BIOTECHNOLOGY PAPER 1
(THEORY)

Maximum Marks: 70

Time Allowed: Three Hours

*(Candidates are allowed **additional 15 minutes** for **only** reading the paper.*

*They must **NOT** start writing during this time.)*

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*Answer all questions in **Section A, Section B** and **Section C**.*

The intended marks for questions or parts of questions are given in brackets [ ].

SECTION A – 14 MARKS

Question 1

(i) The labelled _____ are used as probe in Western Blotting technique. **[1]**

(ii) During gel electrophoresis, DNA molecules move towards the _____ electrode. **[1]**

(iii) The nitrogenous base that has double rings is: **[1]**

(a) Cytosine

(b) Guanine

(c) Thymine

(d) Uracil

(iv) A plant geneticist is studying the possibility of combining desirable traits from two different plant species. He is particularly interested in developing a hybrid plant that combines disease resistance from one species with high yield potential from another species. **[1]**

Name the technique that can be used by the plant geneticist to develop the hybrid plant.

(v) Give a reason for the following.

(a) A haploid plant obtained by androgenesis produces viable gametes by meiotic division. **[1]**

(b) A co-repressor is required by the repressor to switch off the operator site in a repressible operon. **[1]**

(vi) Define the following:

(a) Genomics **[1]**

(b) Single cell protein **[1]**

(vii) Differentiate between the following:

(a) *Monocistronic mRNA* and *Polycistronic mRNA* **[1]**

(b) Sticky ends and blunt ends **[1]**

(viii) Expand the following:

(a) EMBL **[1]**

(b) NCBI **[1]**

(ix) **Assertion:** *Lac operon* is an inducible operon. **[1]**

Reason: Lactose inhibits the process of transcription in *Lac operon*.

(a) Assertion and Reason are true and Reason is correct explanation for assertion.

(b) Assertion and Reason are true but Reason is not the correct explanation for assertion.

(c) Assertion is true but Reason is false.

(d) Both Assertion and Reason are false.

(x) **Assertion:** In *Sanger's* DNA sequencing method, radio labelled ddNTPs are used to terminate the chain. **[1]**

Reason: ddNTPs have the radiolabelled nitrogenous bases which are identified by autoradiography.

(a) Assertion and Reason are true and Reason is correct explanation for Assertion.

(b) Assertion and Reason are true but Reason is not the correct explanation for Assertion.

(c) Assertion is true but Reason is false.

(d) Both Assertion and Reason are false.

SECTION B – 28 MARKS

Question 2 **[4]**

Write short notes on the following:

(i) Identification of recombinant host by *Blue – white selection method*

(ii) *Reverse transcription*

Question 3 **[4]**

(i) Briefly explain the following:

(a) Edible vaccines

(b) Growth regulators in plant cultures

OR

(ii) Briefly explain the following:

(a) Colorimetry

(b) Biolistic

Question 4 **[4]**

State *any two* differences between the following:

(i) YAC and BAC

(ii) Synthetic culture medium and semisynthetic medium

Question 5 **[4]**

(i) Describe the process of animal cloning.

OR

(ii) Discuss the process of DNA isolation from a plant cell.

Question 6 **[4]**

Give reasons for the following:

(i) *Flavr savor* tomato can be stored for longer time.

(ii) Golden rice is more nutritious than normal rice.

Question 7 **[4]**

Briefly explain the methods of sterilizing the following:

(i) Instruments

(ii) Culture medium

(iii) Explants

(iv) Vitamins

Question 8 **[4]**

A group of researchers is studying ancient DNA samples obtained from archaeological remains in order to understand the genetic history of a particular population. The DNA samples are highly degraded due to age and environmental factors.

Describe the technique that the researchers can employ to raise the amount of highly degraded DNA samples obtained from ancient remains.

SECTION C – 28 MARKS

Question 9

(i) Discuss the role of *any four* enzymes involved in DNA replication in prokaryotes. **[4]**

(ii) Mention *any three* differences between *Southern blotting* and *Northern blotting*. **[3]**

OR

(i) How is rDNA molecule constructed?. **[4]**

(ii) Mention *any three* differences between BLAST and FASTA. **[3]**

Question 10

(i) Discuss the levels of stem cells on the basis of their developmental potential. **[4]**

(ii) Explain the clover leaf model of tRNA. **[3]**

Question 11

(i) ***Figure 1*** shows growth kinetics of one of the microbial cultures. Study the figure given below and answer the questions that follow: **[4]**

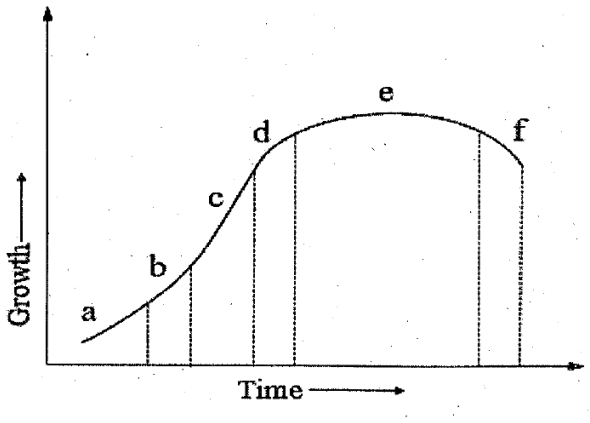

Figure 1.

(a) What type of microbial culture is depicted in ***Figure 1***?

(b) What happens to cell mass and cell culture in phase "**c**"?

(c) Which phase yields maximum product? Give one reason to support your answer.

(d) In which phase do the cells adapt to grow in the culture medium? Give reasons.

(ii) ***Figure 2*** shows an important process. Study the figure given below and answer the questions that follow. **[3]**

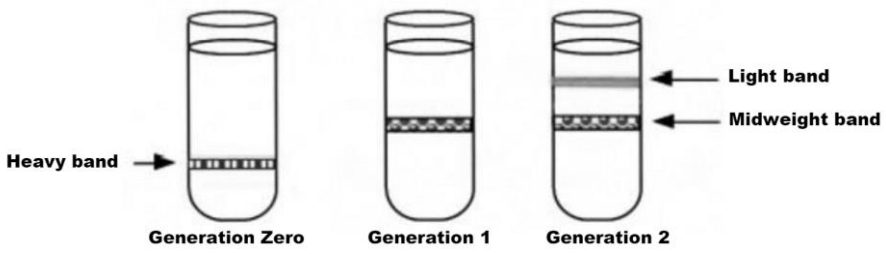

Figure 2

(a) What is represented by heavy band in Generation Zero of ***Figure 2***?

(b) Which method was used to determine the density of DNA?

(c) What is the result for Generation 1?

Question 12

A scientist is conducting an experiment to determine whether DNA is the genetic material responsible for inheritance. She has two groups of bacteria, Group A and Group B, and she is going to treat each group differently.

The scientist treats Group A bacteria with an enzyme that specifically degrades DNA. She treats Group B bacteria with an enzyme that specifically degrades RNA.

After treating Group A with the DNA-degrading enzyme, the scientist isolates the remaining cellular components, including proteins and RNA.

After treating Group B with the RNA-degrading enzyme, the scientist isolates the remaining cellular components, including proteins and DNA.

(i) What would be the expected outcome in the growth of the bacterial colony of Group A bacteria after DNA degrading enzyme is used? **[1]**

(ii) What would be the expected outcome in the growth of the bacterial colony of Group B bacteria after RNA degrading enzyme is used? **[1]**

(iii) Explain the process that would be taken to analyse the nucleic acid(s) content after treating Group B bacteria with RNA degrading enzyme. **[3]**

(iv) Explain the process that would be taken to analyse the nucleic acid/s content after treating Group A bacteria with DNA degrading enzyme. **[2]**