II B.Sc. III Semester Examination, March April 2022
BIOTECHNOLOGY SCHEME OF EVALUATION
Molecular Biology and Genetic Engineering

Time 3 Hours Max. Marks: 70

I. Answer all the questions. 5X1=5

1. Define Central Dogma of Molcular Biology,

The **central dogma of molecular biology** is an explanation of the flow of genetic information within a biological system. the genetic message transferring process between DNA to RNA Molecule and RNA to a Protein Molecule. **Definition -1 Mark**

2. What is Dispensive method of DNA replication

In the dispersive model, **DNA replication results in two DNA molecules that are mixtures, or "hybrids," of parental and daughter DNA**. In this model, each individual strand is a patchwork of original and new DNA. **Definition -1 Mark**

3. Give any two examples for transcription inhibitors.

Actinomycin D and α-amanitin **Any two--1 Mark**

4. What are Cosmids?

Cosmid vectors are **hybrids between plasmid and phage λ vectors**. The classic example of cosmid vector is c2RB, which carries an origin of replication and a cloning site and has antibiotic-resistant genes. As with the phage λ vector, the cosmid vector encodes the cos sequences required for packaging of DNA into λ capsid. **Definition -1 Mark**

5. Name the tracking dye used in agarose gel electrophoresis

The tracking dyes are **xylene cyanol FF (4 kB) and bromphenol blue (300 bp) or orange G (50 bp) in a 50% glycerol solution**. **Any two--1 Mark**

II Answer any five questions. 5X3= 15

6.Define inhibitors. Explain the role of actinomycin as inhibitors of replication.

Compound, or even a macromolecule, that blocks the action of an enzyme by reversible attachment in such a way as to prevent binding by the substrate or by prevention of the reaction even if the substrate can still bind.

DNA replication is initiated by the synthesis of a short segment of RNA called RNA primer. The RNA primer synthesis is catalysed by the enzyme RNA polymerase. This enzyme is inhibited by an antibiotic called actinomycin D. When RNA polymerase is inhibited, RNA primer cannot be synthesized and hence DNA synthesis is also inhibited. **Explanation types-3 Marks**

7.Write a note on initiation of transcription.

Initiation Phase

During initiation, RNA polymerase recognizes a specific site on the DNA, upstream from the gene that will be transcribed, called a **promoter site** and then unwinds the DNA locally.

Promoters and Initiation

- The holoenzyme binds to a promoter region about 40–60 bp in size and then initiates transcription a short distance downstream (i.e. 3 to the promoter).
- Within the promoter lie two 6 base pair sequences that are particularly important for promoter function.
- They are highly conserved between species.
- Using the convention of calling the first nucleotide of a transcribed sequence as +1, these two promoter elements lie at positions –10 and –35, that is about 10 and 35 bp, respectively, upstream of where transcription will begin.
- The –10 sequence has the consensus Because this element was discovered by Pribnow, it is also known as the Pribnow box. It is an important recognition site that interacts with the σ factor of RNA polymerase.
- The –35 sequence has the consensus **TTGACA** and is important in DNA unwinding during transcriptional initiation.
- RNA polymerase does not need a primer to begin transcription; having bound to the promoter site, the RNA polymerase begins transcription directly. **Explanation -3 Marks**

8. How are vectons classified ? Explain.

The four major types of vectors are **plasmids, viral vectors, cosmids, and artificial chromosomes**. **Explanation -3 Marks**

9. Give an account on importance of ligase in genetic engineering.

Uses : 1. DNA ligase is used to join a vector DNA and a target DNA to construct recombinant DNA.
2. It is used to join DNA fragments of different organisms for making vectors with desired characters.
3. It is used to add linker and adaptor sequences to blunt ended vector DNA and target DNA.
4. It is used to join oligonucleotides together in the chemical synthesis of DNA by ligase chain reaction (LCR).
Explanation -3 Marks

10.What are probes? Write their applications.

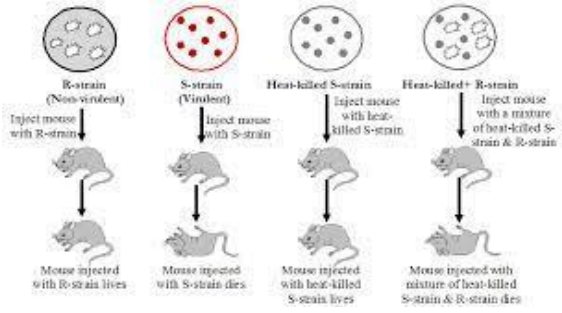
A probe is **a single-stranded sequence of DNA or RNA used to search for its complementary sequence in a sample genome**. The probe is placed into contact with the sample under conditions that allow the probe sequence to hybridize with its complementary sequence. **Definition -1 Mark applications -2 Marks**

11. Write a note on the application of northern blotting

1. The technique can be used for the identification and separation of RNA fragments collected from different biological sources.
2. Northern blotting is used as a sensitive test for the detection of transcription of DNA fragments that are to be used as a probe in Southern Blotting.
3. It also allows the detection and quantification of specific mRNAs from different tissues and different living organisms.
4. Northern blotting is used as a tool for gene expression studies related to overexpression of cancer-causing genes, and gene expression during transplant rejects.
5. Northern blotting has been used as a molecular tool for the diagnosis of diseases like Crohn's disease.
6. The process is used as a method for the detection of viral microRNAs that play important roles in viral infection.
Any 3 points--3 Marks

III Answer any four questions **4x5-20**

12. Explain the Griffith experiment.



Explanation -5 Marks

13. Describe the Deciphering or Genetic Code.

<u>Deciphering the Code:</u>
Deciphering the code means the identification of the codon for each amino acid, It is also called breaking or cracking the genetic code. It helps to determine the genetic codes for the different amino acids. By elucidating the different codes, a codon dictionary is formulated. The codon dictionary clearly gives an idea about the different codons determining the different amino acids. The deciphering of codons was carried out by Nirenberg and Mathaei (1960).

The deciphering of genetic code was done by utilizing many devices, of which three methods are very important:

1. Use of homopolymer
2. Use of heteropolymer
3. Use of trinucleotides **Explanation -5 Marks**

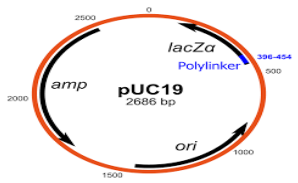
14. Explain briefly the types of Restriction endonucleases.

Types of Restriction Enzymes

The restriction endonucleases are grouped into three types.
They are i. Type I restriction endonucleases

ii. Type II restriction endonucleases
iii. Type III restriction endonucleases **Explanation -5 Marks**

15.With the help of neat diagram explain puc 19.



Explanation -3 Marks Diagrm-2 marks

16. Describe the procedure for Isolation of DNA

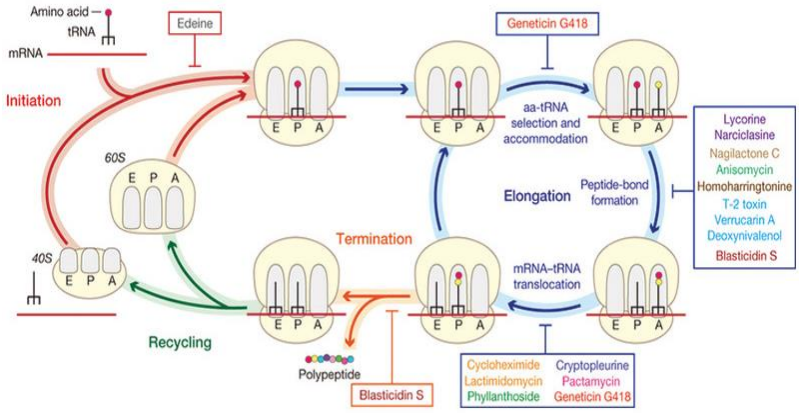
Explanation -5 Marks

IV. Answer any three questions**.** **3x10 =30**

17. Describe the steps involved in the process of translation in Eukaryotes.

Translation (Protein Synthesis) in Eukaryotes

- Translation involves translating the sequence of a messenger RNA (mRNA) molecule to a sequence of amino acids during protein synthesis.
- It is the process in which ribosomes in the cytoplasm or ER synthesize proteins after the process of transcription of DNA to RNA.



Explanation -10 Marks

18. Explain the steps involved in DNA replication.

DNA replication occurs by three steps

1. Initiation:

- Initiation complex formation
- Closed complex formation
- Open complex formation

2. Elongation:

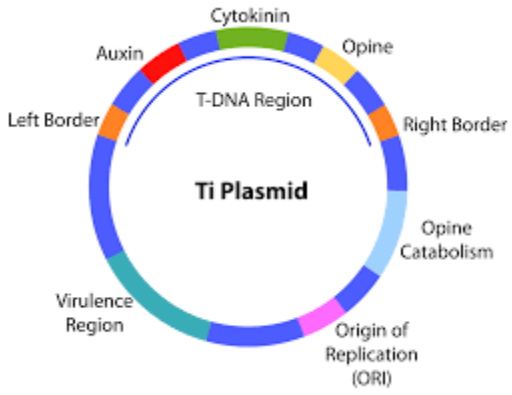
- Leading strand synthesis
- Lagging strand synthesis

3. Termination **10 Marks Explanation -10 Marks**

19. Give an account on the principle and applications of PCR
Principle- **5 Marks** applications-**5 Marks**

20. Write a note on:

a) Ti plasmids



Explanation -3 Marks Diagrm-2 marks

b) Macroinjection and liposoma gene transfer

Explanation of each -2.5X2=5 Marks
