

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science

B. Sc Third Year syllabus Revised from June 2013

Subject: **Agricultural Microbiology** (Semester V&VI)

Sr. No.	Semester	Paper. No	Title of paper	Total periods/week	Total period	Total Marks
1	V	XII	Genetics and Molecular Biology	03	45	50
		XIII	Industrial Biotechnology	03	45	50
2	VI	XIV	Recombinant DNA technology and genetic engineering	03	45	50
		XV	Agricultural Biotechnology	03	45	50
3	Practical (Annual)	XVI	Practical paper (Based on XII & XIV)	04	45	100
		XVII	Practical paper (Based on XIII & XV)		practicals	

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

Note: B. Sc Third year practical includes studies of growth of microorganisms. These studies needs two consecutive days for completion of practicals.

B.Sc. Third year
(Effective from June 2013)
(Semester V)
Subject: Agricultural Microbiology

Paper XII: Genetics and Molecular Biology

Max. Marks: 50

Max. Periods: 45

Unit-I Introduction to Molecular biology

10

- 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 and Genetic code

11

- Genes – location of genes, genome and Plasmid, recon, muton, cistron, number of genes, Number of nucleotides in the average gene, gene action, split genes (Hexon gene, ovalbumin gene, β -globin gene) overlapping genes, jumping genes.
- Genetic code- 13 different characteristics of genetic code

Unit-III Mutation

12

- 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-IV Protein synthesis

12

- Central dogma, Transcription: initiation, elongation, termination. RNA polymerase
- Translation: activation of amino acids, formation and amino acyl t-RNA, initiation, elongation and Termination of Protein synthesis

B.Sc. Third year
(Effective from June 2013)
(Semester V)

Subject: Agricultural Microbiology

Paper XIII: Industrial Biotechnology

Max. Marks: 50

Max. Periods: 45

Unit- I Introduction to Industrial Microbiology **10**

- Introduction, definition & scope of industrial microbiology
- Historical developments in industrial microbiology
- Fermenter- Design & role of different parts of fermenter
- Screening method: primary & secondary screening
- Maintenance of Microbial Strains

Unit- II Developments of Industrial fermentation processes **11**

- Inoculum preparation, strain development: mutation, selection of mutants, recombination, gene technology.
- Fermentation Process development: Media composition, media sterilization, & contamination.
- Fermentation process- Shake flask, batch, continuous, solid state, aerobic and anaerobic, immobilized cell bioreactors.
- Scale up of fermentation and increasing product yields.

Unit-III Typical fermentation process **12**

- Antibiotic fermentations: Penicillin, Streptomycin
- Organic acids: Citric acid , Lactic acid, Glutamic acid

Unit-IV Typical fermentation process **12**

- Wine fermentation
- SCP: Fungal, Algal
- Enzymes: Amylases, Proteases

B.Sc. Third year
(Effective from June 2013)
(Semester VI)
Subject: Agricultural Microbiology

Paper XIV: Recombinant DNA technology and Genetic engineering

Max. Marks: 50

Max. Periods: 45

Unit-I Regulation of gene activity in prokaryotes **10**

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

Unit-II Bacterial recombination **12**

- 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-III Recombinant DNA technology **11**

- Microorganisms as a tool in genetic engineering, Isolation and characterization of particular DNA fragments
- Vectors- Plasmids, bacteriophages (lytic and lysogenic phages) Single stranded DNA phages, M13.

Unit-IV Genetic engineering and its application **12**

- Joining of DNA molecules, insertion of a particular DNA molecule in to a vector, Detection of recombinant molecules Screening for particular recombinants
- Applications of genetic engineering, commercial possibilities, uses in research, production and application of eukaryotic proteins.

B.Sc. Third year
(Effective from June 2013)
(Semester VI)

Subject: Agricultural Microbiology

Paper XV: Agricultural Biotechnology

Max. Marks: 50

Max. Periods: 45

Unit-I Plant cell cultures	10
<ul style="list-style-type: none">• Basic Requirements for Tissue culture laboratory• Formulation of tissue culture medium• Collection of ex plant materials• Callus culture, suspension culture, embryo culture, meristem culture, anther culture• Secondary metabolites, artificial seeds.• Application of tissue culture.	
Unit-II Biotransformation in plant cells	11
<ul style="list-style-type: none">• Definition of biotransformation• Biotransformation process• Biotransformation in plant cells via <i>Agrobacterium</i> mediated gene transfer• Applications of Biotransformation	
Unit-III Biofertilizer	12
<ul style="list-style-type: none">• Production and field applications of Biofertilizer:<ul style="list-style-type: none">○ Rhizobium○ Azotobacter○ Blue green algae○ Mycorrhizae○ Azospirillum	
Unit-IV Biofuel	12
<ul style="list-style-type: none">• Ethanol: Industrial Production of Ethanol and its application• Biogas: Production of Biogas, Stages of methanogenesis, Biochemistry of methane formation, Application of Biogas• Hydrogen Production and conversion of light energy, its application• Biodiesel production: Biodiesel producing plants, industrial production its application.	

B.Sc. Third year (Semester V&VI)

Subject: Agricultural Microbiology

Paper XII: Genetics and Molecular Biology and

Paper XIV: Recombinant DNA technology and Genetic engineering

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 (Semester V&VI)
Subject: Agricultural Microbiology
Paper XIII: Industrial Biotechnology and
Paper XV: Agricultural Biotechnology

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) Peppler and Perlmen , Microbial Technology, Vol I and II , Academic Press.
- 15) Peppler H.J and Periman D., Microbial technology, Vol.I and Vol. II. Academic press New York.
- 16) Power C.H and H.F. Dajinawala. General microbiology Vol. I and II.
- 17) Principles of Biochemistry 2 nd 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.

B.Sc. Third year (Annual pattern)
Subject: Agricultural Microbiology

Practical Paper XVI (based on theory paper XII & XIV)

Max. Marks: 50

Time: 4 hrs

1. Purification of chromosomal / plasmid DNA :
 - Confirmation of nucleic acid by spectral study
 - Quantitative estimation of DNA 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 (Dark and Photo reactivation)
3. Isolation of antibiotics resistant mutants by chemical mutagenesis
4. Extraction and purification of RNA from *S. cerevisiae*
5. Studies on gene expression in *E. coli* with reference to Lac operon
6. Study of conjugation in *E. coli*
7. Generalized transduction in *E. coli* using p1 phage
8. Restriction digestion and Agarose gel electrophoresis of DNA
9. Ampicillin selection method for isolation of autotrophic mutants.

B.Sc. Third year (Annual pattern)
Subject: Agricultural Microbiology

Practical Paper XVII: (based on theory paper XIII & XV)

Max. Marks: 50

Time: 4 hrs

1. Screening of antibiotic producers from soil
2. Screening of organic acid producers from soil
3. Production of citric acid by *Aspergillus niger* sp
4. Downstream processing and estimation of citric acid
5. Extraction of amylase, protease, lipases, from bacterial and fungal sp.
6. Bioassay of Penicillin/ Streptomycin
7. Alcohol production by *S. cerevisiae*
8. Estimation of alcohol by specific gravity method
9. Preparation of plant tissue culture media
10. Callus culture development
11. Preparation of artificial seeds
12. Production of Biofertilizers: *Rhizobium* / *Azotobacter* sp.
13. Demonstration of VAM
14. Production of SCP
15. Biodiesel production from plants.