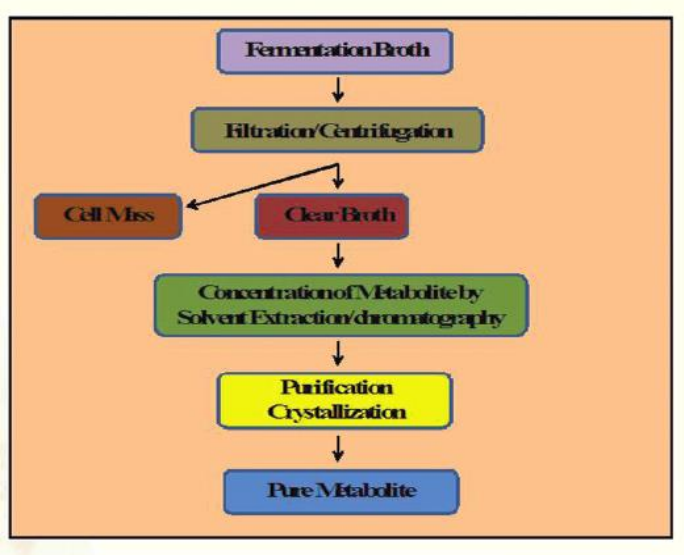
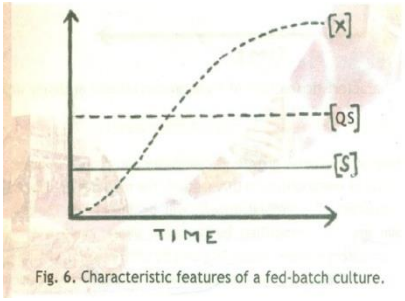
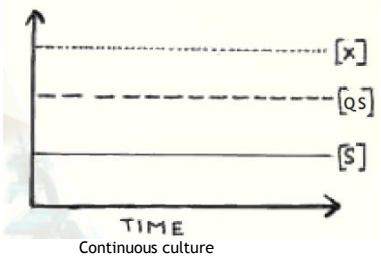
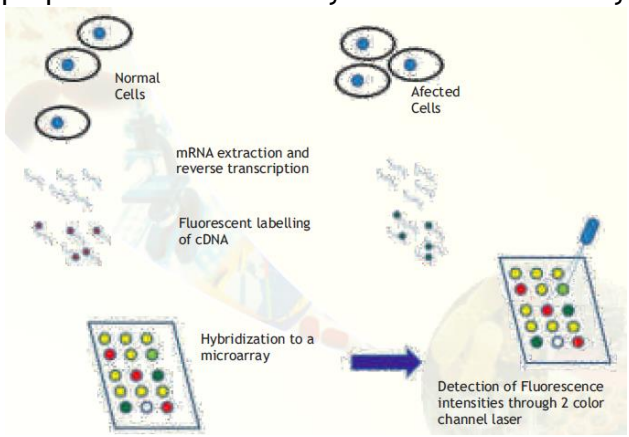
Marking Scheme of Sample Question Paper
Class – XII
Biotechnology (Theory) 2016 -17
Sub code: 045

	Section A	
1.	Sparging / forced aeration	1
2.	A mini version of the commercial plant is essential to validatelab processes on an intermediate scale before attempting commercial production	1
3.	To utilize barnase/ barstar system	1
4.	Plant cells in culture cannot perform photosynthesis	1
5.	To periodically provide fresh nutrients and growing space to cells	1
6.	tPA / Tissue plasminogen activator	1
	Section B	
7.	Type II restriction enzymes are used because these can recognise and cut specific cleavage sites in palindromic sequences	1+1
8.	Ionic bonds These involve interactions between the oppositely charged groups of a molecule. For example the positively charged amino acid side chains of lysine and arginine can form salt bridges with the negatively charged side chains of aspartate and glutamate. These ionic interactions are also known as salt bridges because these are dominant bonds found in salts like sodium chloride wherein the positively charged sodium ion interacts with the negatively charged chloride ion. Hydrogen bonds Hydrogen bonds are formed by "sharing" of a hydrogen atom between two electronegative atoms such as Nitrogen and Oxygen. In this case strongly polarised bonds between hydrogen and a small, very electronegative atom (N,O or F) allow a strong dipole-dipole bond to be formed with another small very electronegative element (N, O or F). Importantly, the very small sizes of these elements also allow them to approach each other so closely that a partial covalent bond is also formed (*e.g.* O-H---N). Van der Waals forces These forces are weak attractions (or repulsions) which occur between atoms at close range. The Van der Waals types of forces are essentially contact forces, proportional to the surface areas in contact. Even though weak, these bonds can be important in macromolecules because the large surface areas involved can result in reasonably large total forces. Hydrophobic interactions Hydrophobic interactions can be best explained by taking an example of oil in water. The oil tends to separate out fairly quickly because the water forces them out. The hydrophobic interaction is thus a manifestation of hydrogen bonding network in water. In water, each molecule is potentially bonded to four other molecules through H-bonds	1+1 (any two)
9.	c DNA library would be preferred. mRNA molecules are highly unstable as they are easily degraded by RNAses .Therefore mRNA molecules are copied into the more stable DNA (now called cDNA) before cloning. The construction of a cDNA library begins with the isolation of mRNA from a given cell type or tissue which are copied into cDNA using a special enzyme called reverse transcriptase. The procedure results in double-stranded cDNA which can be incorporated into vectors such as pBR322.These recombinant vectors are transformed into host bacterial cells eg. E.coli. This forms a cDNA library.	1+1

10.	i) Maintenance of pH ii) Maintenance of physiological conditions (%CO2, temperature) iii) Use of inhibitors to prevent the action of proteolytic enzymes iv) Avoidance of agitation or addition of chemicals which may denature the protein v) Minimize processing time	1+1 (any two)
11.	Due to the existence of overlapping genes, splice variants, post translational and post transcriptional modifications	2
12.	$u = \frac{2.303(\log X_t - \log X_0)}{t}$ $u = \frac{2.303(\log 10^7 - \log 10^4)}{4}$ ($X_0 = 10^4$, $X_t = 10^7$, t= 4 hours) Solving the above equation by using the values, we get, u = 1.73/hr $t_d = \frac{0.693}{1.73}$ = 0.4 hrs 0.4x60 = 24 mins OR n = 3.3 (Log 10 - Log 10) = 3.3 (7 - 4) = 10 t = 240 minutes / 10 d = 24 minutes	2
13.	Ti plasmid vectors are disarmed because they do not require any chemical or equipments to transfer the gene of interest into plant cells. The gene of interest is incorporated in the T- DNA region of Ti plasmid	1+1
14.	Serum is a source of various amino acids, hormones, lipids, vitamins,polyamines and salts containing various ions. Serum also contains growth factors required for proliferation and attachment of animal cells to culture vessels. Antibiotics control the growth of bacterial and fungal contaminants	1+1
	Section C	
15.	Insertional inactivation of Lac Z gene leads to suppression of its activity. This ensures selection of recombinant cells which appear white in colour from non-recombinant cells which appear blue in colour (Blue-White selection).	3
16.	Yep contains LEU 2 gene which codes for an enzyme required for the synthesis of amino acid leucine. Recombinant yeast cells will grow on a medium lacking leucine and hence can be selected over cells not containing the plasmid (which cannot grow on such a medium).	3
17.	A popular method called Matrix Assisted Laser Desorption Ionisation (MALDI) is used to volatalise and protonate peptides and proteins. In this procedure, the sample is transferred from a condensed phase to a gas phase with the help of a solid matrix. This technique determines the molecular weight of proteins by separating molecular ions according to their mass/charge ratio. Uses: To obtain protein structural information such as peptide mass or amino acid sequences. To identify the type and location of amino acid modification within proteins. OR Principle of IEF: Separation of proteins on the basis of their different pI values	1+2

	Principle of SDS PAGE: Separation of proteins on the basis of their size 2D electrophoresis is better because proteins are separated into 2D patterns with high resolution on the basis of charge and size.	1+1+1
18.	Steps in flowchart  	3
19.	SNPs or single nucleotide polymorphisms are common variants in DNA that can have any one of the four DNA bases (A,T,G,C) at a single site, so that different individuals may have different bases at these positions. Relevance of studying SNPs using any 2 of the following applications: 1. DNA fingerprinting 2. Medicine 3. Population genetics Ancestral relationships	1 1+1
20.	 Fig. 6. Characteristic features of a fed-batch culture.  Continuous culture Continuous culture is suitable for obtaining maximum amount of cellular products.	1+1 1
21.	Metagenomics approach has been developed to identify and select microbial genes synthesizing novel molecules. This approach directly utilizes the large number of microbial genomes present in an environmental niche, for example in soil, in water such as ocean or in human gut. These genomes are contributed by both the culturable and the non-culturable variety of microbes and together constitute what has been termed as metagenome. The collective DNA is extracted from a sample of soil, water or any other environmental niche. It is subjected to restriction digestion using restriction endonucleases and the fragments are cloned into suitable vectors. The clones are then screened for presence of a variety of molecules. The clones expressing novel molecules or molecules with improved characteristics are used for large-scale production by	3

	fermentation techniques.	
22.	The genes encoding antigenic proteins can be isolated from pathogens and expressed in plants. Such transgenic plants or their tissues producing antigens can be eaten for vaccination / immunization. These are called edible vaccines. Edible vaccines offer following advantages over conventional vaccines: 1. Low cost 2.Alleviation of storage problems 3.Easy delivery system by feeding (any other relevant point)	1 1+1
23.	Plants raised by tissue culture of somatic hybrid cells formed by fusion of plant cell protoplasts are called as somatic hybrids. Procedure: Isolation of plant cell protoplasts and their fusion. Selection of hybrid cells and raising by plant tissue culture	1 2
24.	In Hybridoma technology, mAbs are produced by fusing antigen-activated B lymphocytes that have been immortalised with myeloma cells using polyethylene glycol. This technique was developed by Ceasar Milstein and George Kohler (Nobel Prize winners). The hybrid cells retain the ability of B cells to secrete antibody and the ability of myeloma cells to grow indefinitely. The hybrid clones when grown in culture produce epitope-specific mAb. Antibodies bind to specific domains of antigens known as epitopes. The antibodies present in serum are a heterologous population released by different populations of B-lymphocytes and therefore are known as polyclonal antibodies. The polyclonal antibodies can bind to related epitopes and are therefore do not give accurate results in diagnostics. Monoclonal antibodies (mAbs), on the other hand bind specifically to an epitope on an antigen and therefore are useful in detecting specific antigens (diagnostics) or blocking their binding by other molecules. Monoclonal antibodies provide accurate results and are therefore used in diagnostics. 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.	3
25.	Kidney cells are anchorage dependant. Hence scale up is done by culturing the kidney cells using roller bottles with micro carrier beads. The culture bottles are kept in CO_2 incubators for the growth of cells. This system largely increase the surface area for the growth of anchorage dependant animal cells and therefore scale up of cultured animal cells is achieved.	3
	Section D	
26.	(a) BCAA are essential for biosynthesis of muscle proteins/ help in anabolic muscle building activity/protect existing muscle mass/reduce muscle breakdown/act as an energy source/carbon part is used as fuel and nitrogen part is used to make alanine which turns into glucose in liver. (b) Whey is used to cure spectrum of illnesses like jaundice, infected skin lesions, urinary tract infections. Whey protein results in the elevation of tripeptide glutathione in cells which helps in the detoxification of xenobiotics and protects cells from the action of free radicals.	1+1+1 (any three points) 2
27.	3'OH group is absent in ddNTP's which cause termination of growing DNA chain during Sanger's DNA sequencing method. DNA fragments formed by chain termination in all the four tubes for the given strand . 3' ATGCTAGC 5'	1 1+1+1+1

	OR Selective amplification of microbial gene (in test water sample) using microbe specific primers by PCR. Brief explanation of the process with PCR technique	1 4
28.	Cellular response to the environment can be studied by comparing the amounts of many different mRNA in normal and affected cells(eg. Cancerous cells). (Explanation of preparation of microarray and cDNA microarray technique).  Major steps involved in comparative microarray hybridization experiments between normal and affected (for example, cancerous) cells. OR a) i) EMBL -- Nucleotide sequence ii) PDB – 3D structure of proteins iii)PALI – Phylogenetic analysis and alignment of proteins b) Provides a means of discovery of all the genes/ shows relationship between genes/ tools for future experimentation/ organizes all genetic information about organisms (any two points).	3 2 3 2