Series &RQPS

SET-4

प्रश्न-पत्र कोड
Q.P. Code **99**

रोल नं.
Roll No.

परीक्षार्थी प्रश्न-पत्र कोड को उत्तर-पुस्तिका के मुख-पृष्ठ पर अवश्य लिखें ।
Candidates must write the Q.P. Code on the title page of the answer-book.

- कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ **19** हैं ।
- कृपया जाँच कर लें कि इस प्रश्न-पत्र में **33** प्रश्न हैं ।
- प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें ।
- **कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में प्रश्न का क्रमांक अवश्य लिखें ।**
- इस प्रश्न-पत्र को पढ़ने के लिए 15 मिनट का समय दिया गया है । प्रश्न-पत्र का वितरण पूर्वाह्न में 10.15 बजे किया जाएगा । 10.15 बजे से 10.30 बजे तक छात्र केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे ।
- Please check that this question paper contains **19** printed pages.
- Please check that this question paper contains **33** questions.
- Q.P. Code given on the right hand side of the question paper should be written on the title page of the answer-book by the candidate.
- **Please write down the serial number of the question in the answer-book before attempting it.**
- 15 minute time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

जैव-प्रौद्योगिकी

BIOTECHNOLOGY

निर्धारित समय : 3 घण्टे | *अधिकतम अंक : 70*

Time allowed : 3 hours | *Maximum Marks : 70*

सामान्य निर्देश :

निम्नलिखित निर्देशों को ध्यानपूर्वक से पढ़िए और उनका पालन कीजिए :

(i) *इस प्रश्न-पत्र में **33** प्रश्न हैं । **सभी** प्रश्न **अनिवार्य** हैं ।*

(ii) *प्रश्न-पत्र **पाँच** खण्डों में विभाजित है – **खण्ड क, ख, ग, घ** तथा **ङ** ।*

(iii) ***खण्ड क** : प्रश्न संख्या **1** से **16** तक बहु-विकल्पीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न **1** अंक का है ।*

(iv) ***खण्ड ख** : प्रश्न संख्या **17** से **21** तक अति लघु-उत्तरीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न **2** अंकों का है ।*

(v) ***खण्ड ग** : प्रश्न संख्या **22** से **28** तक लघु-उत्तरीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न **3** अंकों का है ।*

(vi) ***खण्ड घ** : प्रश्न संख्या **29** तथा **30** केस आधारित **4** अंकों के प्रश्न हैं । प्रत्येक प्रश्न में उपप्रश्न हैं तथा एक उपप्रश्न में आंतरिक विकल्प दिया गया है ।*

(vii) ***खण्ड ङ** : प्रश्न संख्या **31** से **33** तक दीर्घ-उत्तरीय प्रकार के प्रश्न हैं । प्रत्येक प्रश्न **5** अंकों का है ।*

(viii) *प्रश्न-पत्र में समग्र विकल्प नहीं दिया गया है । यद्यपि, खण्ड क के अतिरिक्त अन्य खण्डों के कुछ प्रश्नों में आंतरिक विकल्प का चयन दिया गया है ।*

खण्ड क

16×1=16

1. नर अनुर्वर पौधे प्राप्त करने की बार्नेज़ एंज़ाइम तथा बारस्टार प्रणाली का प्राकृतिक स्रोत है : *1*

(A) *बैसिलस सबटिलिस*

(B) *बार्टोनेला हेन्सेली*

(C) *बैसिलस एमाइलोलिक्विफेशिएंस*

(D) *बारनेसिएला कोलाई*

2. उग्र संयुक्त इम्यूनोडेफिशिएंसी रोग इसकी अनुपस्थिति (अभाव) के कारण होता है : *1*

(A) एडीनोसीन डाईफॉस्फेट

(B) एडीनोसीन डिएमीनेज़

(C) एडीनोसीन साइक्लेज़

(D) ग्वानीडीन नाइट्रेट

General Instructions :

Read the following instructions carefully and follow them :

(i) *This question paper contains **33** questions. **All** questions are **compulsory**.*

(ii) *Question paper is divided into **five** sections – **Section A, B, C, D** and **E**.*

(iii) ***Section A** : Questions number **1** to **16** are Multiple Choice Type Questions. Each question carries **1** mark.*

(iv) ***Section B** : Questions number **17** to **21** are Very Short Answer Type Questions. Each question carries **2** marks.*

(v) ***Section C** : Questions number **22** to **28** are Short Answer (SA) Type Questions. Each question carries **3** marks.*

(vi) ***Section D** : Questions number **29** and **30** are Case-based Questions carrying **4** marks each. Each question has sub-parts with internal choice in one sub-part.*

(vii) *In **Section E** : Questions number **31** to **33** are Long Answer (LA) Type Questions. Each question carries **5** marks.*

(viii) *There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the Sections except Section A.*

SECTION A

16×1=16

1. The natural source of enzyme barnase and barstar, a system used to achieve male sterile plant is : *1*

(A) *Bacillus subtilis*

(B) *Bartonella henselae*

(C) *Bacillus amyloliquefaciens*

(D) *Barnesville coli*

2. Severe combined immunodeficiency disease is caused due to the absence of : *1*

(A) Adenosine diphosphate

(B) Adenosine deaminase

(C) Adenosine cyclase

(D) Guanidine nitrate

3. एकल न्यूक्लीयोटाइड बहुरूपता सामान्यत: _____ क्षेत्र में होता है । *1*

(A) कोडिंग

(B) नॉन-कोडिंग

(C) नियामक

(D) एक्ज़ोनी

4. कायिक भ्रूणों को _____ अवस्था में एक सुरक्षित आवरण में संपुटित करके कृत्रिम बीजों का निर्माण किया जाता है । *1*

(A) टॉरपिडो

(B) ग्लोब्यूलर

(C) बीजपत्र

(D) त्रिभुजाकार

5. पात्रे संवर्धन में जंतु कोशिकाओं की स्वस्थ संवृद्धि को प्रोत्साहित करने हेतु पेप्टाइड हॉर्मोन तथा वृद्धि कारकों को सामान्यत: इससे प्राप्त किया जाता है । स्रोत है : *1*

(A) फीनॉल रेड

(B) प्रतिजैविक

(C) रुधिर सीरम

(D) ऐमीनो अम्ल

6. उस संवाहक की पहचान कीजिए जो F-प्लाज़्मिड युक्त तथा एकल रज्जुक वृत्ताकार जीनोम वाली *ई. कोलाई* कोशिकाओं को संक्रमित करता है : *1*

(A) *एग्रोबैक्टीरियम ट्यूमीफ़ेशियंस*

(B) YEp

(C) pBR322

(D) M13

7. सूक्ष्मजीवी कोशिकाओं द्वारा उत्पादित द्वितीयक उपापचयज का एक उदाहरण है : *1*

(A) विटामिन

(B) ऐल्कोहॉल

(C) अम्ल

(D) प्रतिजैविक

3. Single nucleotide polymorphisms usually occur in _____ regions. *1*

(A) Coding

(B) Non-coding

(C) Regulatory

(D) Exonic

4. Artificial seeds are produced by encapsulating the somatic embryos at the _____ stage in a protective coating. *1*

(A) Torpedo

(B) Globular

(C) Cotyledon

(D) Triangular

5. The peptide hormones and growth factors to promote healthy growth of animal cells *in vitro* are often derived from : *1*

(A) Phenol red

(B) Antibiotics

(C) Blood serum

(D) Amino acids

6. Identify the vector that infects *E. coli* cells containing F-plasmid and that has a single-stranded circular genome : *1*

(A) *Agrobacterium tumefaciens*

(B) YEp

(C) pBR322

(D) M13

7. An example of secondary metabolites produced by microbial cells include : *1*

(A) Vitamins

(B) Alcohol

(C) Acids

(D) Antibiotics

8. जब एक आनुवंशिकता: रूपांतरित फ़सल से कोई विजातीय जीन परागकणों के माध्यम से किसी संबंधी पादप प्रजाति में पलायन कर जाता है, तो इसे कहते हैं : *1*

(A) जीन स्थानांतरण

(B) जीन प्रदूषण

(C) डीएनए संदूषण

(D) आविषालुता स्थानांतरण

9. 10,000 डाल्टन अणुभार तथा 5^+ चार्ज (आवेश) वाले प्रोटीन का संहति स्पेट्रममितिक विश्लेषण किया गया । इसके संहति-चार्ज अनुपात का अभिकलन कीजिए । *1*

(A) 2001 (B) 2000

(C) 2501 (D) 5001

10. भ्रूण की कोरकपुटी (ब्लास्टोसिस्ट) अवस्था से प्राप्त की गई भ्रूणीय मूल कोशिकाएँ _____ प्रकृति की होती हैं । *1*

(A) पूर्णशक्त (टोटीपोटेंट) (B) बहुशक्त (प्लूरीपोटेंट)

(C) बहुक्षम (मल्टीपोटेंट) (D) द्विशक्त (बाइपोटेंट)

11. प्रतिजैविक पेनिसिलिन की उच्च सान्द्रता के उत्पादन में समर्थ *पेनिसिलियम* का सुधरीकृत स्ट्रेन है : *1*

(A) *पेनिसिलियम नोटेटम*

(B) *पेनिसिलियम क्रोईसोजेनम*

(C) *पेनिसिलियम यूट्रोफस*

(D) *पेनिसिलियम सैरीविसेएई*

12. _____संवर्धों को लंबे समय तक बनाए रखने के लिए उसका बार-बार उपसंवर्धन किया जाता है । *1*

(A) अंडाशय (B) प्रोटोप्लास्ट

(C) कैलस (D) मास सेल

8. When a transgene from a Genetically Modified crop escapes through pollen to a related plant species, it is known as _____. *1*

(A) Gene transfer

(B) Gene pollution

(C) DNA contamination

(D) Toxicity transfer

9. A protein ion with a molecular weight of 10,000 Daltons carried a charge of 5^+ and was subjected to mass spectrometric analysis. Calculate its mass to charge ratio. *1*

(A) 2001 (B) 2000

(C) 2501 (D) 5001

10. Embryonic stem cells derived from blastocyst stage of the embryo are _____ in nature. *1*

(A) Totipotent (B) Pluripotent

(C) Multipotent (D) Bipotent

11. An improved strain of *Penicillium*, capable of producing higher concentration of antibiotic penicillin is : *1*

(A) *Penicillium notatum*

(B) *Penicillium chrysogenum*

(C) *Penicillium eutrophus*

(D) *Penicillium cerevisiae*

12. _____ cultures can be maintained for a prolonged period of time by repeated sub-culturing. *1*

(A) Ovary

(B) Protoplast

(C) Callus

(D) Mass cell

प्रश्न संख्या 13 से 16 के लिए, दो कथन दिए गए हैं — जिनमें एक को अभिकथन (A) तथा दूसरे को कारण (R) द्वारा अंकित किया गया है । इन प्रश्नों के सही उत्तर नीचे दिए गए कोडों (A), (B), (C) और (D) में से चुनकर दीजिए ।

(A) अभिकथन (A) और कारण (R) दोनों सही हैं और कारण (R), अभिकथन (A) की सही व्याख्या करता है ।

(B) अभिकथन (A) और कारण (R) दोनों सही हैं, परन्तु कारण (R), अभिकथन (A) की सही व्याख्या ***नहीं*** करता है ।

(C) अभिकथन (A) सही है, परन्तु कारण (R) ग़लत है ।

(D) अभिकथन (A) ग़लत है, परन्तु कारण (R) सही है ।

13. *अभिकथन (A) :* कुछ विशेषज्ञ मानते हैं कि मानव जीनोम में 30,000 से अधिक जीन अवश्य होने चाहिए ।

कारण (R) : इन सिलिको द्वारा जीन पूर्वानुमान की अविश्वसनीयता ही मानव जीनोम में कम जीनों की रिपोर्टिंग के लिए उत्तरदायी है । *1*

14. *अभिकथन (A) :* जटिल सूक्ष्मजीवीय संवर्धन माध्यम का सही रासायनिक संघटन ज्ञात है ।

कारण (R) : जब सूक्ष्मजीव की विशिष्ट वृद्धि आवश्यकता अज्ञात हो, तो जटिल पोषक माध्यम का उपयोग किया जाता है । *1*

15. *अभिकथन (A) :* स्तनधारी कोशिकाओं की उत्तरजीविता (जीवित रहने) के लिए pH का नियमन अनिवार्य है ।

कारण (R) : निश्चित pH बनाए रखने के लिए जंतु कोशिका संवर्धों में अधिकतर बाईकार्बोनेट – कार्बन डाईऑक्साइड बफरिंग प्रणाली का उपयोग किया जाता है । *1*

16. *अभिकथन (A) :* पादप कोशिका संवर्धन में कर्त्तोतक को सोडियम हाइपोक्लोराइट से उपचारित किया जाता है ।

कारण (R) : सोडियम हाइपोक्लोराइट पुनर्जनित पौधों के पर्यानुकूलन में सहायक है । *1*

For Questions number 13 to 16, two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is ***not*** the correct explanation of the Assertion (A).

(C) Assertion (A) is true, but Reason (R) is false.

(D) Assertion (A) is false, but Reason (R) is true.

13. *Assertion (A) :* Some experts believe that there must be more than 30,000 genes in human genome.

Reason (R) : Unreliability of in silico gene prediction is responsible for reporting lesser number of genes in human genome. *1*

14. *Assertion (A) :* The exact chemical composition of complex microbial growth media is known.

Reason (R) : Complex nutrient media is used when specific growth requirement of a microorganism is unknown. *1*

15. *Assertion (A) :* The regulation of pH is essential for survival of mammalian cells.

Reason (R) : Animal cell cultures mostly make use of Bicarbonate – carbon dioxide buffering system to maintain pH. *1*

16. *Assertion (A) :* During plant tissue culture, the explants are treated with sodium hypochlorite.

Reason (R) : Sodium hypochlorite helps in acclimatization of the regenerated plants. *1*

खण्ड ख

17. एक पुनर्योगज डीएनए अणु के निर्माण को दर्शाने हेतु विभिन्न चरणों का निदर्श चित्रण कीजिए । *2*

18. जीन निरसन (नॉकआउट) वाले चूहे (माउस) मॉडल का सृजन करने के क्या लाभ हैं ? *2*

19. दिए गए किसी एक कोशिका प्रारूप की संपूर्ण प्रोटीन प्रोफाइल के अध्ययन में सहायक तकनीक का नाम लिखिए । इस तकनीक के सिद्धांत की संक्षिप्त व्याख्या कीजिए । *2*

20. पादप आनुवंशिक इंजीनियरिंग द्वारा द्वितीयक उपापचयजों के उत्पादन को बढ़ाने के लिए किन्हीं दो कार्य-नीतियों के विषय में लिखिए । *2*

21. (क) जंतु कोशिका के पात्रे संवर्धन की दो कमियों (सीमाओं) के विषय में लिखिए । *2*

अथवा

(ख) (i) एक अर्बुद-विज्ञानी एक रोगी की ट्यूमर (अर्बुद) की कोशिकाओं के निवह बनने की क्रिया का आमापन कर रहा है । वह क्या जानने का प्रयास कर रहा है ?

(ii) एक संवर्ध में संवर्धित कोशिकाएँ संस्पर्श संदमन (कांटेक्ट इनहिबिशन) दर्शाती हैं । मानव शरीर में होने वाली परिघटनाओं के साथ इसका संबंध स्थापित कीजिए । *2*

खण्ड ग

22. (क) सिद्धांत और उपयोगिता के संदर्भ में FISH की तुलना सूक्ष्मव्यूह के साथ कीजिए । *3*

अथवा

(ख) अभिव्यक्ति तथा प्रकार्यात्मक प्रोटिओमिक्स के बीच विभेद कीजिए। *3*

23. निम्नलिखित में से किन्हीं ***तीन*** प्रोटीन औषधियों को प्राप्त करने के लिए प्राणी कोशिका वंशक्रम तथा चिकित्सीय उपयोग लिखिए : *3*

(क) एरिथ्रोपोएटिन
(ख) हर्सेप्टिन
(ग) इंटरल्यूकिन 2
(घ) ऊतक प्लाज़्मिनोजन सक्रियक

SECTION B

17. Illustrate steps to show the construction of a recombinant DNA molecule. *2*

18. What are the advantages offered by creating mouse model with gene knockout ? *2*

19. Name the technique that helps to study the entire protein profile from a given cell type. Briefly explain the principle of this method. *2*

20. Write about any two strategies available to enhance the production of secondary metabolites in plant genetic engineering. *2*

21. (a) Give any two drawbacks of animal cell culture in vitro. *2*

OR

(b) (i) An oncologist is performing colony formation assay on tumour cells from a patient. What is he trying to determine ?

(ii) Animal cells growing in culture show the property of contact inhibition. Relate this to what happens in an adult human body. *2*

SECTION C

22. (a) Compare the techniques of FISH with Microarray in terms of principle and applications. *3*

OR

(b) Differentiate between Expression and Functional Proteomics. *3*

23. Write the therapeutic use and the animal cell line employed in obtaining any ***three*** of the following protein pharmaceuticals : *3*

(A) Erythropoietin

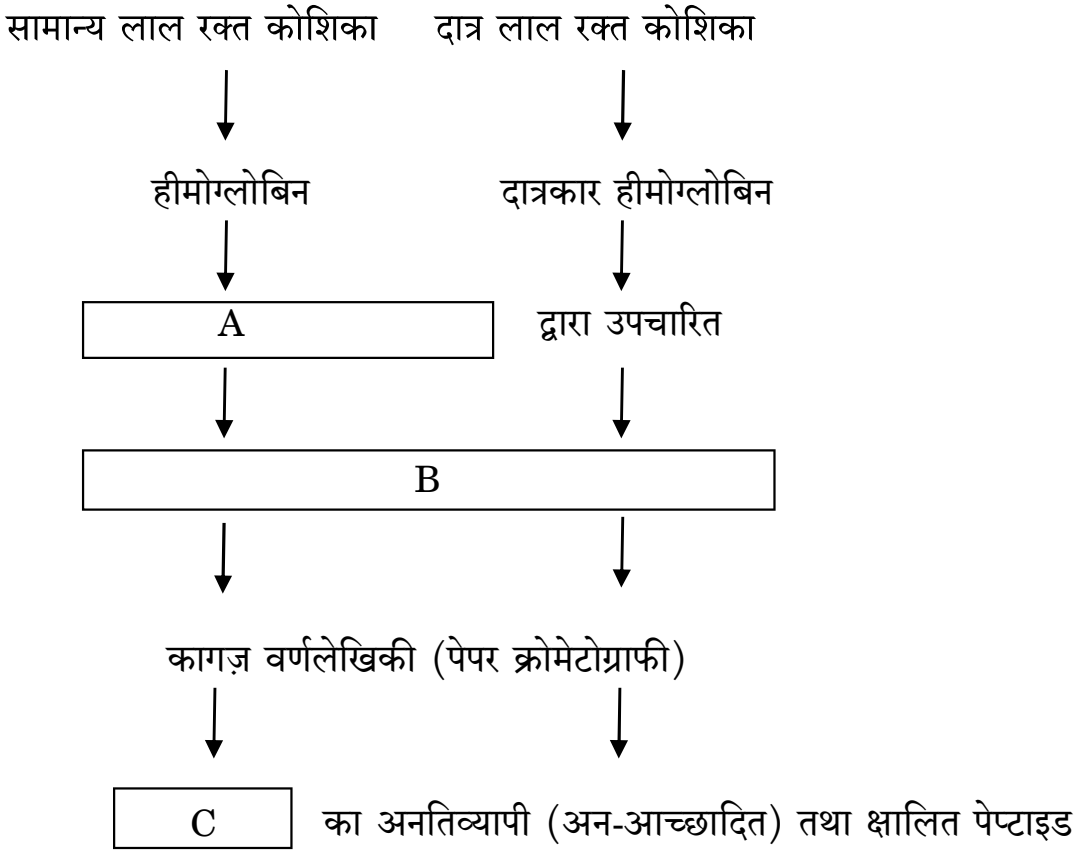
(B) Herceptin

(C) Interleukin 2

(D) Tissue plasminogen activator

24. पीसीआर आवर्धन तकनीक में शामिल चरणों की व्याख्या कीजिए । *3*

25. एक शोधकर्ता ने सामान्य हीमोग्लोबिन तथा दात्र कोशिका अरक्तता वाली लाल रक्त कोशिकाओं की प्रोटीन अंगुलिछापी का निष्पादन किया । इस प्रक्रम के प्रवाह-आरेख (फ्लोचार्ट) में A, B, C की समुचित शब्दों द्वारा पूर्ति कीजिए । *3*



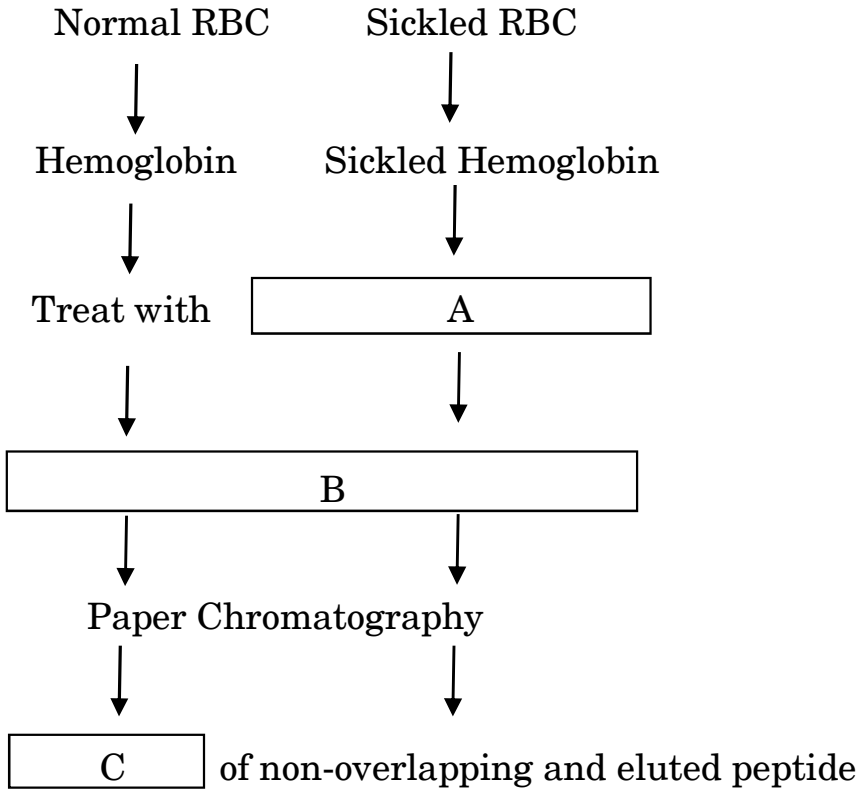
26. ऐसी तीन विधियों (तरीकों) की चर्चा कीजिए जिनके द्वारा सूक्ष्मजीवीय कोशिका वृद्धि का आमापन किया जा सके । *3*

27. ज़ाइमोजन क्या हैं ? काइमोट्रिप्सिनोजन काइमोट्रिप्सिन से किस प्रकार भिन्न है ? *3*

28. ऐसे तीन जीनों के नाम लिखिए जिन्हें पुनर्योगज डीएनए प्रौद्योगिकी में वरण-योग्य चिह्नक के रूप में उपयोग किया जा रहा है । वे जिस विशेषक/प्रोटीन को विनिर्दिष्ट करते हैं उसका भी उल्लेख कीजिए : *3*

24. Explain the steps involved in PCR amplification method. *3*

25. A researcher performed protein fingerprinting on hemoglobin from both normal and sickled red blood cells. Complete the flow-chart of the process by filling A, B, and C. *3*



26. Discuss any three ways that can be employed to measure microbial cell growth. *3*

27. What are zymogens ? How is chymotrypsinogen different from chymotrypsin ? *3*

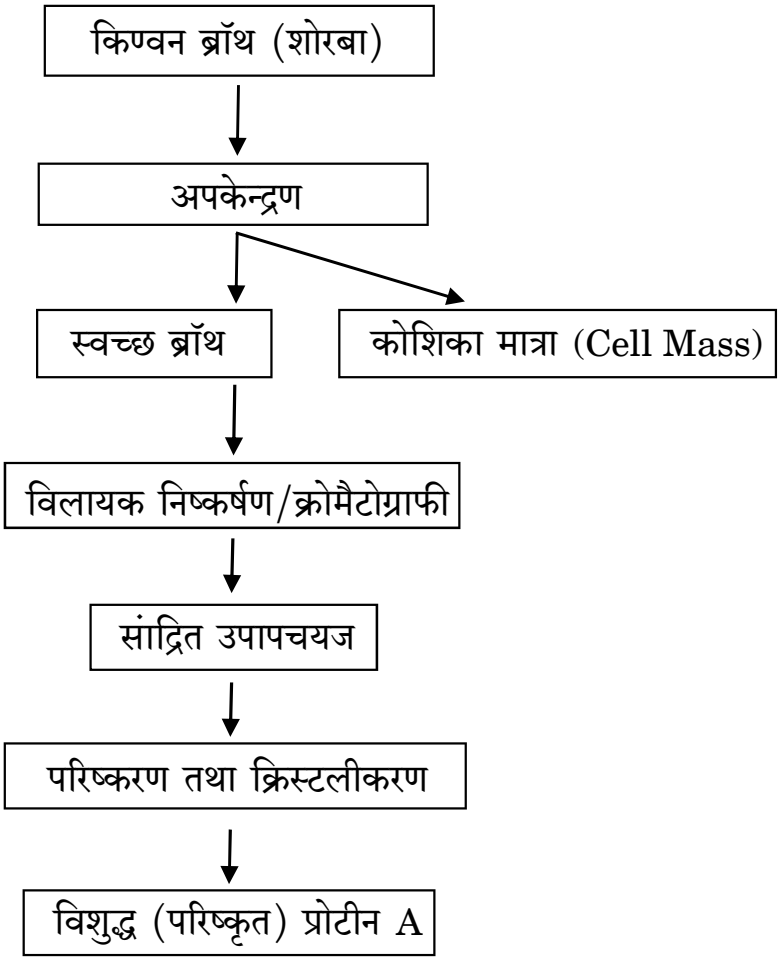
28. Give the names of any three genes that are used as selectable markers in recombinant DNA technology. Also mention the trait/protein they specify. *3*

खण्ड घ

29. नीचे दिए गए प्रवाह-आरेख (फ्लोचार्ट) को ध्यानपूर्वक पढ़िए तथा उससे संबंधित अग्रगामी प्रश्नों के उत्तर लिखिए :

प्रोटीन A के पृथक्करण का प्रवाह-चार्ट योजना :

सूक्ष्मजीवीय उत्पाद का पृथक्करण



(क) प्रोटीन A की उत्पत्ति अंत:-कोशिकी है अथवा बाह्य-कोशिकी ? लिखिए । *1*

(ख) परिशोधन योजना में कौन-सा चरण उपापचयज विशिष्ट है ? *1*

(ग) *ई. कोलाई* से ह्यूमुलिन के पृथक्करण की परिशोधन योजना लिखिए । *2*

अथवा

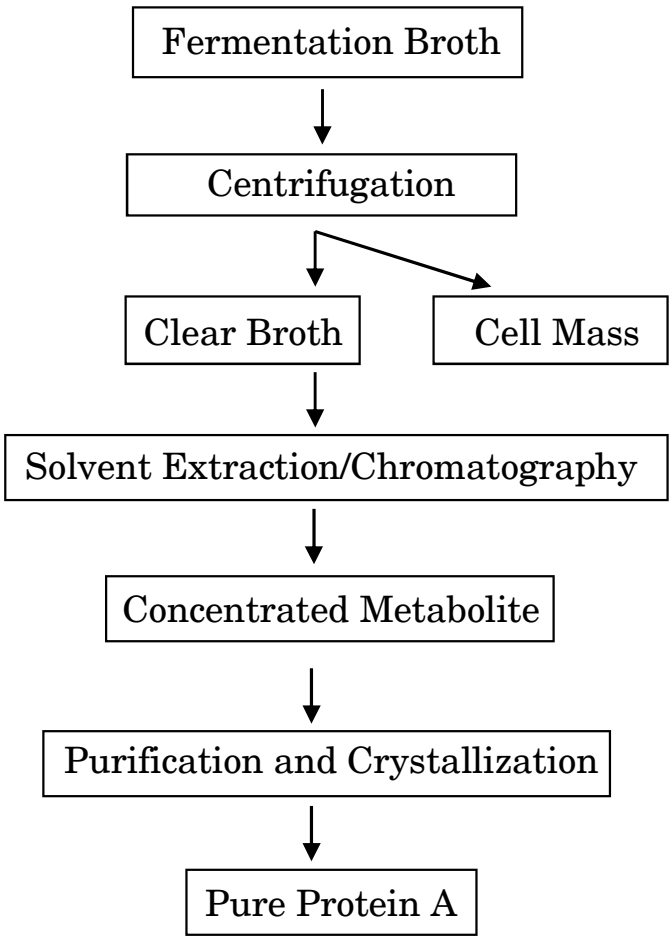
(ग) अनुप्रवाह संसाधन में अपेक्षाकृत कम चरणों के उपयोग की सलाह क्यों दी जाती है ? *2*

SECTION D

29. Carefully read the below mentioned flow-chart and answer the questions that follow :

Flow-chart scheme for isolation of Protein A is as given below :

Isolation of Microbial Product



(a) Write whether Protein A is of intra or extra cellular origin. *1*

(b) Which step in the given purification scheme is metabolite specific ? *1*

(c) Give the purification scheme for isolation of Humulin from *E. coli* *2*

OR

(c) Why is it advisable to use lesser number of steps for downstream processing ? *2*

30. नीचे दी गई तालिका के परिप्रेक्ष्य में संबंधित प्रश्नों के उत्तर लिखिए :

पादप पोषक माध्यम को बनाने में उपयोग किए जाने वाले संघटकों की सूची नीचे दशाई गई है ।

पादप वृद्धि माध्यम (संवर्धन माध्यम)

संघटक	मात्रा
NH_4NO_3	1650 mg/L
$CaCl_2$	440 mg/L
$MnSO_4$	22 mg/L
$FeSO_4$	27 mg/L
ग्लाइसीन	2 mg/L
KNO_3	1900 mg/L
सुक्रोस	3g/mL
इनोसिटॉल	100 mg/L
EDTA	33 mg/L

(क) दी गई सूची में कौन-सा घटक कार्बन का स्रोत है ? *1*

(ख) विटामिन आवश्यकता की पूर्ति हेतु किस संघटक का उपयोग किया गया है ? *1*

(ग) पादप संवर्ध पोषी माध्यम तैयार करने में सामान्यत: कौन-से पादप हॉर्मोनों का निवेश किया जाता है ? *2*

अथवा

(ग) प्रयोगशाला में संवर्धन माध्यम का निर्जर्मीकरण कैसे किया जाता है ? व्याख्या कीजिए । *2*

30. Consider the following table and answer questions :

Given is a list of ingredients used for preparation of plant nutrient medium.

Plant Growth Media

Ingredients	Amount
NH_4NO_3	1650 mg/L
$CaCl_2$	440 mg/L
$MnSO_4$	22 mg/L
$FeSO_4$	27 mg/L
Glycine	2 mg/L
KNO_3	1900 mg/L
Sucrose	3 g/mL
Inositol	100 mg/L
EDTA	33 mg/L

(a) Which component in the given list is acting as the carbon source ? *1*

(b) Which ingredient has been used to fulfill vitamin requirement ? *1*

(c) Name two phytohormones which are generally added to prepare plant nutrient media. *2*

OR

(c) Explain how the sterilization of the growth media is achieved in the laboratory. *2*

खण्ड ङ

31. (क) (i) पनीर जल प्रोटीनों के चिकित्सीय उपयोग के कारण की व्याख्या कीजिए । *2*

(ii) ऐसे दो रोगों के नाम लिखिए जिनका पनीर जल द्वारा उपचार किया गया है । *2*

(iii) प्रतिजैविकों के साथ दही के प्रयोग का भी परामर्श दिया जाता है । क्यों ? *1*

अथवा

(ख) (i) एक नवल (नोवल) प्रोटीन के विकास की चर्चा कीजिए । *3*

(ii) ऐसे दो गुणधर्मों के नाम लिखिए जिन्हें प्रोटीन इंजीनियरिंग का उपयोग करके पुनर्व्यवस्थित (मैनिपुलेट) किया जा सकता है ? *2*

32. (क) (i) सेंगर के शृंखला समापन विधि (चेन टर्मिनेशन विधि) में ddNTP का समावेशन वृद्धि करती DNA शृंखला को समयपूर्व समाप्त कर देता है । व्याख्या कीजिए कैसे ? *2*

(ii) सेंगर की DNA अनुक्रमन शृंखला समापन विधि के विभिन्न चरण लिखिए । *3*

अथवा

(ख) (i) DNA अनुक्रमन की अवधि में मूल अनुक्रम पर पहुँचने के लिए स्वविकिरणी चित्रण (ऑटोरेडियोग्राम) में अंतिम छोर से ऊपर की ओर क्यों पढ़ा जाता है ? *2*

(ii) एकल ट्यूब DNA अनुक्रमन विधि को बेहतर तथा ज्यादा सुरक्षित क्यों माना जाता है ? *2*

(iii) DNA के एक रज्जुक के अनुक्रमन के लिए हमें एकल रज्जुक रूप में क्लोन करने की आवश्यकता होती है । इसके लिए आप किस संवाहक को चुनना पसन्द करेंगे ? *1*

33. (क) (i) एनसीबीआई (NCBI) से उपलब्ध तीन डाटाबेस पुन: प्राप्य युक्तियों के नाम लिखिए । वे हमें क्या अभिगम करने की अनुमति देते हैं ? *3*

(ii) UniprotKB तथा PDB डाटाबेसों में किस प्रकार की सूचना उपलब्ध है ? *2*

अथवा

(ख) (i) अनुक्रम समानता के विश्लेषण में BLAST का उपयोग कैसे किया जाता है ? व्याख्या कीजिए । *3*

(ii) उस कंप्यूटर प्रोग्राम (योजना) का नाम लिखिए जिसके द्वारा जीवाणु जीनोम तथा सुकेंद्रकियों (यूकैरियोटिक) के जीनोम की जीन प्रागुक्ति (पूर्वानुमान) की जा सकती है । *2*

SECTION E

31. (a) (i) Explain the reason for therapeutic use of whey proteins. *2*

(ii) Name any two diseases that have been treated with whey. *2*

(iii) Curd is advised to be administered with antibiotics. Why ? *1*

OR

(b) (i) Discuss the development of a novel protein. *3*

(ii) Name any two properties that can be manipulated using Protein Engineering. *2*

32. (a) (i) In Sanger's chain termination method, incorporation of ddNTP cause the growing DNA chains to terminate prematurely. Explain how. *2*

(ii) Briefly write the steps of Sanger's chain termination method of DNA sequencing. *3*

OR

(b) (i) During DNA sequencing, why is the autoradiogram read from bottom to top to arrive at the original sequence ? *2*

(ii) Why is single tube DNA sequencing considered better and safer ? *2*

(iii) To perform DNA sequencing of a strand, we need to clone the sequence in a single-stranded form. Which vector will you prefer for this ? *1*

33. (a) (i) Name three database retrieval tools available from the NCBI. What all do they allow us to access ? *3*

(ii) What kind of information is available in UniProtKB and PDB databases ? *2*

OR

(b) (i) How is BLAST used to analyses sequence similarity ? Explain. *3*

(ii) Name the computer programmes that can perform gene prediction for bacterial and eukaryotic genomes. *2*

Marking Scheme

Strictly Confidential

(For Internal and Restricted use only)

Senior School Certificate Examination, 2024

SUBJECT NAME BIOTECHNOLOGY .(SUBJECT CODE 045) (PAPER 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 News Paper/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, they may be assessed for their correctness otherwise and due marks be awarded to them. In class-X, 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 delibration 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 totaled 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 _____(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 totaling 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 totaling on the title page. ● Wrong totaling 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 un assessed portion, non-carrying over of marks to the title page, or totaling 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 totaled 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

SUBJECT : BIOTECHNOLOGY THEORY (045)

AISSCE 2024

SET 4 QP. CODE 99

SESSION: 2023-24

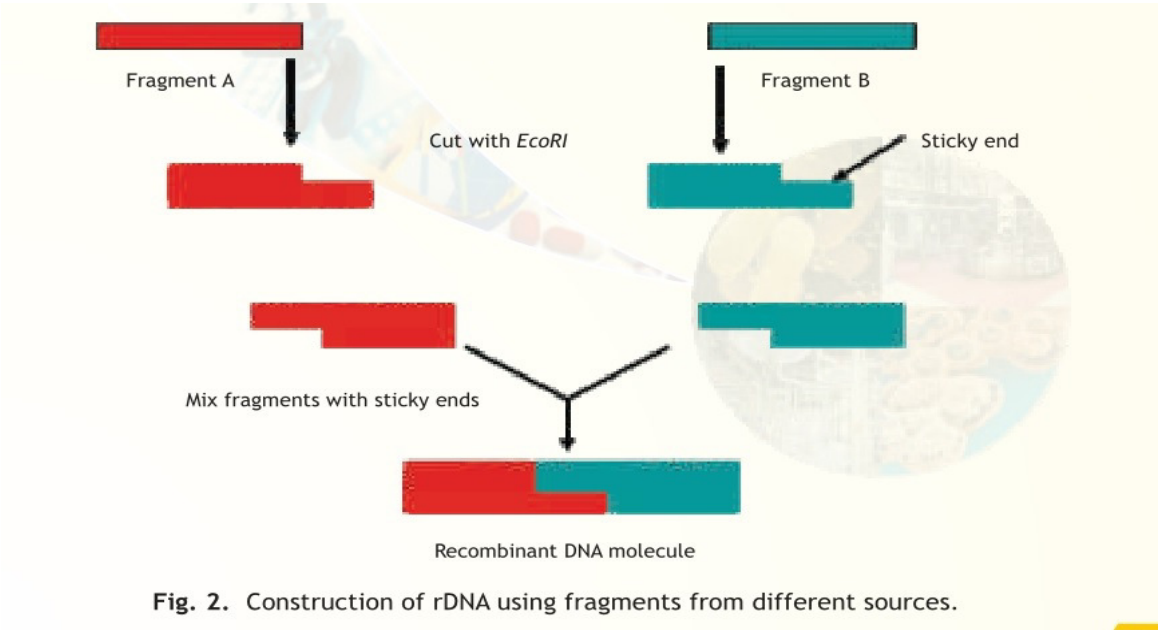
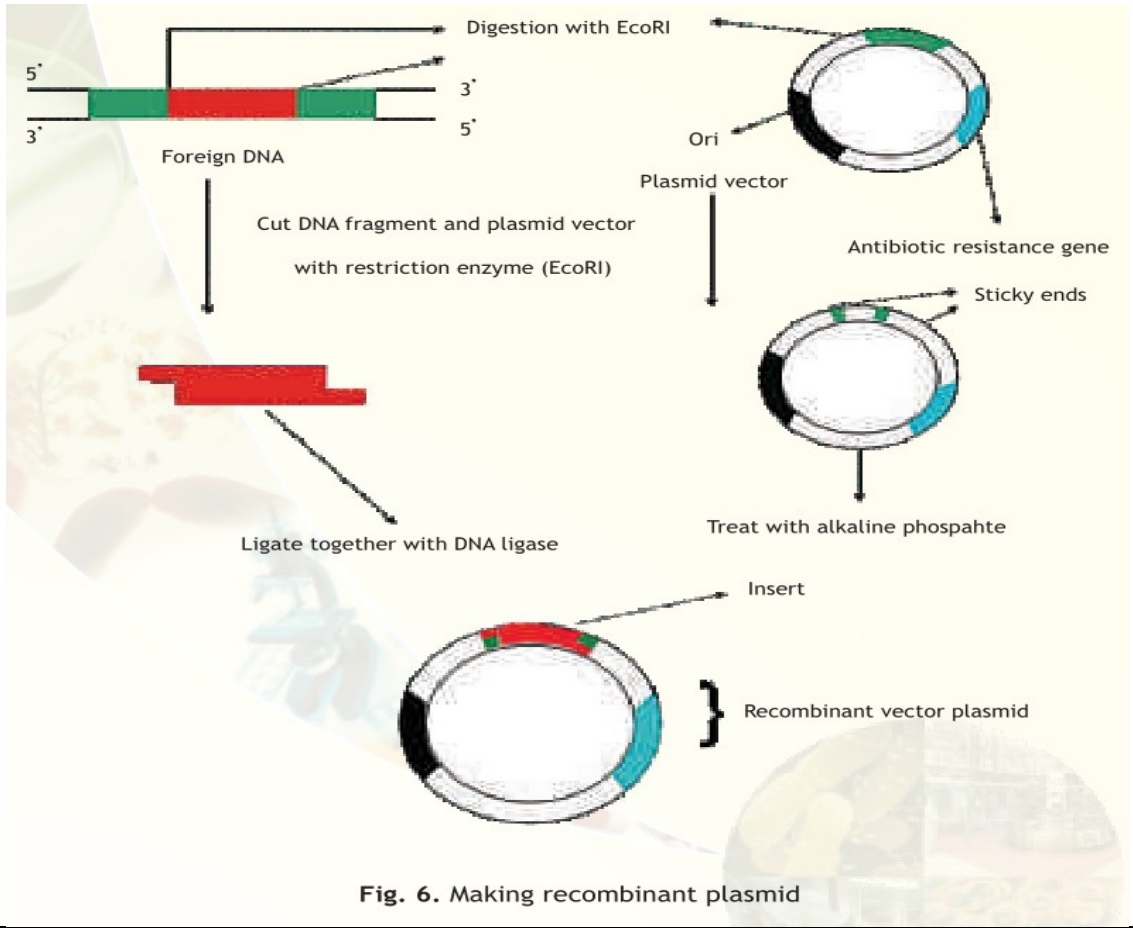
GENERAL INSTRUCTIONS :

a. The Marking Scheme carries suggested value points for the answers.
b. These are guidelines which constitute the complete answer.
c. The students can have their own expression and if the expression is correct the marks can be awarded accordingly.

MARKING SCHEME
BIOTECHNOLOGY (045)
SET-4 (Series &RQPS)
Q.P. CODE 99
(2023-24)

SECTION – A

Sl. No.	Value Points	Marks
1	(C) Bacillus amyloliquefaciens	1
2	(B) Adenosine deaminase	1
3	(B) Non-coding / (A) Coding (As per the prescribed text book, pg63,both options(A)and(B) are correct)	1
4	(A) Torpedo	1
5	(C) Blood serum	1
6	(D) M13	1
7	(D) Antibiotics	1
8	(B) Gene pollution	1
9	(A) 2001	1
10	(B) Pluripotent	1
11	(B) *Penicillium chrysogenum*	1
12	(C) Callus	1
13	(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A) .	1
14	(D) Assertion (A) is false, but Reason (R) is true.	1
15	(B) Both Assertion (A) and Reason (R) are true, but the Reason (R) is ***not*** the correct explanation of the Assertion (A).	1
16	(C) Assertion (A) is true, but Reason (R) is false.	1

	SECTION – B	
17	Fig 2, Pg 6 / Fig 6, Pg 14 (**Any One Fig**.)  **Fig. 2.** Construction of rDNA using fragments from different sources.  **Fig. 6.** Making recombinant plasmid	2

18	To understand the genetic basis of a disease To search for new diagnostic methods To search for new therapeutic modality or uses (Any two)	1+1= 2
19	Two dimensional Gel Electrophoresis Technique / Mass Spectrometry Technique Principle of Two dimensional Gel Electrophoresis Technique: Separation of proteins is on the basis of charge and size. First proteins get separated on the basis of isoelectric pH (pI) by IEF technique and then on the basis of molecular size by SDS PAGE technique . Principle of Mass Spectrometry Technique: It determines the molecular weight of a chemical compound or protein by separating the molecular ions according to m/z ratio. **(Any one technique with principle)**	1+1=2
20	-To overexpress a gene that encodes for the first enzyme in the biosynthetic pathway -To use Agrobacterium rhizogenes to induce excessive secondary roots (hairy roots) in plants that normally produce useful secondary metabolites in this region.	1+1= 2
21	(a) Drawbacks : Small size / Scale up is challenging / may not represent in vivo phenotype or genotype (Any two for 1 mark each) OR (b) (i) The oncologist is trying to determine whether the tumour is cancerous or not. (ii)Cell comprising tissues and organs like liver of an animal grow only to a certain size after which they cease to grow / Infant animal grow only to adulthood and not any further.	1+1= 2 1+1= 2
	SECTION C	
22	(a) The principle involved in FISH technique is hybridization of DNA of metaphase chromosomes affixed to a microscopic slide with a fluorescent DNA probe. The principle of Microarray is that complementary sequences will bind to each other by base pairing or hybridisation. Fluorescently labelled single stranded probe binds with single stranded DNA molecule spotted on the microarray plate. Applications of FISH are : Diagnosis of genetic diseases Locating specific DNA sequences	1 1

Identification of presence or absence of a gene

To study translocation of genes on chromosomes. (Any 1 point) ½

Applications of Microarray are :

To monitor the whole genome on a single chip for interactions among thousands of genes simultaneously. ½

To compare the amounts of many different mRNA in two cell populations in tissue specific genes to study the regulatory gene defects, cellular response to environment, cell cycle variations. (Any 1 point)

OR

(b)

	Expression Proteomics	Functional Proteomics
1	Study of qualitative and quantitative expression of proteins in different environment or disease.	Identification and analysis of protein networks involved in a living cell/ nuclear pore complex/ study of protein functions and interactions/ molecular mechanisms and biological roles.
2	Used to identify disease specific proteins	To analyse the properties of molecular networks involved in a living cell.
3	To provide understanding of the basis of tumour development.	Identification of novel proteins which are important for translocating important molecules from cytoplasm of a cell to nucleus and vice versa.

½ x 6 =3

.

23

S. No.	Protein Pharmaceutical	Therapeutic Use	Animal Cell Line
(A)	Erythropoietin	Anaemia	CHO cell line
(B)	Herceptin	Breast cancer therapy	CHO cell line
(C)	Interleukin 2	Cancer therapy	CHO cell line
(D)	Tissue plasminogen activator	Stroke	CHO cell line

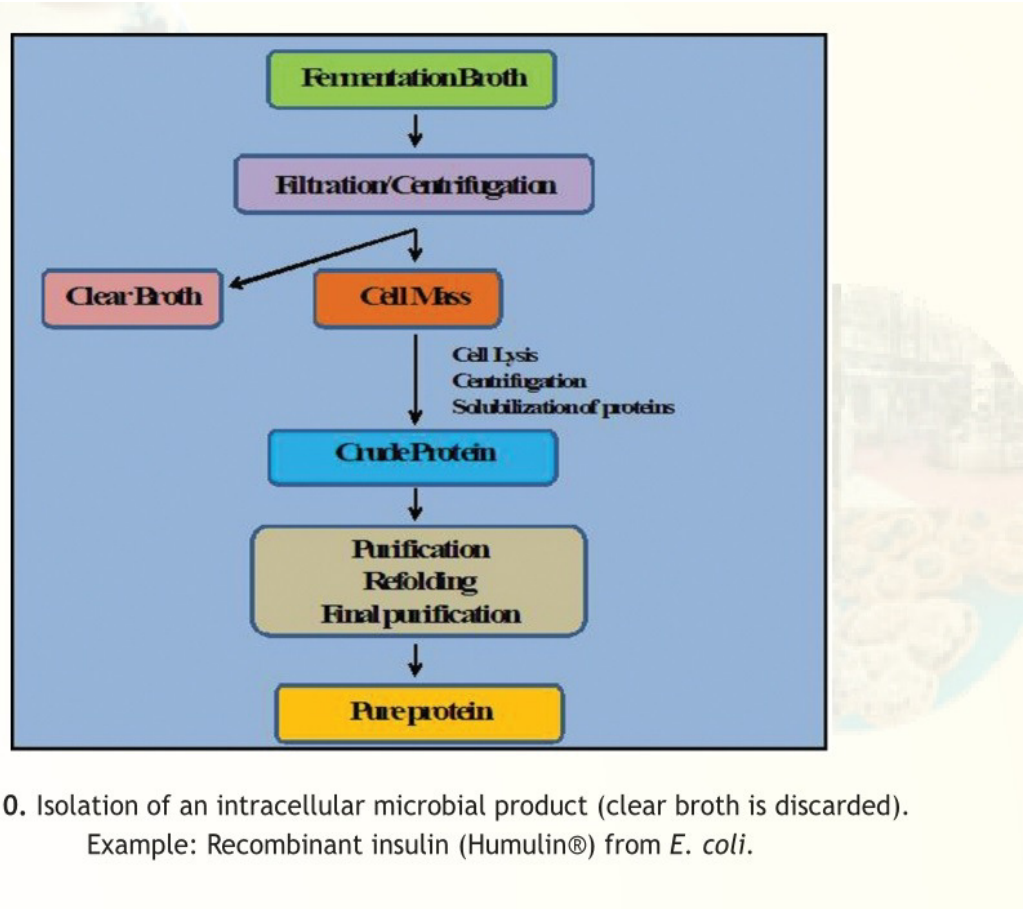
Any Three

½ x 6 =3

<table>
<tr><td>24</td><td>Step 1 –
Denaturation : The DNA duplex gets separated at temperature above 80°C to form two single stranded DNA templates.
Step 2 –
Annealing : Two primers bind to the 3’ end of DNA templates at temperature between 50 - 60°C
Step 3 –
Extension : Each primer is extended by Taq DNA polymerase in 5’► 3’ direction using dNTPs and the DNA strand as template at 70°C</td><td>½ x 6= 3</td></tr>
<tr><td>25</td><td>A – Trypsin
B – Paper Electrophoresis
C – Sequencing</td><td>1 x 3 = 3</td></tr>
<tr><td>26</td><td>Viable plate count method [colony forming units(CFU)]– counting the number of live cells
Turbidity measurement – Absorbance at a particular wavelength is proportional to cell concentration
Coulter counter – Direct counting of cells in suspension as they pass through electrical field in a single file.
Dry weight – to measure constant weight of fixed volume of culture after drying.
Wet weight- to measure weight of fixed volume of culture. ATP measurement- to measure ATP in the beginning end at the end of the culture.
[Any Three ways with explanation]</td><td>½ x 6 =3</td></tr>
<tr><td>27</td><td>Inactive, harmless precursors of proteolytic enzymes are called zymogens.

<table><tr><th>Sl. No.</th><th>Chymotrypsinogen</th><th>Chymotrypsin</th></tr><tr><td>1</td><td>It is inactive precursor of chymotrypsin enzyme.</td><td>It is fully active enzyme.</td></tr><tr><td>2</td><td>The substrate-binding pocket is blocked/ not exposed.</td><td>The substrate-binding pocket is not blocked and is exposed.</td></tr><tr><td>3</td><td>Serine 195 is not acidic.</td><td>Serine 195 is acidic.</td></tr><tr><td>4</td><td>Charge relay doesn’t operate</td><td>Charge relay operates</td></tr></table>
Any two points</td><td>1

1+1 = 2</td></tr>
</table>

28	Ampicillin resistance gene -- provides ampicillin resistance Lac Z gene -- produces β galactosidase enzyme GFP gene – Produces Green Fluorescent Protein Tetracycline resistance gene -----provides tetracycline resistance Leu 2 gene -- codes for an enzyme needed for synthesis of amino acid leucine Any three	½ x 6 =3
	SECTION D	
29	(a) Protein A is extracellular (b) Solvent extraction / Chromatography (c) Fig 10, Pg. 100  **Fig. 10.** Isolation of an intracellular microbial product (clear broth is discarded). Example: Recombinant insulin (Humulin®) from *E. coli*. OR (c) Lesser number of steps for downstream processing are advisable for : - Less cost - High yield	1 1 2 1+1 = 2

30	(a) Sucrose (b) Inositol (c) Auxins and Cytokinins **OR** (b) - Autoclaving: Sterilisation is performed at 15 pounds per square inch pressure for 20 minutes in an autoclave - Membrane filter sterilisation- Culture medium is forced through a membrane of very fine pore size.	1 1 2 1+1 = 2
	SECTION E	
31	(a) (i) Elevation of glutathione (a reducing compound) in cells that detoxifies xenobiotics. Protects cellular components from oxygen intermediates and free radicals. (ii) Jaundice / Infected skin lesions / genito urinary tract infections / Intestinal infections. (iii) Curd is used as a probiotic as it is a source of beneficial bacteria which can colonise the intestinal tract. **OR** *(b)* (i) Recombinant vaccine based on selected epitope: Synthetic gene for an epitope of a virus is assembled and introduced into host cells which are grown on large scale . The epitope protein is isolated, purified and used as recombinant or subunit vaccine. (ii) Thermal stability / pH stability / Solvent tolerance / Solubility / Catalytic potency/ Biological adaptation to environmental stresses such as high salinity, drought , cold, etc. Any two	1+1=2 1+1=2 1 3 1+1= 2
32	(a) (i) ddNTPs lack 3′Hydroxyl group so the phosphodiester bond between 3' hydroxyl group of the previous nucleotide cannot be formed with the 5' phosphate group of the incoming nucleotide and hence the growing DNA chain cannot be further extended and the chain gets terminated. (ii) The sequencing technique is carried out in four test tubes, each carrying single stranded DNA template, deoxy nucleotide tri phosphates, primer and DNA polymerase. A small amount of four dideoxy nucleotide triphosphates i.e. ddATP, ddTTP, ddGTP and ddCTP are added separately into the four test tubes and the reaction is allowed to proceed. Prematurely terminated strands in a given tube are separated on special gels by electrophoresis wherein the bands can be resolved even if they differ by one nucleotide . The shorter fragments move faster towards the anode. The radioactive primers help in easy visualisation using autoradiography. The gel is read from bottom to top to arrive at 5′ to 3′ original DNA sequence.	2 3

	OR (b) (i) - The fastest moving shortest DNA fragment is obtained at 5' position (towards anode). - Since DNA synthesis occurs in 5' to 3' direction, the gel is read from 5' end (anode) (ii) Single tube DNA sequencing uses fluorescent colours rather than radioactive isotopes so is **safer.** It is **better** as it is automated /faster /uses a single lane gel for electrophoresis/ result is directly displayed on a computer screen and data can be stored in a computer. (iii) M13-based vector	2 1+1=2 1
33	(a) (i)**Entrez** allows us to access literature in the form of abstracts , sequences and structures. Entrez provides comprehensive information on a given biological question. **Taxonomy browser** provides information on taxonomic classification of various species. **Locus link** provides information on official gene names, descriptive information about genes and on homologous genes (ii) **UniProtKB** gives information about annotated protein sequences. **PDB** (Protein Database) contains information about three dimensional structure of proteins. **OR** (b) (i)In BLAST: - A given sequence is compared with the database sequences using matrices which give scores. They either reward a match or penalise a mismatch. - Top scoring matches are ranked based on whether the match was due to ancestral relationship or just a random chance. - True matches are examined through ENTREZ (ii) GeneMark for bacterial genomes and GENSCAN for eukaryotic genomes.	½ x 6= 3 1+1 =2 1 x 3 = 3 1+1= 2