

**JYOTI NIVAS COLLEGE AUTONOMOUS
SYLLABUS FOR 2018 BATCH AND THEREAFTER**

Programme: B.Sc.

Semester: V

**GENETICS PAPER V
GENETIC ENGINEERING**

Course Code: 18VGT5

No. of Hours: 45

COURSE OBJECTIVES:

- To understand the DNA technology and appreciate its role in molecular genetics Diagnostics
- To understand the isolation, sequencing and synthesis of genes
- To appreciate the methods of gene transfer, gene therapy and transgenic organisms
- To include skill component in practical

LEARNING OUTCOMES:

- The students are able to appreciate the various techniques used in modern Genetics that can be used to treat incurable genetic diseases
- Students will be able to understand creation of transgenics that can be beneficial such as disease and drought resistance plants, biopharming to obtain certain drugs and organs from transgenic animals
- They learn the skill of plasmid DNA, restriction enzyme digestion, ligation of DNA fragments and transformation

UNIT - I:INTRODUCTION TO RECOMBINANT DNA TECHNOLOGY 10 HRS

A brief introduction to genetic engineering & cloning **01 HOUR**

Tools: 03 HRS

a) Nucleic acid modifying enzymes:

Restriction endonucleases – Types and characteristic features, Nomenclature, Modification of cut ends.

Others: Alkaline phosphatase, SI nuclease, Mung bean

b) Linkers and adaptors

Cloning Vectors: 04 HRS

Plasmids: pBR322, Ti plasmid (Structure: nopaline type, octopine type, vir region, T-DNA, Cosmids.

Viruses: SV 40 (transducing, late replacement, early replacement, plasmid vectors)

CaMV, Gemini, Vaccinia& Retroviruses **01 HRS**

Bacteriophages: Lambda (insertion and replacement), M13. **01 HRS**

UNIT II: NUCLEIC ACID HYBRIDIZATION	16 HRS
rDNA Techniques:	04 HRS
Electrophoresis: Agarose Gel, SDS-PAGE,	
Blotting: Nucleic acid hybridization, Southern blotting, Northern blotting, Western blotting; Dot blots	
PCR (principle and applications)	
Isolation, Sequencing and Synthesis of gene:	
1. Isolation:	
Bacterial DNA	01 HRS
Plasmid DNA – alkaline denaturation, EtBr-CsCl density gradient Centrifugation	01 HRS
Bacteriophage DNA – lambda phage	01 HRS
Genomic library (construction using shotgun cloning),	01 HRS
cDNA library (construction using Reverse transcriptase)	01 HRS
2. Sequencing:	
Sanger's Dideoxy method;	01 HRS
Next generation sequencing	03 HRS
3. Synthesis:	
Organochemical synthesis of a complete gene (phosphotriester method	03 HRS
UNIT - III GENE TRANSFER METHODS	06 HRS
Vector mediated gene transfer in E.coli and Agrobacterium	03 HRS
Direct gene transfer – Lipofection, Electroporation, Particle shot gun method and microinjection	03 HRS
UNIT - IV SELECTION OF RECOMBINANTS	07 HRS
Direct methods: plaque formation, insertional inactivation	01 HRS
Indirect methods: colony hybridization, Immunochemical selection using reporter genes, selectable gene (Kanamycin resistance) and scoreable gene (lacZ)	03 HRS
Expression based screening: unique gene products (complementation, Immunochemical method using antibodies, South-Western screening)	03 HRS
UNIT - V TRANSGENIC ORGANISMS	06 HRS
Transgenic crops – Resistance to herbicides, insecticides, viruses and fungi; nif gene transfer	03 HRS

Transgenic Animals – Methods to create transgenic animals (in brief); Chicken, Cow, Pig, Rabbit, Sheep, Goat, knock-out Mouse and their applications. ethical issues in transgenics.

03 HRS

III B.SC. GENETICS - SEMESTER V PRACTICAL PAPER 5

DURATION: 3 HOURS / UNIT

NO. OF UNITS: 15

1. Instrumentation: 03 UNITS

PCR, Microneedle, Electronic Balance, Magnetic Stirrer, UV Transilluminator

2. Quantification of DNA (DPA method) and RNA (orcinol method). 03 UNITS

3. Agarose Gel Electrophoresis of DNA. 01 UNIT

4. SDS PAGE 01 UNIT

5. Demonstration of: 05 UNITS

a) Isolation of Plasmid DNA.

b) Restriction Enzyme digestion.

c) Ligation of DNA fragment.

d) Transformation

e) Isolation of lambda phage DNA

Practical tests/repetition

2 UNITS

Note: 13 Practical + 2 units for practical tests/repetition

REFERENCES

1. AN INTRODUCTION TO GENETIC ENGINEERING, Nicholl, Desmond S.T. (2002), South Asian Edition, Cambridge University Press.
2. CELL AND MOLECULAR BIOLOGY, Gupta P.K., 2nd edition, Rastogi Publications, Meerut.
3. GENE IV, V, VI, Benjamin Lewin, Oxford University Press, Oxford.
4. GENETICS: FROM GENES TO GENOMES, Hartwell L.H. et al (2004), 2nd edition, McGraw-Hill, New York
5. GENOMES, Brown T.A. (1999), Bios Scientific Publishers, Oxford.
6. HUMAN GENETICS: CONCEPTS & APPLICATIONS, Lewis R. (2001), McGraw Hill, Boston.
7. HUMAN MOLECULAR GENETICS, Sudbery P. (1998), Addison-Wesley, Longman Harbor.
8. PRINCIPLES OF GENOME ANALYSIS, Primrose S.B. (1995), Blackwell, Oxford.
9. THE SCIENCE OF GENETICS, Atherly A.G., Girton J.R. & McDonald J.F. (1999), Saunders College Publishing/Harcourt Brace.