

Sample Question Paper
Class XII (2020-21)
Biotechnology (045) Theory

Time: 3 Hours

Maximum Marks: 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. All questions are compulsory.
- (iii) Section A has 14 questions of 1 marks each and two 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 few questions. A student has to attempt only one of the alternatives in such questions.
- (v) Wherever necessary, neatly labeled diagrams should be drawn.

| SECTION A | | |
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| 1. | What is a shuttle vector? | 1 |
| 2. | Name the amino acids involved in the catalytic triad that regulates charge -relay system in the enzyme Chymotrypsin? | 1 |
| 3. | Specify one advantage of developing vectors based on M13. | 1 |
| 4. | On which chromosome in humans, is the genetic defect for the Huntington disease located? | 1 |
| 5. | Name the red algae from which agar is obtained. | 1 |
| 6. | What is RFLP? | 1 |
| 7. | What are nutraceutical proteins? | 1 |
| 8. | What is the disadvantage of using primary animal culture as compared to secondary culture? | 1 |
| 9. | Counting genes and predicting their presence have proved to be laden with inaccuracies. Give reasons. | 1 |
| 10. | Which technique is used to confirm the detection of Sickle cell anaemia? Who developed this technique? | 1 |
| 11. | <p>(i) Assertion – Native enzyme subtilisin is easily inactivated by bleach</p> <p>Reason- Site directed mutagenesis at codon position 222 to replace methionine with alanine is found best in terms of activity and stability</p> <p>(a) Both Assertion and Reason are true and the reason is the correct</p> | 1 |

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| | <p>explanation of the assertion</p> <p>(b) Both Assertion and Reason are true but the reason is not the correct explanation of the assertion</p> <p>(c) Assertion is true but Reason is false</p> <p>(d) Both Assertion and Reason are false</p> <p style="text-align: center;">OR</p> <p>(ii) Assertion- OKT-3 is used to prevent graft rejection following kidney transplantation</p> <p>Reason- OKT-3 blocks immune cells which attack foreign grafts.</p> <p>(a) Both Assertion and Reason are true, and the reason is the correct explanation of the assertion</p> <p>(b) Both Assertion and Reason are true, but the reason is not the correct explanation of the assertion</p> <p>(c) Assertion is true but Reason is false</p> <p>(d) Both Assertion and Reason are false</p> | |
| 12. | <p>Composition of minerals like calcium and phosphorus in mg/ml is highest in-</p> <p>(a) Cow milk</p> <p>(b) Buffalo milk</p> <p>(c) Human milk</p> <p>(d) Goat milk</p> | 1` |
| 13. | <p>RefSeq is a curated database of:</p> <p>(a) mRNA and proteins</p> <p>(b) DNA and proteins</p> <p>(c) DNA and m RNA</p> <p>(d) DNA and t RNA</p> | 1 |
| 14. | <p>During isolation of streptomycin, clear broth is-</p> <p>(a) discarded</p> <p>(b) subjected to liquid-liquid extraction chromatography</p> <p>(c) subjected to ultra filtration</p> <p>(d) subjected to solubilization of proteins</p> | 1 |
| 15. | <p><u>Read the following and answer any four questions from 15 (i) to 15 (v)</u></p> <p><u>Testing for COVID-19 using PCR</u></p> <p>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</p> | 4 |

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| | <p>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 2^{35}.</p> <p>PCR based diagnosis is faster, safer and more specific because it does not use live pathogens.</p> | |
| (i) | <p>The sequence of steps in PCR is-</p> <p>(a) Denaturation, annealing, extension (b) Annealing, denaturation, extension (c) Extension, annealing, denaturation (d) Denaturation, extension, annealing</p> | |
| (ii) | <p>A primer is-</p> <p>(a) short ss piece of DNA (b) short ds piece of DNA (c) short ds piece of RNA (d) Either (b) or (c)</p> | |
| (iii) | <p>After n cycles, the number of DNA copies produced are-</p> <p>(a) n^2 (b) 2^n (c) $n \times 2$ (d) $n \div 2$</p> | |
| (iv) | <p>Taq DNA polymerase synthesizes DNA at a temperature of around 70°C as it is-</p> <p>(a) thermophilic (b) thermostable (c) thermoregulator (d) thermolabile</p> | |
| (v) | <p>Culture based approaches for detecting pathogens, as compared to PCR based assays are-</p> <p>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.</p> | |
| 16. | <p><u>Read the following and answer any four questions from 16 (i) to 16 (v)</u></p> <p><u>Tissue Culture in Rose Propagation</u></p> <p>In January 2014, an experiment was conducted to explore the intricacies of in vitro propagation of <i>Rosa hybrida</i> from explants. The purpose was to determine the proper basal medium and growth regulators for these tissue culture techniques. Plant hormones play a pivotal role in growth and differentiation of cultured cells and tissues. An acidic pH is also very important. There are several types of media like</p> | 4 |

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| | <p>MS, LS, B5 and Nitsch's medium, and the choice of media is dictated by the plant species, variety or plant part. However, the most extensively used nutrient medium is MS medium, which was developed by Murashige and Skoog in 1962.</p> <p><i>Rosa hybrida L.</i> species are propagated around the world, using seed propagation, micropropagation, stem cuttings, budding, grafting, and even tissue culture. To increase the productivity of roses, somatic hybridization is also thought of.</p> | |
| (i) | <p>To enhance the productivity through micropropagation, which medium is generally used.</p> <p>(a) MS medium (b) LS (c) B5 (d) Nitsch's medium</p> | |
| (ii) | <p>An optimum pH is very important in plant cell tissue culture. It is usually:</p> <p>(a) 8.7 (b) 7.7 (c) 9.7 (d) 5.7</p> | |
| (iii) | <p>In order to enhance the productivity of rose plants, which of the following could be an effective strategy?</p> <p>(a) Somatic hybridization (b) Generation of haploids (c) Embryo rescue (d) Generation of triploids</p> | |
| (iv) | <p>Which technique is not included in vegetative propagation?</p> <p>(a) Layering propagation (b) Transgenic (c) Budding (d) Grafting</p> | |
| (v) | <p>The term explant used in the passage is ...</p> <p>(a) any part of the plant (b) only shoot (c) only root (d) only leaf</p> | |
| SECTION B | | |
| 17 | <p>A given protein with a molecular weight of 20,000 daltons containing 5,4,3,2, and 1 charges, is subjected to mass spectrometry. Find the sequence of protein ions detected by the mass spectrometer.</p> <p style="text-align: center;">OR</p> <p>Thalassemic patients produce excess alpha or beta subunits of haemoglobin leading</p> | 2 |

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| | to impaired oxygen-binding capacity by their erythrocytes. How can the subunit produced in excess be determined? | |
| 18 | Which information can be retrieved from the following databases? i) EMBL ii) PDB | 2 |
| 19 | Name any two diseases showing gene polymorphism with complex inheritance. OR (a) Which database was created to manage the redundancy in EST data? (b) What is the role of the curator in Bio-informatics. | 2 |
| 20 | Name any two medical conditions for which stem cells can be used. | 2 |
| 21 | Differentiate between somaclones and gametocloning. Who proposed the term somaclones? | 2 |
| 22 | 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 |
| 23 | a) 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? b) What are Interferons? | 2 |
| 24 | How does the metagenomics approach help to identify novel genes present in the environment? Explain the process. | 2 |
| 25 | Specify two advantages of animal cell culture. | 2 |
| SECTION C | | |
| 26 | Which functional property of <i>whey protein</i> is exploited in the following food systems: (i) Eggless cakes; (ii) Soups; (iii) Coffee whiteners Also, state their mode of action. | 3 |
| 27 | Listed below are four different single strands of DNA. Which of these would you expect to be cleaved by a restriction endonuclease? Give reason. (a) ACTCCAGAATTC ACTCCG (b) ACTCCACTCCCGACTCCG (c) GCCTCATTCGAAGCCTGA (d) GAGCGGTTTATCTGAGCAG OR Students of Class XII visited Microbial Type Culture Collection, Chandigarh and observed microbial cultures of <i>Providencia stuartii</i> , <i>Streptomyces albus</i> and <i>Haemophilus aegyptus</i> . Name the restriction enzymes obtained from them and also specify their restriction sites | 3 |
| 28 | With the help of a diagram, show the cultivation of adult stem cells from bone marrow and their differentiation into specialized cells. | 3 |

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| | Name two scientists who established the field of stem cell research | |
| 29 | Considering the impact of Biotechnology in our lives, write any three applications of plant genetic engineering. | 3 |
| 30 | What kinds of analysis can be undertaken using various bioinformatics tools? State any three. | 3 |
| SECTION D | | |
| 31 | What are BCAA? Name any two BCAA. State any two functions of BCAA. Also, explain Biological Value. OR Explain any five protein based products. | 5 |
| 32 | Explain the method for the selection of recombinants that makes use of insertional inactivation, with the help of suitable diagram. OR Explain various steps involved in a recombinant DNA technology experiment. Name any two molecular biologists who helped to create the first r-DNA molecule. | 5 |
| 33 | Write the steps involved in microbial strain isolation. How can the presence of a particular strain be confirmed? OR Differentiate between Fed Batch and Continuous microbial culture, along with well-defined graphs for them. | 5 |
