PRE BOARD / XII / BIOTECHNOLOGY / 2020-21

Time: 3 Hrs. **MM: 70**

General Instructions:

(i) All questions are compulsory.
(ii) The question paper has four sections: Section A, Section B, Section C and Section D. There are 33 questions in the question paper.
(iii) Section–A has 14 questions of 1 mark each and 02 case-based questions. Section–B has 9 questions of 2 marks each. Section–C has 5 questions of 3 marks each and Section–D has 3 questions of 5 marks each.
(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
(V) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION: A

Q1. Name any two scientists involved in designing the first recombinant DNA molecule. 1

Q2. Write any two properties which can be improved through protein engineering. 1

Q3. What is the advantage of using polylinker in a vector ? 1

Q4. On which chromosome in humans, is the genetic defect for the Huntington disease located? 1

Q5. Name the red algae from which agar is obtained. 1

Q6. How does a modification enzyme protect its own DNA from digestion? 1

Q7. Expand PER? 1

Q8. An enriched medium containing salts, glucose, proteins and vitamins was made and a commercially available animal cell line was introduced. However, the cells began dying. What could be the reason behind it? 1

Q9. Counting genes and predicting their presence have proved to be laden with in accuracies. Give reasons. 1

Q10. Which technique is used to confirm the detection of Sickle cell anaemia? Who developed this technique? 1

Q11. (i) Assertion – Persons suffering from haemophilia fail to produce blood clotting factor VIII. 1

Reason- Prothrombin producing platelets in such persons are found in very low concentration.

(a) Both Assertion and Reason are true and the reason is the correct explanation of the assertion

(b) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion

(c) Assertion is true but Reason is false

(d) Both Assertion and Reason are false

OR

(ii) Assertion- OKT-3 is used to prevent graft rejection following kidney transplantation

Reason- OKT-3 blocks immune cells which attack foreign grafts.

(a) Both Assertion and Reason are true, and the reason is the correct explanation of the assertion
(b) Both Assertion and Reason are true, but the reason is not the correct explanation of the assertion
(c) Assertion is true but Reason is false
(d) Both Assertion and Reason are false

Q12. The disease due to the deficiency of an enzyme Adenosine Deaminase (ADA) is: 1
a) SCID
b)Thallasemia
c) Haemophilia
d) Mad cow disease

Q13. Which of the following is a sequence alignment tool: 1
a) PIR
b) PROSITE
c) BLAST
d) PRINT

Q14. During isolation of streptomycin, clear broth is- 1
(a) discarded
(b) subjected to liquid-liquid extraction chromatography
(c) subjected to ultra filtration
(d) subjected to solubilization of proteins

Q15. Read the following and answer any four questions from 15 (i) to 15 (v) 4

Testing for COVID-19 using PCR

The objective of COVID-19 testing is to identify part of the corona viral genome in the patient sample. As, there is insufficient viral RNA to detect directly in the patient sample, a process called reverse transcription polymerase chain reaction (RT-PCR) is used for amplification. Short single stranded pieces of DNA called primers recognize unique RNA sequences within the viral genome. When double-stranded DNA copy of the target region of the viral RNA is produced, it undergoes successive rounds of amplification during which the DNA undergoes denaturation. Two primers anneal to their target sequences and then Taq polymerase extends a new strand. The number of copies of the target region of the viral genome doubles with each cycle. In practice, the virus is typically detected in 35 cycles of PCR, after which the number of DNA copies produced will be 235 . PCR based diagnosis is faster, safer and more specific because it does not use live pathogens.

(i) The sequence of steps in PCR is-
(a) Denaturation, annealing, extension
(b)Annealing, denaturation, extension
(c) Extension, annealing, denaturation
(d)Denaturation, extension, annealing

(ii) Culture based approaches for detecting pathogens, as compared to PCR based assays are :
(a) Faster, safer but less specific
(b) Slower but safer and more specific
(c) Slower, less safer and less specific
(d) Slower, less safer but more specific.

(iii) Taq DNA polymerase synthesizes DNA at a temperature of around 70^0 C as it is-
(a) Thermophilic
(b) Thermostable
(c) Thermoregulator
(d) Thermolabile

(iv) After n cycles, the number of DNA copies produced are-
(a) n
(b) 2^n
(c) nx2
(d) n÷2

(v) A primer is-
(a) Short ss piece of DNA
(b) Short ds piece of DNA
(c) Short ds piece of RNA
(d) Either (b) or (c)

Q16. Read the following and answer any four questions from 16 (i) to 16 (v) 4

Protoplast culture

Plant protoplasts are totipotent and can regenerate into various organs. In addition, they can easily take up foreign genetic material such as DNA, chromosomes, organelles, and viral particles . Plant protoplasts have therefore garnered interest as experimental single cells in various fields of plant biotechnology, such as genetic manipulation, protoplast transient gene expression, plant gene functional characterization, and genome editing. Despite the success of clustered regularly interspaced short palindromic repeats/CRISPR-associated 9 (CRISPR/Cas9)-mediated genome editing in several plant species using Agrobacterium-mediated transformation, off-target effects cause unwanted results. Indeed, target gene editing via ribonucleoprotein (RNP) complex delivery using protoplast-based technology is much less likely to produce off-target mutants compared with *Agrobacterium*-meditated transformation .

Various methods of isolating and culturing protoplasts in *Petunia hybrida* have been reported since a few decades ago. However, shoot regeneration from a protoplast-derived callus has thus far remained challenging, although a few studies have reported genotype-dependent shoot regeneration from protoplast-derived calli , with most genotypes being minor or of no commercial importance. Indeed, successful protoplast isolation with high yield and reproducibility often requires an optimal digestion enzyme dose and digestion time . In addition, the concentration of sucrose as a carbon source also plays a vital role in the success of protoplast culture . Unfortunately, a protocol suitable

for one cultivar might not be suitable for other cultivars. Therefore, optimization of the factors involved in protoplast isolation, callus induction, and shoot regeneration is necessary for each cultivar.

(i) Somatic hybridization is achieved through:
(a) Grafting
(b)Protoplast fusion
(c)Conjugation
(d)Recombination DNA technology

(ii) Totipotency is shown by:
(a)All plant cell
(b)All eukaryotic cell
(c) All animal cell
(d)None of the above

(iii) Plant tissue culture is redefined method of:
(a) Hybridization
(b) Vegetative Propagation
(c) Asexual Reproduction
(d) Sexual Reproduction

(iv) Plant gene transfer method used in genetic engineering to:
(a) Transfer modified gene
(b) Introduce new gene
(c) Both
(d) only A

(v) The enzyme required to obtain wall-free/naked protoplast are:
(a) Cellulase and protease
(b) Cellulose and Amylase
(c) Cellulase and pectinase
(d) Amylase and pectinase

SECTION B

Q17. A given protein with a molecular weight of 10,000 daltons containing 5,4,3,2, and 1charges, is subjected to mass spectrometry. Find the sequence of protein ions detected by the mass spectrometer. 2

OR

Thalassemic patients produce excess alpha or beta subunits of haemoglobin leading to impaired oxygen-binding capacity by their erythrocytes. How can the subunit produced in excess be determined?

Q18. Which information can be retrieved from the following databases? 2

(i) EMBL
(ii) SWISS-PROT

Q19. Name any two diseases showing gene polymorphism with complex inheritance. 2

OR

(i) Which database was created to manage the redundancy in EST data?
(ii) What is the role of the curator in Bio-informatics.

Q20. Maintenance of extra-cellular and intra-cellular pH is essential for survival of mammalian cells in culture. Why ? 2

Q21. (i) Plants are cheap factories. Why? 2

(ii) What can be done to raise:
(i) hybrids of inter-specific cross plants
(ii) male sterile plants?

Q22. The laboratory scale design cannot be scaled up to industrial scale directly. Write any two points that need to be considered while going for industrial scale production. 2

Q23. (i) Animal cells in a culture medium were placed in a regular incubator used for growing bacterial cells. Do you expect the animal cells to grow in it? 2

(ii) What are Interferons?

Q24. A bacterial culture has an initial cell density of $0.5x10^3$ cells/ml . If the generation time is 20 min, what is the cell density at the end of 1hr 40 min? 2

Q25. Specify two advantages of animal cell culture. 2

SECTION C

Q26. Complete the table by filling the mode of action / functional properties indicated as A, B, C, D, E and F. 3

Functional Property	Mode of action
Whipping/Foaming	A
B	Formation and stabilization of fat emulsions
C	Protein matrix formation and setting
Viscosity	D
E	Hydrogen bonding of water; entrapment of water
Solubility	F

Q27. Listed below are four different single strands of DNA. Which of these would you expect to be cleaved by a restriction endonuclease? Give reason. 3

(a) ACTCCAGAATTCACTCCG
(b) ACTCCACTCCCGACTCCG
(c) GCCTCATTCGAAGCCTGA
(d) GAGCGGTTTATCTGAGCAG

OR

Students of Class XII visited Microbial Type Culture Collection, Chandigarh and observed microbial cultures of *Providencia stuartii*, *Streptomyces albus* and *Haemophilus aegyptus*. Name the restriction enzymes obtained from them and also specify their restriction sites.

Q28. Stem cell technology offers exciting possibilities for the future. Using haematopoiesis as an application, explain this new technology and its use. 3

Q29. (i) How are edible vaccines produced ? 3

(ii) Edible vaccines have advantages over recombinant vaccines produced by bacteria. List any two advantages.

Q30. (i) What is meant by the term proteomics? 3

(ii) Name some of the important branches of proteomics.

(iii) Why is the study of proteome relevant in the age of genomics?

SECTION D

Q31. (i) What are nutraceutical proteins ? 5

(ii) Curd has been used as a pro-biotic. Why ?

(iii) Whey protein can treat a spectrum of diseases. Explain.

(iv) In which food system is the water binding property of whey protein used?

(v) How does the consumption of branched chain amino acids help athletes in enhancing their performance?

OR

(i) Detergents now-a-days are provided with 'biologically active enzymes'.

(a) Name the enzyme commonly used.

(b) Why is this enzyme inactivated in the presence of bleach ?

(c) How is the engineered enzyme different from its natural form ?

(ii) Proteins have maximum functional diversity among biomolecules. Why?

Q32. Explain the method for the selection of recombinants that makes use of insertional inactivation, with the help of suitable diagram. 5

OR

A bacteriophage is known to infect E.coli with pili. How can it be modified to serve as a suitable vector? What are the major advantages of developing vectors based on such bacteriophages?

Q33. Write the steps involved in microbial strain isolation. How can the presence of a particular strain be confirmed? 5

OR

Differentiate between Fed Batch and Continuous microbial culture, along with well defined graphs for them.