std make.	with 3 Jars and Timer	1.
15.	Single pan balance (triple beam)	National/Remi/ or any std. make	III gram capacity	2.
16.	Anaerobic Jar	Dynomicro/or any std. make	Capacity 10 Petri dishes complete set.	1.
17.	Rotarv shaker. Hozt.table top	Yarco/tempo/ or any std. make	Flask capacity 36 flask Remi or 250 ml Mechanical Variable speed motion size 24*24 platform	1.
18.	Automatic Pipette washer	Kumar/Modem or any.std.make	staineless steel 1 ml.5ml. 10ml capacities.	1.
19.	Over head Projector	Metzer/ photophone or any.std.make	complete with screen 72*50" Glass screen 16*16	1.
20.	Membrane Filter Assembly	Yarco/Tempo/or any.std.make	with Vaccum pump 0.5 h.p. Filter funnel Adaptor. Filtering Flask membrane filters 0.45 mm and 0.22 mm. for 125 filters compl set.	1.
21.	Microscope a. Monocular	Olympus/Metzer/ Labo.or any. std.make	Straight with Mechanical stage.mirror.bojectives 10x45x,&100x, Eve piece 5x,10x& 15x	20.
22.	Binocular	Olumpus/metzer/ Labo or any.	Inclined with Mechanical stage.5. Mirror lighting arrangement std.make objectivesb 10x, 45x,100x,Eve piece 5x,10x, and 15x.	5.
23.	Oil Immersion lens	Olympus/Meopta Labo/or any.std. make(preferably Imported)	Original(imported)with good spring load.	20.

24.	Autolet	Ames or any std. make	with laoncet holer lancet cover end cap.	2.
25.	Laminar Air-flow (Hozt) to be installed in Asceptic room)	Micro flit/or any std make	Complete with U.V. Light HEPA filter stainless steel top. side glass window pressure 25mm w.q.at rated flow D.O.P.efficiency 99.97% blower 1/4 hp. size 3'x2', 4'x2'	1.
26.	Ultra-violet light(to be Fitted in Asceptic room)	Amtres/Videocon or std.make	15 Watts/30 Watts of variable length	1.
27.	Air-Conditioner (to be installed in Asceptic Room)	Amrtx-Videocon or any.std make	Window Room A/C at list 1.5.ton capacity special filter or dust free air 4 wav air distribution Noiseless Standared compressors.	1.
28.	Asceptic room air-conditioner	10*10 Tatally Enclosed with	Dimension 10*10 with Air Conditioner and U.V.Light	1.
29.	B.O.D. Incubator	Toshiba/Kumar/ Remi or any std. make	Chamber size 45"x45"x45"x digital make temp range 5 c-60 sensitivity +0.5 230 volts.double walled Aluminium/ staineless steel.	1.
30.	Teaching aids Epidiscope	Metzer/ Photophone or any.std.make	500w. Imported Halogen illumination both for Diascopic projection with powerful and Noiseless colling system.An astigmatic lenses and Reflecting mirrors.	1.
31.	Slide projector	Metzer/300w. Photophone	Imported projection bulb Noiseless cooling system. Slide carries for slides 2"*2: and film strip carries with mask for 35 mm a best quality	1.

32.	Video cassettes	Indian/Imported	projection lenses 8 German lenses 85 mm f. 2.8, coated lens. Practical Microbiology Applied Microbiology (Environement food) Industrial and medical Microbiology)	1. each
33.	V.C.R. & T.V.set	National/Sony Philips/Videocon or any.std.make	Recording & playing facility T.V. 21" withremote control	1. each
34.	Computer with printer and legal software	Intel pentium or any standard make.	Current configuration	01
35.	Lactometer	Std-Make	Glass/S.S.	1
36.	Water purifier with U.V. Light/ Filter	Eureka Forbes or any std-make	Filter, Activated carbon, U.V.Light Fully Automatic	1
37.	Micropipette	Std.Make	0.54/-1000 / Variable range.	1 each
38.	Paper Chromatographic Chamber	Std.make	Glass with lid	1

## 6. BIOCHEMISTRY

(Implemented from the Session 2005-06)

The examination in Biochemistry will comprise of two theory papers and one practical. Theory papers shall be of three hours duration and shall carry 60 marks each. The practical examination shall be of six hours duration in one day and shall carry 30 marks.

The following syllabus is prescribed on the basis of 3 lectures per paper per week and two practicals of three periods each on consecutive days.

### PAPER - V

#### MOLECULAR BIOLOGY AND BIOTECHNOLOGY

##### UNIT - I A) Basic Concepts of Genetic Information

- Nucleic acids as genetic information carriers, experimental evidence e.g. bacterial genetic transformation, Hershey-Chase Experiment,