SHRI SHIVAJI SCIENCE AND ARTS COLLEGE, CHIKHLI (DIST. BULDANA)
DEPARTMENT OF MICROBIOLOGY
B.Sc. II 3 S-Microbiology
Molecular Biology Molecular Biology and Genetic Engineering

The examination shall comprise of two theory papers, one in each semester and one practical in each semester. Each theory paper will be of 3 hours duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of at least 4 hours duration in one day and shall carry 50 marks. The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question on every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of semester-III (08 Marks).

Paper - Molecular Biology and Genetic Engineering

Unit I: Gene multiplication and expression

- Concept of gene – Definition of Gene, Muton, recon, cistron, gene within gene, split gene.
- Replication of DNA- Modes of replication, (Conservative, Semi conservative and Dispersive).Experiment of Meselson and Stahl to provesemiconservative mode of replication. Mechanism of replication with enzymes involved, models of replication: Knife and fork, rolling circle.

c) DNA repair mechanisms- light and dark.
d) Genetic code- Characteristic features of genetic code.
e) Out line of Protein synthesis- Transcription and Translation.

Unit II : Gene : Regulation and Mutation

a) Gene regulation Mechanisms - *lac* operon, *trp* operon.
b) Mutation- Definition & types of mutations – Base pair substitution, frame-shift, point, missense, nonsense & silent mutations, Random Vs. Directed mutation, Rate of mutation, Effect of Mutation on Phenotype,

- Genetic suppressions:- Intragenic (Intracodon suppression, reading frame Suppression) and extragenic suppression (Non sense and Missense Suppression).
- Molecular basis of spontaneous and induced mutations - Spontaneous mutation (Tautomerism), Induced Mutation (Chemical Mutagens) e.g. Base analogues, Nitrous Oxide, Hydroxylamine, Acridine dyes, Physical mutagens e.g. X-rays, Gamma rays,
  U.V. light.

Unit III: Genetic recombination:

Mechanism of recombination:

Breakage and reunion, breakage and copying, complete copy choice.

Transfer of genetic material in prokaryotes:

- Transformation: Experiment of Griffith. Avery, MacLeod and McCarty experiment to

prove Genetic Transformation. Mechanism of Transformation.

- Transduction: Experiment of Zinder and Lederberg. General mechanism of Transduction. Types of Transduction: Generalized and Restricted, Complete and Abortive, Low Frequency and High Frequency Transduction. Comparison between Transformation and Transduction.
- Conjugation: Experiment of Lederberg and Tatum, Experiment of Davis, Nature and function of FPlasmid. Hfr formation. Various Mating types. Mechanism of conjugation: i)F+ x Fii) Hfr X F – . F' Plasmid and Sexduction.

Unit IV: Tools of Genetic Engineering:

- Introduction to basic technique of genetic engineering.

b) Enzymes for splicing: Restriction Endonuclease.

c) Range of DNA manipulating enzymes: Nucleases, Ligases, Polymerases, DNA modifying enzymes, Topoisomerases.

- Vectors: Ideal characters and types: Plasmid, Cosmid and Bacteriophage.

Unit V : Techniques of genetic engineering:

- Isolation of Genomic and Plasmid DNA from bacteria, Analysis of DNA fragment size by agarose gel electrophoresis.
- Introducing Lambda DNA into host cell, competent cells, transduction of cells and identification of transformed cell (e.g. Antibiotic resistance gene in Plasmid) Selection of clones: Direct (colony hybridization) and Indirect method (southern blotting).
- Definition, method and applications of gene mapping, DNA sequencing (by microarray) and PCR.
- Introduction to expression of cloned genes. Construction of gene library. Cells for cloning.

UNIT VI: Applications of Genetic Engineering:

- Health care biotechnology: - Recombinant Insulin, Recombinant Hepatitis vaccine,
  Gene therapy, DNA probes in diagnosis.

b) Agricultural biotechnology: - Transgenic plants.

c) Environmental biotechnology: - Genetically engineered microbes for pollution control.

d) Industrial biotechnology: - Strain improvement for industrial product.

Practicals

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1. Isolation of genomic DNA from bacteria.

2. Demonstration of Agarose gel electrophoresis.
3. Genetic recombination in bacteria.

a) Transformation b) Conjugation

4. Estimation of DNA and RNA.
5. Isolation of fermentative mutant using physical mutagen (U.V. radiation).
6. Detection of streptomycin (antibiotic resistant mutant) by replica plating technique.
7. Transformation of plasmid DNA using CaCl2.

Distribution of marks Semester – III - Microbiology practical

1. Major experiment -	15 Marks
2. Minor experiment -	10 Marks
3. Viva-Voce -	10 Marks
4. Spotting -	10 Marks
5. Laboratory journal -	05 Marks
TOTAL	**50 Marks**