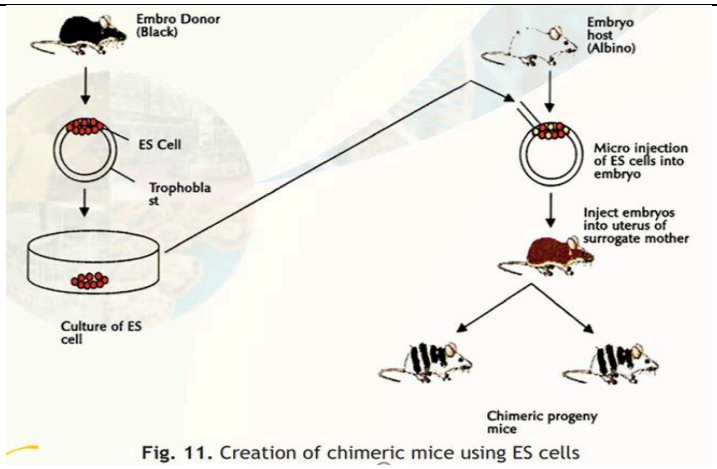
Marking Scheme
BIOTECHNOLOGY (045)
Class-XII (2024-25)

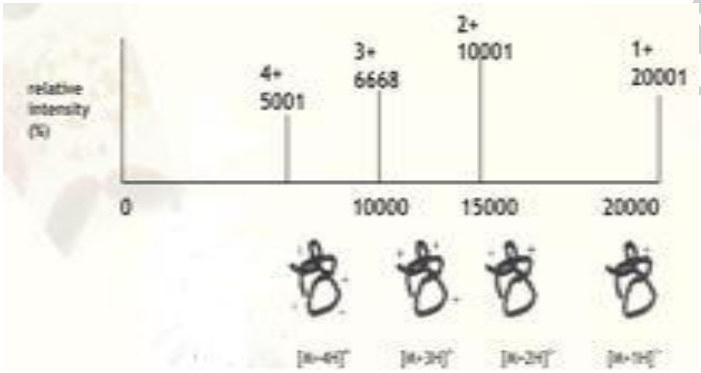
Max. Marks:70 **Time allowed: 3 hours**

<table>
<tr><th>S. No.</th><th>Section - A</th><th>Marks</th></tr>
<tr><td>1</td><td>A. Metagenomics</td><td>1</td></tr>
<tr><td>2</td><td>C. 5-10%</td><td>1</td></tr>
<tr><td>3</td><td>B. (i) and (ii)</td><td>1</td></tr>
<tr><td>4</td><td>C. ethylene forming gene(s)</td><td>1</td></tr>
<tr><td>5</td><td>B. Aspergillus niger</td><td>1</td></tr>
<tr><td>6</td><td>D. (ii) and (iii)</td><td>1</td></tr>
<tr><td>7</td><td>D. Gene expressed in equal measure in both types of cells.</td><td>1</td></tr>
<tr><td>8</td><td>B. Migraine</td><td>1</td></tr>
<tr><td>9</td><td>B. Sickle Cell Anaemia</td><td>1</td></tr>
<tr><td>10</td><td>B. cancer therapy</td><td>1</td></tr>
<tr><td>11</td><td>A. In response to internal and external changes the biochemical machinery of the cell could be changed.</td><td>1</td></tr>
<tr><td>12</td><td>A. Hepatitis B vaccine</td><td>1</td></tr>
<tr><td>13</td><td>A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion.</td><td>1</td></tr>
<tr><td>14</td><td>C. Assertion is true but Reason is false</td><td>1</td></tr>
<tr><td>15</td><td>A. Both Assertion and Reason are true and the reason is the correct explanation of the assertion.</td><td>1</td></tr>
<tr><td>16</td><td>B. Both assertion and reason are true but reason is not the correct explanation of assertion</td><td>1</td></tr>
<tr><td colspan="3">Section-B</td></tr>
<tr><td>17.</td><td>
<table>
<tr><th>Vector Type</th><th>Insert size (kb)</th></tr>
<tr><td>Plasmid</td><td>0.5-8</td></tr>
<tr><td>Bacteriophage lambda</td><td>9-23</td></tr>
<tr><td>Cosmid</td><td>30-40</td></tr>
<tr><td>BAC</td><td>50-500</td></tr>
<tr><td>YAC</td><td>250-1000.</td></tr>
</table>
</td><td>0.5 X 4</td></tr>
</table>

18	<table><tr><th>Cancerous cells</th><th>Non-cancerous cells</th></tr><tr><td>They do not exhibit contact inhibition.</td><td>They exhibit contact inhibition.</td></tr><tr><td>They pile on each other due to uncontrolled growth.</td><td>Don't pile on each other.</td></tr><tr><td>More rounded in shape.</td><td>Less rounded in shape.</td></tr></table>	1 0.5 0.5
19	*Student to attempt either option A or B.* A. In animal cell cultures, cells are at the bottom of the containers and hence can be visualized only by an inverted microscope in which the optical system is at the bottom with the light source on top. **OR** B. Monoclonal antibodies are produced by fusing antigen-activated B lymphocytes that have been immortalised with myeloma cells so that so that the hybrid cells retain the ability of B cells to secrete antibody and the ability of myeloma cells to grow indefinitely. Hybridoma technology has revolutionized the area of diagnostics and antibody-based therapies/ The availability of monoclonal antibodies has helped in early detection of many infectious diseases like hepatitis and AIDS. (any one)	2 1 1
20	Both IEF and SDS-PAGE are powerful techniques which separate proteins on the basis of Isoelectric point and Molecular weight respectively. Proteins are separated over a large surface area in two perpendicular directions/ the resolution obtained is very high. (Any two points)	1 1
21	Unigene was created to manage redundancy in EST data. A curator is the one who checks the newly submitted data in bioinformatics for accuracy.	1 1
	Section - C	
22	A. Sickled RBCs resist malarial infection hence safeguarded that population. B. The substitution of glutamic acid with valine in ScHb results in increase in hydrophobic interaction between the Hb molecules resulting in aggregation and ultimately leading to deformation of RBC to a sickle shape. C. Shape of the Sickle cell RBC is like that of SICKLE.	1 1 1

23	Autoclaving is an important process in microbial cell culture. Autoclaving means heating the desired nutrient or equipment at 15psi at 121^0C for 15-20 minutes. The nutrient medium is autoclaved before using it for culturing microbes to destroy the microbes (fungal spores and bacteria) present in the medium. To sterilize a heat-labile substance such as an antibiotic solution, we make use of techniques like ultra-filtration. In this technique, we make use of membrane filters whose pore size is usually less than 0.5mm.	1 1 0.5 0.5
24	A. (i) Cathranthus roseus (ii) Codeine (iii) Antimalarial (iv) Anticarcinogenic B. A possible solution is provided by cell and root cultures.	0.5 x 4 1
25	A Chymotrypsin folds bringing together Asp102, His 57, Ser 195 in this sequence in space. Asp 102, His 57 and Ser 195 lie in this order forming a charge relay; The negatively charged aspartate carboxylate residue pulls the Ser –OH proton through His, leaving it with a negative charge. Ser195 becomes acidic due to the unique constellation of the three amino acid residues because the protein has folded uniquely in space.	1 1 1
26	• To have proper three dimensional folding. • Removal of introns is not there in the prokaryotes as they lack intron removal machinery. • Modification of proteins (Post-translational modification) is not there.	1 1 1
27	Stem cells could be used to create chimeric mice by taking ES cells from a black mouse and implant it into the embryo of an albino mouse (white). The progeny so developed had skin color of black and white	1 2

	 Fig. 11. Creation of chimeric mice using ES cells	
28	*Student to attempt either option A or B.* A. Replica plating. • Host cells are first plated (master plate) on solid media with the desired antibiotic overnight. • Velvet paper is aligned, pressed on master plate. • With the same alignment it is pressed onto the replica plate. • Keep it overnight, transformed colonies will not grow in replica plate. • The colonies having insert can easily be scored off from master plate by comparing the two plates. **OR** B. Yeast cells have been used extensively for functional expression of eukaryotic genes because of several features. Yeasts are the simplest eukaryotic organisms (unicellular) and like E. coli have been extensively characterised genetically, easy to grow and manipulate and large amounts of cloned genes or recombinant proteins can be obtained from yeast cultures grown in fermenters (large culture vessels). (Any two)	0.5 0.5 x 5 1 2
	Section - D	
29	A. Reciprocal translocation and the disease is CML B. FISH *Student to attempt either subpart C or D.* C. The enzymes, DNA polymerase I makes DNA and DNase I cuts DNA and are combined in a buffered reaction with dNIP's including dUTP labelled with a red or green fluorescence. **OR** D. The status of the disease could easily be identified by counting the number of cells, which appeared yellow. Further, it was possible to monitor the effect of chemotherapy and drugs by taking out samples and counting the number of cells appearing yellow.	1 1 2

30	A. Streptomycin/any other relevant antibiotic. B. Downstream processing. *Student to attempt either subpart C or D.* C. We will disrupt the cell and concentrate the product. **OR** D. Minimum the number of steps, more will be purity and yield of the metabolite.	1 1 2
	Section - E	
31	*Student to attempt either option A or B.* A. (i) The mass spectrometer detects the protein ions at m/z = 2501, 3334, 5001 and 10,001 respectively. (ii)  **OR** B. Essential amino acids and BCAA profile: Essential amino acids are those amino acids which have to be obtained from food and cannot be made in our cells. The branched chain amino acids (BCAA) are essential for the biosynthesis of muscle proteins. They help in increasing the bio-availability of high complex carbohydrates intake and are absorbed by muscle cells for anabolic muscle building activity. Biological value (BV) measures the amount of protein nitrogen that is retained by the body from a given amount of protein nitrogen that has been consumed. It has been observed that the BV of whey proteins is the highest compared to rice, wheat, soya and egg proteins. Protein efficiency ratio (PER)- PER is used as a measure of growth expressed in terms of weight gain of an adult by consuming 1g of food protein. The PER value of the following proteins are arranged in decreasing order- whey, milk, casein, soya, rice, wheat.	0.5x4 3 1 1 1 2
32	*Student to attempt either option A or B.* A. The basic technique of plant tissue culture involves the	0.5 x 6

following steps:

(i) Selection of suitable explants like shoot tip, leaf, cotyledon and hypocotyls.

(ii) Surface sterilization of the explants by disinfectants (e.g. sodium hypochlorite) and then washing the explants with sterile distilled water.

(iii) Inoculation (transfer) of the explants onto the suitable nutrient medium (which is sterilized by autoclaving or filter-sterilized to avoid microbial contamination)in culture vessels under sterile conditions (i.e., in laminar flow cabinet).

(iv) Growing the cultures in the growth chamber or plant tissue culture room, having the appropriate physical conditions [i.e., artificial light (16 h photoperiod), temperature (~26 C) and relative humidity (50-60%)].

(v) Regeneration of roots and shoots from cultured plant tissues and their elongation.

(vi) Transfer to the green house and then to fields.

Applications of Plant cell culture- 2

- Micropropagation
- Producing virus free plants
- Producing artificial seeds
- Embryo rescue in interspecific & intergeneric hybrids
- Generating haploids & triploids
- Somatic hybrids & Cybrids
- In vitro germplasm conservation
- Somaclonal variations
- Production of secondary metabolites (any 2)

OR

B. The protoplasts are isolated from two species of different plants and are allowed to fuse with each other in the presence of fusogenic agents like polyethylene glycol (PEG - most widelyused and most successful method for protoplast fusion) or by electro-fusion. The required fusion products (hybrid cells) are selected by various methods such as the use of different antibiotic markers or fluorescent dyes for two different protoplasts — 1 + 1

Cybrids- cytoplasmic hybrids (cybrids) through protoplast fusion in which the genomesof one of the partners is lost. — 1

Edible vaccines offer following advantages over conventional vaccines: — 2

- Low cost

	- Alleviation of storage problems - Easy delivery system by feeding (any other relevant point)	
33	*Student to attempt either option A or B.* A. Dr Frederick Sanger Sanger's Method: Whenever ddNTP comes in the DNA synthesis, further synthesis of DNA stops due to non-formation of 3'-5' phospodiester linkage as in ddNTP , there is 3' H (Instead of 3'OH) Structure of any ddNTP- (dideoxy ribose is a pentose sugar witoxygen atom removed from each 2' and 3' position. It must include the following reagents: - Single strand DNA which needs to be sequenced. - A primer with a free 3'-OH. - DNA polymerase - dNTPs - ddNTPs (1 % of total dNTPs) Method: - Primer extension in 4 different tubes each containing a specific ddNTP at low concentration. - Termination at the point where ddNTP is incorporated. - Gel electrophoresis. - Autoradiography-+reading of gel sequence. **OR** B. - Dye termination method is automated/ doesn't use radioactive isotopes so is safer/ uses single lane Agarose gels/fewer steps needed. (Any two reasons for 1M each) - An autoradiogram is read from bottom to top because for arriving at the original sequence from 3' to 5', every C is read as G, T as A, A as T and G as C as we arrive at the sequence from anode to cathode. - Bacteria produce restriction enzymes to restrict the multiplication of Phage genome. Bacteria protect their own DNA from phage action by methylation of its restriction site available in chromosomal DNA.	1 4 2 1 2

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