

Marking Scheme
Strictly Confidential
(For Internal and Restricted use only)
Senior Secondary School Supplementary Examination, 2026 (XII)
SUBJECT NAME: - BIOTECHNOLOGY (SUBJECT CODE 045) (Q.P. CODE – 99)

General Instructions: -

1	You are aware that evaluation is the most important process in the actual and correct assessment of the candidates. A small mistake in evaluation may lead to serious problems which may affect the future of the candidates, education system and teaching profession. To avoid mistakes, it is requested that before starting evaluation, you must read and understand the spot evaluation guidelines carefully.
2	“Evaluation policy is a confidential policy as it is related to the confidentiality of the examinations conducted, evaluation done and several other aspects. Its leakage to public in any manner could lead to derailment of the examination system and affect the life and future of millions of candidates. Sharing this policy/document to anyone, publishing in any magazine and printing in Newspaper/Website, etc. may invite action under various rules of the Board and IPC.”
3	Evaluation is to be done as per instructions provided in the Marking Scheme. It should not be done according to one's own interpretation or any other consideration. Marking Scheme should be strictly adhered to and religiously followed. However, while evaluating, answers which are based on latest information or knowledge and/or are innovative, may be assessed for their correctness otherwise and due marks be awarded to them. In Class-XII, while evaluating two competency-based questions, please try to understand given answer and even if reply is not from marking scheme but correct competency is enumerated by the candidate, due marks should be awarded.
4	The Marking scheme carries only suggested value points for the answers. These are in the nature of Guidelines only and do not constitute the complete answer. The students can have their own expression and if the expression is correct, the due marks should be awarded accordingly.
5	The Head-Examiner must go through the first five answer books evaluated by each evaluator on the first day, to ensure that evaluation has been carried out as per the instructions given in the Marking Scheme. If there is any variation, the same should be zero after deliberation and discussion. The remaining answer books meant for evaluation shall be given only after ensuring that there is no significant variation in the marking of individual evaluators.
6	Evaluators will mark (✓) wherever answer is correct. For wrong answer CROSS 'X' be marked. Evaluators will not put right (✓) while evaluating which gives an impression that answer is correct and no marks are awarded. This is most common mistake which evaluators are committing.
7	If a question has parts, please award marks on the right-hand side for each part. Marks awarded for different parts of the question should then be totalled up and written in the left-hand margin and encircled. This may be followed strictly.
8	If a question does not have any parts, marks must be awarded in the left-hand margin and encircled. This may also be followed strictly.
9	If a student has attempted an extra question, answer of the question deserving more marks should be retained and the other answer scored out with a note “Extra Question” .
10	No marks to be deducted for the cumulative effect of an error. It should be penalized only once.
11	A full scale of marks 0 to 70 (example 0 to 80/70/60/50/40/30 marks as given in Question Paper) has to be used. Please do not hesitate to award full marks if the answer deserves it.

12	Every examiner has to necessarily do evaluation work for full working hours i.e., 8 hours every day and evaluate 20 answer books per day in main subjects and 25 answer books per day in other subjects (Details are given in Spot Guidelines). This is in view of the reduced syllabus and number of questions in question paper.
13	Ensure that you do not make the following common types of errors committed by the Examiner in the past :- • Leaving answer or part thereof unassessed in an answer book. • Giving more marks for an answer than assigned to it. • Wrong totalling of marks awarded on an answer. • Wrong transfer of marks from the inside pages of the answer book to the title page. • Wrong question wise totalling on the title page. • Wrong totalling of marks of the two columns on the title page. • Wrong grand total. • Marks in words and figures not tallying/not same. • Wrong transfer of marks from the answer book to online award list. • Answers marked as correct, but marks not awarded. (Ensure that the right tick mark is correctly and clearly indicated. It should merely be a line. Same is with the X for incorrect answer.) • Half or a part of answer marked correct and the rest as wrong, but no marks awarded.
14	While evaluating the answer books if the answer is found to be totally incorrect, it should be marked as cross (X) and awarded zero (0) Marks.
15	Any unassessed portion, non-carrying over of marks to the title page, or totalling error detected by the candidate shall damage the prestige of all the personnel engaged in the evaluation work as also of the Board. Hence, in order to uphold the prestige of all concerned, it is again reiterated that the instructions be followed meticulously and judiciously.
16	The Examiners should acquaint themselves with the guidelines given in the “Guidelines for Spot Evaluation” before starting the actual evaluation.
17	Every Examiner shall also ensure that all the answers are evaluated, marks carried over to the title page, correctly totalled and written in figures and words.
18	The candidates are entitled to obtain photocopy of the Answer Book on request on payment of the prescribed processing fee. All Examiners/Additional Head Examiners/Head Examiners are once again reminded that they must ensure that evaluation is carried out strictly as per value points for each answer as given in the Marking Scheme.

MARKING SCHEME
BIOTECHNOLOGY (Subject Code - 045)
(PAPER CODE: 99)

Q.No.	EXPECTED OUTCOMES/VALUE POINTS	Marks
SECTION – A		
1.	(B) Prevent excessive foam formation. Unit-VI, Chapter-1, Pg-87	1
2.	(B) Pluripotent Unit-VI, Chapter-3, Pg-151	1
3.	(B) Hybridisation of complementary nucleic acid sequences labelled with fluorescent dyes. Unit-V, Chapter-3, Pgs-65, 66, 67	1
4.	(C) Meristem Unit-VI, Chapter-2, Pg-117	1
5.	(D) Creating turbulence for better aeration. Unit-VI, Chapter-1, Pg-88	1
6.	(B) DNA Ligase creates phosphodiester bonds between adjacent nucleotides in DNA. Unit-V, Chapter-1, Pg-7	1
7.	(B) Some SNPs vary in frequency between different populations. Unit-V, Chapter-3, Pg-63, 64	1
8.	(A) They have descended from a common ancestor. Unit-V, Chapter-3, Pg-79	1
9.	(A) Proteins Unit-V, Chapter-2, Pg-53	1
10.	(C) Yellow Unit-VI, Chapter-3, Pg-142	1
11.	(D) EMBL Unit-V, Chapter-3, Pg-80	1
12.	(B) It contains live beneficial bacteria. Unit-V, Chapter-2, Pg-50	1
13.	(A) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A). Unit-VI, Chapter-3, Pg-142	1

14.	(C) Assertion (A) is true, but Reason (R) is false. Unit-VI, Chapter-1, Pg-94	1
15.	(B) Both Assertion (A) and Reason (R) are true, but the Reason (R) is not the correct explanation of the Assertion (A) Unit-VId, Chapter-1, Pg-9, 10	1
16.	(A) Both Assertion (A) and Reason (R) are true and the Reason (R) is the correct explanation of the Assertion (A) Unit-VI, Chapter-2, Pg- 118	1
	SECTION - B	
17.	Origin of replication → To replicate cloning vector Selectable marker gene → Selection of recombinants Unit-V, Chapter-1, Pg- 8 OR PVC – 19 vector contains Lac Z gene with a restriction enzyme site for insertional inactivation. Active Lac Z expresses β galactosidase that turns bacterial colonies blue on X-gel medium. Unit-V, Chapter-1, Pg- 17	1+1=2 1+1=2
18.	OKT3 is the therapeutic monoclonal antibody used during organ transplantation. OKT3 binds and blocks the function of CD3 in T-cells. Unit-VI, Chapter-3, Pg- 150	1+1=2
19.	- Contact inhibition means when animal cells grow and reach the walls of container, they stop growing further. - Normal animal cells. Unit-VI, Chapter-3, Pg- 138	1+1=2
20.	- By comparing the electrophoretic mobility of normal (Hb) and sickle cell haemoglobin (ScHb). - Hb moved faster than ScHb Unit-V, Chapter-2, Pg- 36	1+1=2
21.	DNase I introduces random single stranded nicks in DNA to be labelled. DNA polymerase I replaces nucleotides at the nick site with fluorescent-labelled nucleotides. Unit-V, Chapter-3, Pg-65	1+1=2

	SECTION - C	
22.	In chymotrypsin, the charge-relay system activates the Serine 195 residue, making it a nucleophile. This activated ser 195 attacks the peptide bond of substrate, leading to cleavage. Asp 102, His 57 and Ser (195) Unit-V, Chapter-2, Pgs-34, 35	1+1+1=3
23.	Flowchart for isolation of streptomycin from <i>Streptomyces gresius</i> as in Fig.9, pg 100. (any other relevant example/flowchart) can be considered Unit-VI, Chapter-1, Pg-99, 100, 101	2+1=3
24.	- Genes encoding antigenic proteins are inserted into plants of edible variety using RDT. - When edible part of such plant is eaten, it stimulates immune response. - Edible vaccines are 100% safe/non-allergic/alleviates storage problems/any other point. Unit-VI, Chapter-2, Pg-130	1+1+1=3
25.	1st Dimension : Isoelectric focusing : Proteins are separated based on isoelectric points (PIs) 2nd Dimension : SDS PAGE : Proteins are separated according to molecular size. - Significance – Separation of proteins is achieved based on charge and size Unit-V, Chapter-2, Pg-37, 38	1+1+1=3
	Answer of the alternative question for the visually impaired in lieu of Q.25:	
25.	- Matrix Assisted Laser Desorption Ionisation. - The peptide sample is mixed with matrix which volatilizes or vaporizes when struck by laser; carries. - Peptide molecules into gas phase and then transfers protons to form charged peptide ions suitable for mass spectrometric detection. Unit-V, Chapter-2, Pg-45, 46	1+1+1=3
26.	- Principle : Variation in size (length) of the restriction enzyme generated fragments of DNA of different individuals of same species. - Steps : Digestion of DNA of different individuals with same restriction enzyme which produces DNA fragments of different lengths. - Separation of these fragments by gel electrophoresis and further analysis of gel pattern obtained.	1+2=3

	Unit-V, Chapter-1, Pg-6, 7	
27.	- To preserve membrane integrity. - Salt and glucose, amino acids. (any 2) - Osmometer. Unit-VI, Chapter-3, Pg-141	$1+\frac{1}{2}+\frac{1}{2}+1=3$
28.	Alu I cuts symmetrically Explanation with palindromic sequence. EcoRI cuts asymmetrically Explanation with palindromic sequence. Unit-V, Chapter-1, Pg-5, 6 (Fragments of DNA cutting mechanisms of Alu I and EcoRI) (1) Alu I Enzyme : $ \begin{array}{ccc} 5' - A - G - \downarrow C - T - 3' & \longrightarrow & 5' - A - G + C - T - 3' \\ 3' - T - C - \uparrow G - A - 5' & & 3' - T - C + G - A - 5' \end{array} $ (Symmetrical cuts) (2) EcoRI Enzyme : $ \begin{array}{ccc} 5' - G - \downarrow A - A - T - T - C - 3' & \longrightarrow & \\ 3' - C - T - T - A - A - \uparrow G - 5' & & \\ 5' - G - 3' & + & 5' - A - A - T - T - C - 3' \\ 3' - C - T - T - A - A - 5' & & 3' - G - 5' \end{array} $ (Assymetrical cuts) OR 'E' from genus 'Escherichia' 'Co' from species 'coli' 'R' from strain 'RY 13' I (Roman numeral) for the first restriction enzyme discovered from that strain. According to the above nomenclature the name of the RE is given as EcoRI. - EcoRI is type II RE because it cleaves a DNA sequence within its recognition site/in its palindromic sequence.	$\frac{1}{2}+1+\frac{1}{2}+1=3$

2+1=3

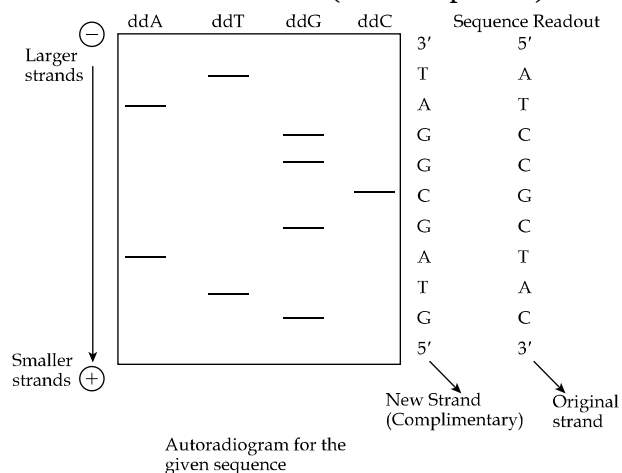
	Unit-V, Chapter-1, Pg-4, 5	
	SECTION - D	
29.	(a) Because in response to internal and external environmental conditions, there are several changes in total number and types of proteins. (b) Expression proteomics. (c)(i) Structural proteomics deals with large scale study of 3-D structures of proteins to understand their functions and Interactions. Application-useful in drug design and discovery/any other relevant point. OR (c)(ii) Functional proteomics is the study of protein functions, interactions and activities within a cell under specific conditions. Application : Used to identify novel proteins important for translocating important molecules from cytoplasm of a cell and vice versa / any other relevant point. Answer of Q.(i), (ii), (iii) : Unit-V, Chapter-3, pgs-69,70,71	1 1 1+1=2 1+1=2
30.	(a) Regulatory sequences that ensure efficient transcription, translation, etc. are present in expression vectors. (b) Due to regulatory switch, the production of r-protein does not occur until required. (c)(i) Stable vector ensures high yield of r-protein/gene expression/foreign gene is retained within cells during cell division/any other relevant points (any two) OR (c)(ii) Challenges – Instability of expression vectors/Low expression level of r-protein/Inclusion bodies/Improper folding of r-protein/any other relevant point. Answer of Q.(i), (ii), and (iii): Unit-VI, Chapter-1, pgs-102, 103	1 1 1+1=2 1+1=2
	SECTION - E	
31.	(A) • Using site directed mutagenesis Met 222 was replaced by several amino acids in native subtilisin. • Alanine was replaced at position 222 for methionine finally. • r-subtilisin is active and stable in presence of bleach whereas native enzyme gets in activated by bleach. Unit-V, Chapter-2, pgs-51, 52 OR (B) • BCAAs help in muscle protein synthesis, reduce muscle breakdown during exercise, enhance performance, provide energy/any other relevant point (any 4)	1+1+1+1+1=5 1x4=4 +1=5

	Definition of Biological value of proteins. Unit-V, Chapter-2, pgs-53, 54	
32.	(A) - Protoplasts are isolated by enzymatic methods by using cell wall digesting enzymes. - Protoplasts are usually cultured by suspension cultures in petriplates. - Protoplasts can be fused by using polyethylene glycol (PEG) or by electro-fusion. - Heterokaryons (Hybrid cells) can be selected by using different antibiotic markers/or fluorescent dyes for two different protoplasts. Unit-VI, Chapter-2, pgs-114, 115 OR (B) - Pests reduce yield and quality of crop. - Pesticides severely affect human health and environment. - Genetic engineering is done by introducing genes for pest resistance (cry genes) into crop plants/Bt genes (from <i>Bacillus thuringiensis</i>) - Btcotton/rice/maize/potato/tomato/brinjal/cauliflower/cabbage/any other relevant point (any one example) Unit-VI, Chapter-2, Pgs-125, 126	$1+1+1+1+1 = 5$ $1+1+2+1 = 5$
33.	(A) - Fig1, Pg 3 for schematic representation showing the basic steps of RDT. - Alkaline phosphatase prevents self ligation of the vector. Unit-V, Chapter-1, pg-3 E-Coli cells containing cloned plasmids. Fig. 1. Schematic representation of the basic steps of RDT Unit-V, Chapter-1, pg-3	$4+1=5$

OR

- (B)
- Principle : DNA synthesis is done in vitro using d NTPs along with small amounts of 2',3' dideoxynucleotide tri-phosphates (dd NTPs).
 - Incorporation of ddNTPs terminates chain elongation because ddNTPs lack a 3' – OH group.
 - The resulting DNA fragments of varying lengths are separated to determine the DNA sequence.
 - Given sequence : 5' ATCCGCTAC 3' complementary sequence : 3' TAGGCGATG 5' Auto radiogram obtained while sequencing.
 - Set of primers → 5' - GTAGC – 3' (backward primer)
→ 5' - TAGGC – 3' (forward primer)

3+2=5



Unit-V, Chapter-1,pgs-22 to 25

- o O o -