

Q.P. Code :20218

[Time: 2½Hours]

[ Marks: 75]

Please check whether you have got the right question paper.

- N.B:
1. All questions are **compulsory**.
  2. Choice is **internal**.
  3. Draw diagrams wherever necessary.
  4. Non-programmable calculators are permitted.
  5. **Figures** to the **right** indicate **full** marks.

Q.1 A) Choose the **MOST APPROPRIATE** answer (**any three**): **03**

- i) DNA replication *in vivo* is discontinuous due to \_\_\_\_\_.
  - a) sister chromatid exchange
  - b) being restricted to synthesis in the 5' to 3' direction
  - c) topoisomerases cutting the DNA in a random fashion
- ii) \_\_\_\_\_enzyme removes the RNA primer during replication.
  - a) RNA primase
  - b) DNA polymerase I
  - c) DNA ligase
- iii) Suppose a mutation occurs in a cell such that normal Okazaki fragments were created during DNA replication but were not linked together into a continuous strand. The gene for which enzyme would you predict was altered by this mutation?
  - a) DNA polymerase
  - b) DNA helicase
  - c) DNA ligase
- iv) Old and new strands of DNA in bacteria can be distinguished by \_\_\_\_\_.
  - a) DNA glycosylases
  - b) AP endonucleases
  - c) methylation patterns
- v) Thymine dimers may be repaired by \_\_\_\_\_ in humans.
  - a) photoreactivation
  - b) excision repair
  - c) oxidative damage repair
- vi) Cytosine undergoes deamination, and becomes \_\_\_\_\_.
  - a) Uracil
  - b) Guanine
  - c) Adenine

B) Answer in brief **any one**: **02**

- i) Theta mode of replication of DNA
- ii) Recombination repair

C) Write a short note on **any one**: **04**

- i) Mismatch repair
- ii) Meselson-Stahl experiment

D) Answer **any one** of the following: **06**

- i) Elaborate on the mechanism of replication in *E.coli*
- ii) Write brief note on: (a) SOS repair (b) Photoreactivation.

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Q.2 A) Choose the **MOST APPROPRIATE** answer **any three:**

**03**

i) In which of the following actions does RNA polymerase differ from DNA polymerase?

- a) RNA polymerase binds to single-stranded DNA, and DNA polymerase binds to double-stranded DNA
- b) RNA polymerase is much more accurate than DNA polymerase
- c) RNA polymerase can initiate RNA synthesis, but DNA polymerase requires a primer to initiate DNA synthesis

ii) As a ribosome translocates along a mRNA molecule by one codon \_\_\_\_\_ occurs.

- a) the tRNA that was in the A site moves into the P site
- b) the tRNA that was in the P site moves into the A site
- c) the tRNA that was in the A site moves to the E site and is released

iii) Which of the following statement **is true** about protein synthesis in prokaryotes?

- a) Extensive RNA processing is required before prokaryotic transcripts can be translated
- b) Translation can begin while transcription is still in progress
- c) Unlike eukaryotes, prokaryotes require no initiation or elongation factors

iv) \_\_\_\_\_ is not directly involved in translation.

- a) mRNA      (b) DNA      (c) rRNA

v) \_\_\_\_\_ nucleotide base is not found in RNA.

- a) Thymine    (b) Guanine (c) Uracil

vi) The tRNA with 5'AUC3' will form a codon- anticodon base pairing interaction With \_\_\_\_\_ mRNA codon.

- a) 5'GUA3'    (b) 5'GAU3'    (c) 5'CUA3'

B) Answer in brief, **any one** of the following:

**02**

- i) Comment on the action of Puromycin
- ii) Explain : Sense strand in transcription

C) Write short notes on **any one** of the following:

**04**

- i) Splicing      (ii) Genetic code

D) Answer **any one** of the following:

**06**

- i) Discuss the mechanism of RNA formation in prokaryotes.
- ii) Explain in detail initiation and termination phase of protein synthesis.

Q.3 A) Choose the **MOST APPROPRIATE** answer **any three:**

**03**

i) \_\_\_\_\_ is derived from proteolytic cleavage of DNA pol I.

- a) DNA Pol III      b) Reverse Transcriptase      c) Klenow fragment

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- ii) A technique that measures degree of genetic similarity between pools of DNA sequences is called\_\_\_\_\_.
- a) annealing                      b) denaturation                      c) hybridization
- iii) In restriction endonuclease EcoRI, "co" stands for\_\_\_\_\_.
- a) colon                              b) coenzyme                              c) coli
- iv) EcoRI cleaves DNA at\_\_\_\_\_.
- a) 5'G↓AATTC<sup>3</sup>'                              b) 5'GTT↓AAC<sup>3</sup>'                              c) 5'C↓AATTG<sup>3</sup>
- v) When two DNA pieces cut with the same restriction enzyme are combined, sticky ends will\_\_\_\_\_.
- a) anneal by covalent bonds      b) anneal by DNA ligase  
c) anneal by complementary base pairing and hydrogen bonds
- vi) Which arrangement of the following four enzymes represents the order in which they would be used in a typical gene-cloning experiment resulting in the insertion of a cDNA into a bacterial plasmid? Begin with the gene's mRNA transcript.
- a) Restriction enzyme, reverse transcriptase, DNA polymerase, DNA ligase  
b) Reverse transcriptase, DNA polymerase, Restriction enzyme, DNA ligase  
c) Reverse transcriptase, Restriction enzyme, DNA polymerase, DNA ligase
- B) Define and explain **any one** of the following in brief: **02****
- i) Blunt end cutter      (ii) Expression vector
- C) Answer **any one** of the following: **04****
- i) Describe use of RDT for pest resistant crops and for therapy of diabetes.  
ii) If a gene needs to be isolated from a source and has to be inserted into another gene, discuss the enzymes employed for the same
- D) Answer **any one**: **06****
- i) Justify: "Shuttle vectors are more efficient as compared to cloning vectors."  
ii) Justify in detail: "Vectors are one of the most essential tools for RDT"
- Q.4 A) Choose the MOST APPROPRIATE answer (any three): **03****
- i) An ampicillin-sensitive culture of *E. coli* is transformed with a plasmid that contains the gene of interest plus an ampicillin-resistance gene. If it is then plated on an ampicillin-containing growth medium\_\_\_\_\_.
- a) it will form blue colonies      b) it will form white colonies      c) it will not form any colonies
- ii) Virus mediated gene transfer is known as\_\_\_\_\_.
- a) transduction                      b) transfection                              c) transformation

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iii) Chemical used in transformation is \_\_\_\_\_.

- a) PEG                      b) CaCl<sub>2</sub>                      c) MgCl<sub>2</sub>

iv) Introduction of DNA using a hypodermic needle is known as \_\_\_\_\_.

- a) macroinjection                      b) micromanipulation                      c) microinjection

v) \_\_\_\_\_ are used for introduction of genes in plants.

- a) Walled cells                      b) Protoplast                      c) Spheroplasts

vi) \_\_\_\_\_ mutants are used in *Lac* selection.

- a) Autotrophic                      b) Auxotrophic                      c) Mexotrophic

B) Define and explain **any one** of the following:

- i) DNA fingerprinting                      (ii) Transformation

02

C) Attempt **any one** of the following:

04

- i) Discuss the technique and advantages of gene transfer that involves the use of electric current  
ii) Give E.M. Southern's contribution to the field of RDT"

D) Answer **any one**:

06

- i) Elaborate cell-free molecular cloning.  
ii) Mahesh has inserted the gene of interest in a plasmid in the tetracycline resistant gene, Discuss the method for selection of the transformant.

Q.5 A) Write a note on **any one** of the following:

03

- i) Write a note on DNA Polymerase I  
ii) Justify: "A single dimer of Polymerase III can simultaneously conduct replication on both leading and lagging strands"

B) Answer in brief **any one** the following:

03

- i) Charging of tRNA  
ii) Give the significance of rho factor and sigma factor

C) Answer in brief **any one** the following:

03

- i) Discuss the different techniques of probe labelling.  
ii) Depict the structure of pBR322, with a neat-labelled diagram ONLY.

D) Answer in brief **any one**:

03

- i) Elaborate on the different types of genomic libraries.  
ii) Discuss the use of liposomes for gene transfer.

- E) State true or False: **(any three)**
- i) Replication is not dispersive in prokaryotes.
  - ii) Cystine dimers form in UV light.
  - iii) Polycistronic RNA are only observed in prokaryotes.
  - iv) Protein synthesis takes place in the the cytosol.
  - v) pUC 18 is only a cloning vector.
  - vi) Bt cotton is resisitant to *B. thuringenesis*.

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