6. Lobeck A.K. : Geomorphology.

PAPER-IV

BOOKS RECOMMENDED

1. Dobby E.H.G. : South East Asia, University of London Press.
2. Cressey G.B. : Aisa's Lands and peoples, Mc Graw Hill.
3. Stamp L.D. : Asia
4. Ginsburg N.(Ed.) : The Pattern of Asia Prentice Hall.
5. Gananathan V.S. : Economic Geography of India, National book Trust.
6. Robinson, Monsson Asia, University of London Press.
7. Spali OHK & ATA Lear - Month : India and Pakistan.
8. Brown J.C. & A.K. Dey : India's mineral Wealth.
9. Choudhari M.R. : Iron & Steel Industry in India.
१०. प्रा. सुरेश दाते व संजीवनी दाते-आशिया, नरेंद्र प्रकाशन पुणे-२
११. प्रा. सुरेश दाते व संजीवनी दाते-भारत का सामान्य व प्रादेशिक भुविज्ञान, नरेंद्र प्रकाशन पुणे-२.

PRACTICALS BOOKS RECOMMENDED :

1. Streers J.A. : Map Projections.
2. Granier B.J. : Practical Work in Geography.
3. Singh R.L. & Dutta P.K. : Elements of Practical Geography Students Friends.

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5. MICROBIOLOGY

(Implemented from the session 2004-05)

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. Examinees should attempt all five questions. Theory paper is of three hours duration and shall carry 60 marks each. Each practical examination (each batch of students) will last for at least two consecutive days with minimum five working hours each day. The syllabus is based on six theory periods and six practical periods per week.

Paper III

(Molecular Biology and Genetic Engineering)

Unit I- Gene Multiplication and expression:

a) Replication of DNA- Modes of replication, (Conservative, Semiconservative and Dispersive). Experiment of Meselson and Stahl to prove semiconservative mode of replication, general features.

Mechanism of replication with enzymes involved, models of replication: Knife and fork, rolling circle.
DNA repair- light and dark.

b) Genetic code- Characteristic features of genetic code.
c) Out line of Protein synthesis- Transcription and translation.

Unit II- Gene and Gene Mutation:

a) Concept of gene – Definition of Gene and experiment of Avery Macleod, McCarty in brief to prove gene as the genetic material. Definition of Muton, recon, cistron, gene within gene, split gene.
b) Gene regulation- Mechanism of Lac operon.
c) Mutation- Definition, Random Vs. Directed mutation, rate of mutation, Effect of Mutation on Phenotype, How does mutation act? types of mutations- Base pair substitution, frame-shift mutation, point, missense, nonsense, silent.
d) Genetic suppressions:- Intragenic (Intracodon suppression, reading frame Suppression) and extragenic suppression, (Non sense and Missense Suppression).
e) Molecular basis of spontaneous and induced mutation Spontaneous mutation (Tautomerism), Induced Mutation (Chemical Mutagens) e.g. Base analogue, Nitrous Oxide, Hydroxylamine, Acridine dyes, Physical mutagens e.g. X-rays, Gamma rays, U.V. light.

Unit III- Genetic recombination:

a) Transformation: History in brief, Experiment of Griffth, Avery, MacLeod and McCarty to prove Genetic Transformation. Mechanism of Transformation.
b) Transduction: Mechanism of Transduction. Generalized and Restricted Transduction (Definition and differences). Comparision between Transformation and Transductions.
c) Conjugation : Discovery of Conjugation :- Experiment of Lederberg and Tatum. Experiment of Davis, Nature and Function of F-Plasmid. Various Mating types:-

$F^+ \times F^-$

F^+ ----> Hfr

Hfr ----> $F^{'}$.

Unit IV- Tools and techniques of genetic engineering:

a) Preparation of pure samples of DNA(Isolation of Genomic and Plasmid DNA from bacteria), Enzymes for splicing (Restriction endonucleases),

Range of DNA manipulating enzymes (Nucleases, ligases, polymerases, DNA modifying enzyme, Topo isomerases), Analysis of DNA fragment size (By agarose gel electrophoresis), Joining of DNA molecules (DNA Ligase), Vectors and their types (Plasmid, Cosmid and Viruses).

b) Introducing γ DNA into host cell, competent cells, transduction of cells, identification of transformed cell.(e.g. Antibiotic resistance gene in Plasmid) Selection of clones. Direct (colony hybridization) and Indirect (southern blotting).

c) Definition and application of gene mapping, DNA sequencing and PCR.

d) Introduction to expression of cloned genes, construction of gene library cells for cloning, Expression of prokaryotic and eukaryotic genes.

Unit V- Applications of Genetic engineering:

a) Health care biotechnology;
   i. Production of Hormones- Insulin.(only biotechnology concept)
   ii. Production of Interferon.(only biotechnology concept)
   iii. Production of vaccines: conventional vaccines, BCG, Salk, Diphtheria, toxoid, ATC., outline of recombinant vaccines (hepatitis)(only biotechnology concept)
   iv. Hybridoma technology and monoclonal antibodies.(only biotechnology concept)
   v. Gene therapy. (Replacement of mutant gene and corrected gene)

b) Agricultural biotechnology(Basic concept only)
   i. Protoplast fusion.
   ii. Bioinsecticide and biopesticides,
   iii. Development of disease free plant.

c) Industrial Biotechnology,
   i. Biopolymers(Xanthan and Dextran).
   ii. Biosensors(Glucose).

d) Ethics and hazards of biotechnology.

Paper IV

(Immunology and Clinical Microbiology)

Unit I- Epidemiology:

a) Definition, classification and scope of epidemiology.

b) Infection- Types of infection and modes of transmission.

c) Normal flora of human body,

d) Infection process,
Pathogenicity and virulence,
Microbial adherence and invasiveness.
Microbial virulence factors, toxins, enzymes, H_2O_2, NH_3, Microbial Iron chelators aggressins.

e) Control of communicable diseases.

Unit II- Immune system,

a) Organs and cells of immune system,

b) General Nonspecific factors- Physiological barriers, Natural cellular factors, Natural humoral factors.

c) Immunity- Definition and classification,

d) Innate immunology- species, Racial, Individual, Herd immunity.

e) Acquired immunity- Active and passive immunity,

f) Antigens- Definition, types and factors determining antigenicity, Bacterial antigens.

g) Antibodies- Definition, Structure, classification, Properties and differences, monoclonal antibodies.

h) Antigen Antibody reactions- Agglutination, Precipitation, Complement fixation, Toxin-antitoxin neutralization, ELISA and RIA.

i) Hypersensitivity : Definition and types (I to V).

Unit III-Pathogenic Bacteria:

Study of following organisms with respect to their morphology, cultural and biochemical properties, antigenic structure, pathogenesis, lab. diagnosis, and prophylaxis:

i. Staphylococcus aureus.
ii. Streptococcus pyogenes.
iii. Neisseria maningitidis/ Neisseria gonorrhoeae.
iv. Clostridium tetani.
v. Salmonella typhi.
vi. Mycobacterium tuberculosis.
vii. Corynebacterium diptheriae.
viii. Vibrio cholerae

Unit IV- Other Pathogenic organisms:

a) Viruses-
   i. AIDS
   ii. Hepatitis
   iii. Polio
   iv. Rabies

b) Rickettias-
   i. R. prowazekii
   ii. R. rickettsii
   iii. R. burnetii
   iv. R. quintana
c) Protozoa- *E. histolytica*
d) Fungi-*C. albicans*

Unit V- Antimicrobial chemotherapy:

a) Basic principles of chemotherapy,
b) Drug- microbe- host interaction,
c) Major antimicrobial agents.
d) Basic mechanism of antibiotic action,
e) *In vitro* drug susceptibility tests,Cup, disc, Dilution – Broth and agar methods.
f) General principles and clinical use of antimicrobial drugs.

Practicals

1. Study of enzymes:
   a) Amylase
   b) Catalase
   c) Gelatinase
   d) Urease
   e) Coagulase
   f) Lecithinase
   g) Oxidase

2. Biochemical Tests:
   a) Fermentation of various sugars,
   b) Hydrogen Sulphide production,
   c) Indole production,
   d) Methyl Red test,
   e) Voges Proskauer Test,
   f) Citrate Utilization,
   g) Nitrate reduction Test.

3. Isolation and Identification of following bacteria:
   a) Staphylococcus aureus,
   b) Salmonella typhi,
   c) E. coli.

4. Laboratory cultivation of following pathogens:
   a) M. tuberculosis,

   b) C. diphtheriae,
   c) V. cholerae,
   d) Cl. tetani.

5. Serological Tests:
   a) Widal
   b) Pregnancy test
   c) VDRL

6. Antibiotic sensitivity by Disc method.
7. Methods of anaerobic cultivation,
8. Clinical investigations.
   a) Blood grouping and Cross matching,
   b) TLC, DLC,
   c) Hemoglobin estimation,
   d) Test for carbohydrates and Protein in Urine,
   e) Blood glucose and cholesterol,

9. Cultural examination of Urine, Blood, Sputum, Stool, Pus, CSF.
10. Isolation of pathogenic fungi,
11. Molecular Biology practicals,
   a) Isolation of plasmid DNA,
   b) Isolation of genomic DNA from *E. coli*
   c) Ligation
   d) Transformation
   e) Conjugation
12. Study Tour.

DISTRIBUTION OF MARKS
for practical examination

1.	Enzymestudy/ Molecular Biology Practical……	04
2.	Serological Tests: Blood grouping/ VDRL/ Widal/ Pregnancytest ……..	03
3.	Identification and Antibiotic sensitivity test of the organisms ……	08
4.	TLC/ DLC/ Hemoglobin Estimation/ Test for carbohydrates and proteins in urine/ Blood cholesterol and Blood glucose/ Isolation of Pathogenic fungi ……	03
5.	Spotting.……	05
6.	Viva-voce.……	05
7.	ClassRecord / Study tour report……..	02
	Total	30

Books Recommended For Paper III :-

1. Recombinant DNA.:-James. D. Watson, John. Tooze, David.Kutz
2 Introduction to Genetic Engineering:- Nicholas
3. An Introduction to Genetic Analysis:- David Suzuki, Anthony. Griffths
4. Biochemistry.:- Lehninger
5 Microbiology.Vol 1&2. :- Powar & Daginawala
6 Molecular Biology of the Cell.:- J. D. Watson, D. Bray
7 The DNA Story:- J. D. Watson
8 Genetics of Prokaryotes.:- Srivastava et.al
9 Genes:- Pramod Kumar
10. Genetic Engineering and its Applications -Joshi P.
11 Gene Transfer and Expreesion a Laboratory Manual :- Michael Kriegler
12 Concept in biotechnology:- D. Balasubramanium
13 Essential Genetics:- Daniel. Hartl.

Books Recommended For Paper IV :-

1.	Medical Bacteriology	:	Dey N.C. & Day T.K.
2.	Medical Microbiology Vol. I & II	:	Cruickshank K.R.
3.	Text Book of Microbiology	:	Ananthanarayan R. & C.E. Panikar
4.	Medical Parasitology	:	Dey N.C. & Dey T.K.
5.	Dorland's Pocket Medical Dictionary		
6.	Microbiology	:	Zinsser W.
7.	Preventive & Social Medicine	:	Park & Park
8.	General Microbiology & Immunity	:	S.G.Wilson. Vol. I & II
9.	Medical Microbiology	:	R. Anantnarayan
10.	Fundamental Priciples of Bacteriology	:	A.J.Salle.
11.	Microbes & Diseases of Man (Helminthology)	:	W.C.Deb.
12.	Microbiology	:	B.D.Davis, R.Dulbecoco, H.N.Eisen, H.S.Ginsburg.
13.	Parasitology	:	K.D.Chatterjee
14.	Text Book of Medical Microbiology	:	H.L.Chopra.

PRACTICALS :

1. Microbes in Action : Seely, Wandermark, Tarporewala, Bombay.
2. Medical Microbiology Vol.II : R.Cruickshank.
3. A mannual of Microbiological : A.J.Salle.
   Methods.
4. Microbiological Methods : Collins
5. Difco mannual :

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List of Instruments/Equipments With Specification required for B.Sc. I, II and Final Microbiology Laboratory

Sr. No.	Name	Make	Specification	Quantity required
1.	Autoclave a. Portable	Yarco/Wiswo or any Std. make	Pressure gauge 0-30 psi size 350X325 mm. Double Walled Non-Electrical	1.
2.	b. Vertical	Wiswo/Yarco	Electrically operated or any std. make coil 2000 Watts. Double walled. mild steel body.	1.
			S.basket. cord & plug to work on 220 V. pressure control switch chamber size.	2.
3.	Hot-air oven	Yarco/Tempo/ Lab.Hosp. or any make	Double walled. Thermostat, Temp. regulator. Size 45X45X45 cm.	2.
4.	Incubator	Yarco/Tempo/Lab. Hosp. or any std. make	Double walled Insulated Temp. regulator size Temp. upto 60 C	2.

			with termostat sensitivity +0.5 C size 45X45X45cm	
5.	Refrigerator	Godrej/Kelvina-tor/BPL/std. any std. or make	Double/Tripple door with 250/300 Lit. capacity having separate freezer.	1.
6.	Serological Water bath	Yarco/Tempo/Lab Hosp or any std.	Double walled -Thermo regulated. Max. Temp. upto 80 C.Size 12X12 X12" with Cover.	1.
7.	Magnetic Stirrer with hot plate	Yarco/Tempo/Remi Lab.Hosp./or any std. make	2 Lit. Capacity with 500 Wt. temp. regulated hot plate.	1.
8.	Cyclo-Mixer	Remi/Tempo/or any std. make	For one test tube only	1.
9.	Centrifuge	Remi R-8c/Yarco or any std make	With replaceable swing out rotorheads one to hold 8-16 tubes of 15 ml capacity Another head to hold 4 tubes of 50-100 ml. 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 any std. make	Digital.Single 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 Lits./hr. Capacity with metal condensor	1.

13.	Single pan Electrical balance	Systronics/K.Roy contac or any std. make	Digital 125 gram capacity. Sensitivity 0.01 gm	1.
14.	Mixer	Sumit/Jyoti/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.	Rotary shaker Hozt. Table top	Yarco/Tempo/Remi or any std. make	Flask Capacity 36 flask or 250 ml. Mechanical Variable speed motion size 24X24" platform.	1.
18.	Automatic Pipette washer	Kumar/Modern or any std. make	Stainless steel 1 ml, 5 ml,10 ml. Capacities	1.
19.	Over head Projector	Metzer/photophone or any std. make	Complete with screen 72X50" Glass screen 16X16".	1.
20.	Membrane Filter Assembly	Yarco/Tempo/or any std. make	With Vacuum pump 0.5 h.p. Filter funnel Adaptor, Filtering Flask. memberane 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, objectives 10X, 45X & 100X. Eye piece 5X, 10X & 15X.	20

22.	b.Binocular	Olympus/Metzer/ Labo. or any std. make	Inclined with Mechanical Stage, Mirror, Lighting arrangment.objectives 10X, 45X, 100X. Eye 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 holder. lancet cover end cap.	2
25.	Laminar Air-flow (Hozt.) (to be inst-lled in Asc-eptic room)	Micro filt/or any std make	Complete with U.V. light HEPA filter stainless steel top. Side glass Window pressure 25mm w.g. 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)	Amtrex/Videocon or std. make	15 Watts/30 Watts of variable length .	1.
27.	Air-Condi-tioner(tobe-Installed in Asceptic Room)	Amtrex/Videocon or any std. make	Window Room A/C at list 1.5 ton capaciy special filter for dust free air 4 way air distribution Noiseless standard compressors.	1.
28.	Asceptic room	10'X10' Totally enclosed with air-conditioner	Dimension 10'X10' with Air-conditioner and U.V. light	1.
29.	B.O.D. Incubator	Toshiba/Kumar/ Remi or any std. make.	Chamber size 45"x45"x45x digital Temp range 5 C-60 C sensitivity	1.

			+ 0.5. 230 Volts. double walled Aluminium/ stainless steel.	
30.	Teaching aids Epidiscope	Metzer/Photophone or any std. make	500 W. Imporated Halogen illumina-tion both for Diascopic projection with powerful and Noiseless colling system. An astigmatic lenses and Reflecting mirrors.	1.
31.	Slide Projector	Metzer/ Photophone	300 W. Imported Projection bulb Noiseless cooling system.Slide carrier for slides 2"x2" and film strip carries with mask for 35 mm A best quality projection lenses B German lenses 85 mm f.2.8 coated lens.	1.
32.	Video Cassettes	Indian/ Imported	Practical Microbiology each Applied Microbio-logy, (Environment, food, Industrial and medical Microbiology)	
33.	V.C.R. & T.V. set	National/ Sony/Philips/ Videocon or any std. make	Recording & playing facility T.V. 21" with remote control.	1 each
34.	Computer with printer and legal softwars.	Intel pentium or any standard make.	Current configuration	1