

2021

**Molecular Biology and Biotechnology****[HONOURS]****Paper : VII**

Full Marks : 80

Time : 4 Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.****Use separate answer script for each GROUP.*****GROUP-A****(Marks : 50)**

1. A. Choose the correct answer from the following options: 1×5=5

- a) Dideoxy nucleotides have
- i) H at 1' and 2' positions of the sugar
  - ii) H at 2' and 3' positions of the sugar
  - iii) H at 3' and 4' positions of the sugar
  - iv) H at 4' and 5' positions of the sugar
- b) Which of the following techniques cannot be used to study gene expression?
- i) Southern blot

- ii) Northern blot
  - iii) Western blot
  - iv) RT-PCR
- c) For successful PCR with respect to its target have
- i) any mismatch
  - ii) mismatch at its 5' end
  - iii) mismatch at its 3' end
  - iv) all of the above
- d) Klenow fragment does not have
- i) 5' → 3' polymerase activity
  - ii) 5' → 3' exonuclease activity
  - iii) 3' → 5' exonuclease activity
  - iv) Proof reading activity
- e) Taq DNA polymerase has
- i) 5' → 3' polymerase activity and 3' → 5' exonuclease activity
  - ii) 5' → 3' polymerase activity and 5' → 3' exonuclease activity
  - iii) 3' → 5' Polymerase activity and 5' → 3' exonuclease activity
  - iv) All of the above.

B. State whether the following statements are **true** or **false**:  $1 \times 6 = 6$

- i) Isoschizomers are restriction enzymes obtained from the same organism.
- ii) With one restriction enzymes we can perform restriction mapping of a plasmid.
- iii) Ti plasmid is a shuttle vector.
- iv) Star activity of a restriction enzyme is associated with high glycerol concentration in the reaction.
- v) Terminal transferase is a template independent DNA polymerase.
- vi) DNA fingerprinting can be designed based on VNTRs.

2. Answer any **three** questions:  $2 \times 3 = 6$

- a) Why cosmids are preferred to construct genomic DNA library?
- b) What is RAPD?
- c) What do you mean by directional cloning?
- d) What do you mean by RT PCR?
- e) Distinguish expression vector from cloning vector.

3. Answer any **two** questions from the following:

$4 \times 2 = 8$

- a) In a 3kb plasmid distance between EcoRI and BamHI sites is 1 kb. A Bam HI digested fragment was inserted at Bam HI site of this plasmid. When this recombinant plasmid was digested with EcoRI two DNA fragments of length 1.25 kb and 4.5 kb fragments were obtained. What was the size of insert? What was the position of EcoRI in the insert? Draw the map of recombinant plasmid.
- b) Compare T4 DNA Ligase and *E. coli* DNA ligase.
- c) Why is linearized plasmid vector treated with alkaline phosphatase before ligation? What would happen if insert, instead of vector is treated with alkaline phosphatase before ligation reaction?

4. Answer any **five** questions:  $5 \times 5 = 25$

- a) What do you mean by His tag? Why are recombinant proteins are tagged with it? Shall your clone fall length cDNA of a given protein in an expression vector to obtain its His tagged product?
- b) What is Western blot? Mention its applications. Why its secondary antibody used in Western blot?  $2+2+1$

- c) What is BAC? Compare plasmid and BAC. Mention one advantage and one disadvantage of BAC as cloning vector. 1+2+2
- d) Design an experiment to study expression of a particular gene in two tissue types, such as muscle and liver of mouse.
- e) Schematically present the principle of DNA sequencing by chain termination method.
- f) Schematically present a strategy of cDNA library construction.
- g) EcoRI recognized GAATTC. Calculate the expected frequency of EcoRI site in a 10kb long random DNA sequence.
- h) What is PCR? Write down the components of this reaction. Why is *E. coli* DNA polymerase not used in PCR?

**GROUP-B**  
**(Marks : 30)**

5. Answer the following questions: 1×4=4
- a) Why is fed-batch fermentation process used in case of industrial production of proteases?
- b) What do you mean by down-stream processing?
- c) Name one fungus and one bacterial strain that produce  $\alpha$ -amylase.
- d) Why are secondary metabolites sometimes called idiolites?
6. Answer any **three**: 2×3=6
- a) Name four substrates commonly used for SCP production.
- b) What is the function of the digester in waste water treatment? Mention the main aim of waste water treatment.
- c) What is methanogenesis? Name one bacteria that causes methanogenesis.
- d) What is the advantage of fed batch method of fermentation over batch fermentation?
- e) Mention the use of baffles in a fermentor. What is the mode of action of a foam separator?

7. Answer any **two**:  $5 \times 2 = 10$
- a) Briefly describe the process of continuous fermentation. 5
  - b) Name one  $\beta$ -lactam antibiotic. Describe its production process by fermentation with a flow chart. 1+4
  - c) Define strain optimization. What is the primary goal of an industrial strain development program? How are high yielding strains generally produced? 1+1+3

8. Answer any **one**:  $10 \times 1 = 10$
- a) i) Why are single-cell proteins considered to have great nutritional value?
  - ii) Mention two bacterial strains commonly used for vitamin B12 production. Briefly explain its production process and write down the main constituents of the media which is used for the production.
  - iii) Name 2 fungal strains and 2 bacterial strains that are important protease producers.
  - iv) What do you mean by biomass?

- b) With reference to citric acid production discuss the following:
  - i) Brief description of the fermenter used.
  - ii) Production of inoculum
  - iii) Product recovery.
  - iv) The suitable strains of microorganisms used.
  - v) Carbohydrate sources and types of trace elements required. 2+2+2+2+2=10