

Swami Ramanand Teerth Marathwada University

Faculty of Science

Proposed revised B.Sc Third Year syllabus.

(Effective from June 2010)

Subject: Microbiology

| Paper No. | Title | Marks |
|-----------|---|-------|
| VIII | Molecular Biology and Genetics. | 100 |
| IX | Microbial metabolism and Microbial technology. | 100 |
| X | Practical based on paper-VIII. | 100 |
| XI | Practical based on paper-IX. | 100 |

The syllabus is based on six (3 x 2) Theory periods per week and 8 (4x2) practical periods per batch per week. Candidates are required to pass separately in theory and practical examination.

B.Sc. Third year
Subject: Microbiology / Agricultural Microbiology

Paper VIII: Molecular Biology and Genetics

Max. Marks: 100

Max. Periods: 80

Unit-I Molecular biology and genetics **16**

Nature of chromosomes in bacteria, viruses and yeast.

Structure of DNA and RNA (t-RNA, m-RNA, r-RNA)

Replication of DNA- The meselson and stahl experiment as evidence for semiconservative nature of DNA replication, mechanism of replication, DNA polymerases, characteristics of DNA polymerases, mode of replication, functions of DNA.

Unit-II Genes, Genetic code and Mutation **17**

Genes – location of genes, genome and Plasmid, recombinant, muton, cistron, number of genes, number of nucleotides in the average gene, gene action, split genes (Hexon gene, ovalbumin gene, α -globin gene) overlapping genes, jumping genes.

Genetic code- 13 different characteristics of genetic code.

Bacterial Mutation: Definition of mutation, mutation rate, lethal, subvital, supravital mutation, action of mutation, types of mutation: spontaneous, induced.

Evidence for occurrence of mutation in bacteria- Replica plate method, fluctuation test.

Mutagenic agent, ames test.

Unit-III Protein synthesis and regulation of gene activity in prokaryotes. **16**

Central dogma, transcription, initiation, elongation, termination. RNA polymerase. Translation- activation of amino acids, formation and amino acyl t-RNA, initiation, elongation and termination.

Principles of regulation, the *E.coli* lactose system and operon model. The tryptophan operon- a biosynthetic system, autoregulation, feedback inhibition.

Unit-IV Bacterial recombination**16**

General features- the fate of exogenote, restriction and modification of foreign DNA, the integration of exogenote and endogenote, segregation of the recombinant cell.

Bacterial transformation: Discovery, nature of transforming principles, transformation of genetic markers, transformation process- occurrence, nature and significance.

Bacterial conjugation: discovery, conjugation process, F^+ , F^- , F' , and HFr strains, plasmids.

Transduction: discovery, mechanism of generalized and restricted transduction, fate of exogenote formed by transduction, abortive transduction.

Unit-V- Introduction to recombinant DNA technology and genetic engineering.**15**

Microorganisms as a tool in genetic engineering.

Isolation and characterization of particular DNA fragments, the joining of DNA molecules, insertion of a particular DNA molecule in to a vector.

Vectors- plasmids, bacteriophages (lytic and lysogenic phages) single stranded DNA phages, M13.

Detection of recombinant molecules.

Screening for particular recombinants.

Applications of genetic engineering, commercial possibilities, uses in research, production and application of eukaryotic proteins.

References:

1. Bacterial and Bacteriophage Genetics 4th Edition by Brige.
2. DNA Repair and Mutagenesis by Errol Friedberg. 1995.
3. Gene VIII by Benjamin Lewin. 2007.
4. Methods of General and Molecular Bacteriology by Philip. 1993.
5. Microbial Genetics by Freifelder- 4th Edition.
6. Microbial Genetics by Maloy. 1994.
7. Modern Microbial Genetics by Streips and Yasbin. 1991.
8. Molecular Biology of Gene- 4th Edition by Watson. 1987.
9. Molecular Genetics of Bacteria by Dale. 1994
10. Organization of Prokaryotic Genome by Robert Charlebois. 1999.
11. General microbiology Vol. I and II by Power C.H and H.F. Dagainawala.
12. Microbiology by Pelczar and Crick.
13. General Microbiology by Stainer.
14. Fundamental principles of bacteriology by A.J. Salle

B.Sc. Third year
Subject: Microbiology
Paper IX: Microbial metabolism and Microbial technology

Max. Marks: 100

Max. Periods: 80

Unit-I Enzymes 14

Definition, general properties, mechanism of enzyme action, factors affecting enzyme activity (Temperature, pH, Substrate concentration and enzyme concentration), Michaelis menten equation, and classification of enzymes according to IUB system.

Unit-II- Microbial metabolism 16

Definition of metabolism, catabolism, anabolism, energy yielding biochemical process i) the role of ATP in metabolism ii) the role of reducing power in metabolism, modes of ATP generation. Biochemistry of fueling reaction in heterotrophs –i) EMP, HMP, ED, PKP, TCA, RETC, ii) fermentations – lactic (homolactic), Alcohol, Mixed acid and 2,3 Butanediol fermentation iii) □-Oxidation of fatty acids (saturated and Unsaturated).

Unit-III- Fermentor, Screening, Stock culture, inoculums & fermentation medium. 15

Definition & scope of industrial microbiology.

Fermentor:- design & role of different parts of fermentor.

Screening method: - primary & secondary screening.

Stock Culture: - primary stock, Working stock, stock culture methods.

Inoculums preparations.

Fermentation Medium: - Media composition, media sterilization, & contamination, media economics, screening for fermentation medium, fermentation process- batch, continuous, dual and solid state.

Unit-VI- Typical fermentation process.

20

Vinegar fermentation, Penicillin fermentation, lactic acid fermentation, Citric acid fermentation, Beer fermentation, wine fermentation, L-glutamic acid fermentation,

Unit-V Modern trends in microbial production of:

15

Bioinsecticides, Biofertilizers, Immobilized enzymes and cells, use of immobilized cell systems in production of fine chemicals.

References:

- 1) Biochemistry by Chatwal.
- 2) Biochemistry by Garrett.
- 3) Biochemistry by Lubest stryer.
- 4) Bioenergetics 3 –Academic press. David G Nicholis & Stuart J.Ferguson.
- 5) Biotechnology, volume 7 A- enzymes in biotechnology 1983 Edited by H.J.Rehm and G. Reed Verlag Cheime.
- 6) Casida L.E., Industrial Microbiology, New age International publisher.
- 7) Cruger and Cruger , Biotechnology : A text Book of Industrial Microbiology.
- 8) Enzymes Dixon and Webb. Academic Press.
- 9) Hand Book of Enzyme Biotechnology by Wiseman
- 10) James E .Bailey and David F Ollis, Biochemical Engineering Fundamentals, McGraw Hill Publication.
- 11) Laboratory techniques in Biochemistry and Molecular Biology by work and work.
- 12) Methods in enzymology by W. A. Wood. Academic Press
- 13) Methods of Enzymatic Analysis by Hans Ulrich. Bergmeyer, Academic Press.
- 14) Pepler and Perlmen , Microbial Technology, Vol I and II , Academic Press.
- 15) Pepler H.J and Periman D., Microbial technology, Vol.I and Vol. II. Academic press New York.
- 16) Power C.H and H.F. Dagainawala. General microbiology Vol. I and II.
- 17) Principles of Biochemistry 2nd Edition by Horton.
- 18) Shuler and Fikret Kargi, Bioprocess Engineering basic concepts, 2nd edition, Prentice Hall publication.
- 19) Stanbury P.F, Whittekar, A and Hall SJ, Principles of fermentation Technology, Pergamon Press.
- 20) Trehan K., Biotechnoogy, New age International publisher.
- 21) West and Toad, text book of Biochemistry. Oxford and IBH.

Practical Paper X (based on theory paper: VIII)

- 1) Purification of chromosomal/plasmid DNA and study of DNA profile.
 - Confirmation of nucleic acid by spectral study.
 - Quantitative estimation by diphenylamine test.
 - DNA denaturation and determination of T_m and G + C contents.
 - Agarose gel electrophoresis of DNA.

- 2) Effect of UV radiations to study the survival pattern of *E.coli* /yeast. Repair mechanisms in *E.coli* / yeast (Dark and Photo reactivation).
- 3) Isolation of antibiotics resistant mutants by chemical mutagenesis.
- 4) Ampicillin selection method for isolation of autotrophic mutants.
- 5) Extraction and purification of RNA from *S.cerevisiae*.
- 6) Studies on gene expression in *E.coli* with reference to Lac operon.
- 7) Study of conjugation in *E.coli*.
- 8) Restriction digestion and Agarose gel electrophoresis of DNA.
- 9) Generalized transduction in *E.coli* using p1 phage.

Practical Paper XI (Based on theory paper: IX)

- 1) Study of enzymes (Amylase, Gelatinase, Urease, Desulfurase, Cellulase, Oxidase, Catalase).
- 2) Estimation of reducing sugar by Summners method.
- 3) Estimation of Amino acids by Rosen's method.
- 4) Screening of antibiotic, amylase and organic acid producers.
- 5) Penicillin Bioassay.
- 6) Vit-B12 Bioassay.
- 7) Estimation of ethanol by specific gravity bottle.
- 8) Estimation of citric acid by titrable acidity
- 9) Production of Biofertilizer (Legume inoculums, Azotobactor).
- 10) Production of wine from grapes.