

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.

जीव विज्ञान (सैद्धान्तिक)
BIOLOGY (Theory)

निर्धारित समय : 3 घण्टे

Time allowed : 3 hours

अधिकतम अंक : 70

Maximum Marks : 70

नोट	NOTE
(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 23 हैं।	(I) Please check that this question paper contains 23 printed pages.
(II) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।	(II) 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.
(III) कृपया जाँच कर लें कि इस प्रश्न-पत्र में 33 प्रश्न हैं।	(III) Please check that this question paper contains 33 questions.
(IV) कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में यथा स्थान पर प्रश्न का क्रमांक अवश्य लिखें।	(IV) Please write down the Serial Number of the question in the answer-book at the given place before attempting it.
(V) 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 परीक्षार्थी केवल प्रश्न-पत्र को पढ़ेंगे और इस अवधि के दौरान वे उत्तर-पुस्तिका पर कोई उत्तर नहीं लिखेंगे।	(V) 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 candidates will read the question paper only and will not write any answer on the answer-book during this period.

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 – Sections **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 Type questions. Each question carries **3** marks.
- (vi) **Section D** – questions number **29** and **30** are Case-Based questions. Each question carries **4** marks. Each question has subparts with internal choice in one of the subparts.
- (vii) **Section E** – questions number **31** to **33** are Long Answer Type questions. Each question carries **5** marks.
- (viii) There is no overall choice. However, an internal choice has been provided in Sections **B, D** and **E** of the question paper. A candidate has to write answer for only **one** of the alternatives in such questions.
- (ix) Kindly note that there is a separate question paper for Visually Impaired Candidates.
- (x) Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION A

Questions no. **1** to **16** are Multiple Choice Type Questions, carrying **1** mark each. Choose the best option. $16 \times 1 = 16$

1. The foetal ejection reflex in human triggers the release of _____ hormone from _____.

Fill in the blanks by choosing right option.

- (A) oxytocin, foetal pituitary
- (B) oxytocin, maternal pituitary
- (C) human chorionic gonadotropin, placenta
- (D) progesterone, corpus luteum

2. Match the IUDs in Column I with suitable example in Column II.

<i>Column I</i>	<i>Column II</i>
a. Non-medicated	i. Lippes loop
b. Copper releasing	ii. LNG-20
c. Hormone releasing	iii. Multiload 375

Options :

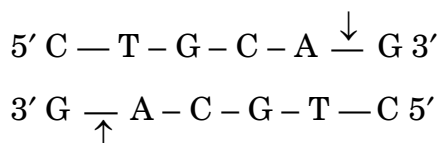
- (A) a-iii, b-ii, c-i
- (B) a-i, b-ii, c-iii
- (C) a-i, b-iii, c-ii
- (D) a-ii, b-i, c-iii
3. In *Pisum sativum*, the flower colour may be violet (V) or white (v). What proportion of the offspring in a cross of 'VV' $\times$ 'vv' would be expected to be violet ?
- (A) 25%
- (B) 50%
- (C) 75%
- (D) 100%
4. Arrange the following in the correct sequence of their evolution and select the correct option :
- (i) Seaweed
- (ii) Invertebrates
- (iii) Jawless fish

Options :

- (A) (i), (ii), (iii) (B) (i), (iii), (ii)
- (C) (ii), (iii), (i) (D) (ii), (i), (iii)

5. If a genetic disease is transferred from a phenotypically normal but carrier female to only some of the male progeny, the disease is :
- (A) autosomal dominant
 - (B) autosomal recessive
 - (C) sex-linked dominant
 - (D) sex-linked recessive
6. A DNA molecule is 160 base pairs long. It has 30% Guanine. How many Adenine bases are present in this DNA molecule ?
- (A) 48
 - (B) 64
 - (C) 96
 - (D) 192
7. A doctor identifies symptoms of nasal congestion, headache, sore throat, hoarseness and cough in a patient. The conclusion is that the patient is infected by a pathogen :
- (A) *Plasmodium*
 - (B) Adenovirus
 - (C) *Salmonella*
 - (D) Rhinovirus
8. Which type of selection is industrial melanism observed in moth, *Biston betularia* ?
- (A) Stabilising
 - (B) Directional
 - (C) Disruptive
 - (D) Artificial

9. C-peptide of human insulin is :
- a part of mature insulin molecule.
 - responsible for formation of disulphide bridges.
 - removed during maturation of pro-insulin to insulin.
 - responsible for its biological activity.
10. Given below is the restriction site of a restriction endonuclease Pst I and the cleavage sites on a DNA molecule.



Choose the option that gives the correct resultant fragments.

- $5' \text{ C — T — G} \qquad \qquad \qquad \text{C — A — G } 3'$
 $3' \text{ G — A — C — G — T} \qquad \qquad \qquad \text{C } 5'$
 - $5' \text{ C — T} \qquad \qquad \qquad \text{G — C — A — G } 3'$
 $3' \text{ G — A — C — G} \qquad \qquad \qquad \text{T — C } 5'$
 - $5' \text{ C — T — G — C} \qquad \qquad \qquad \text{A — G } 3'$
 $3' \text{ G — A — C — G} \qquad \qquad \qquad \text{T — C } 5'$
 - $5' \text{ C — T — G — C — A} \qquad \qquad \qquad \text{G } 3'$
 $3' \text{ G} \qquad \qquad \qquad \text{A — C — G — T — C } 5'$
11. Which of the following fish led to the extinction of an ecologically unique assemblage of more than 200 species of cichlid fish in Lake Victoria of East Africa ?
- Catla Catla
 - Dogfish
 - Nile Perch
 - African Catfish
12. Cattle or goats are never seen browsing on the weed, *Calotropis*. Select the correct option for the reason.
- The plant produces highly poisonous tannins.
 - The plant produces quinine, which is bitter in taste.
 - The plant produces the poisonous chemical, cardiac glycoside.
 - The plant bears prickles.



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) : Repetitive sequences make up a very large portion of human genome.

Reason (R) : Repetitive sequences do not have direct coding functions in the genome.

14. Assertion (A) : The embryo with 8 to 16 blastomeres is called a morula.

Reason (R) : The morula continues to divide and transform into trophoblast.

15. Assertion (A) : The use of chitinase enzyme is necessary for the separation of DNA from yeast cells but not in the case of Spirogyra.

Reason (R) : Fungal cell wall is made up of fungal chitin.

16. Assertion (A) : Besides curdling of milk, LAB also improves its nutritional quality by increasing Vitamin B12.

Reason (R) : LAB, when present in the stomach checks disease-causing microbes.

SECTION B

17. State the role of thymus as a lymphoid organ. Name the cells that are released from it and mention their functions. 2

18. (a) Explain the mutually rewarding relationship between *Yucca* plant and species of moth. 2

OR

(b) Pollination success will be reduced unless the orchid flower co-evolves with the pollinator. Explain. 2

19. (a) Differentiate between grazing food chain and detritus food chain. 2

OR

(b) Ecological pyramids are widely accepted but they still have some limitations. Write any two limitations. 2

20. How do 'implants' act as an effective method of contraception in human females ? Mention one advantage of implants over contraceptive pills. 2

21. (a) Explain any two methods of vectorless gene transfer. 2

OR

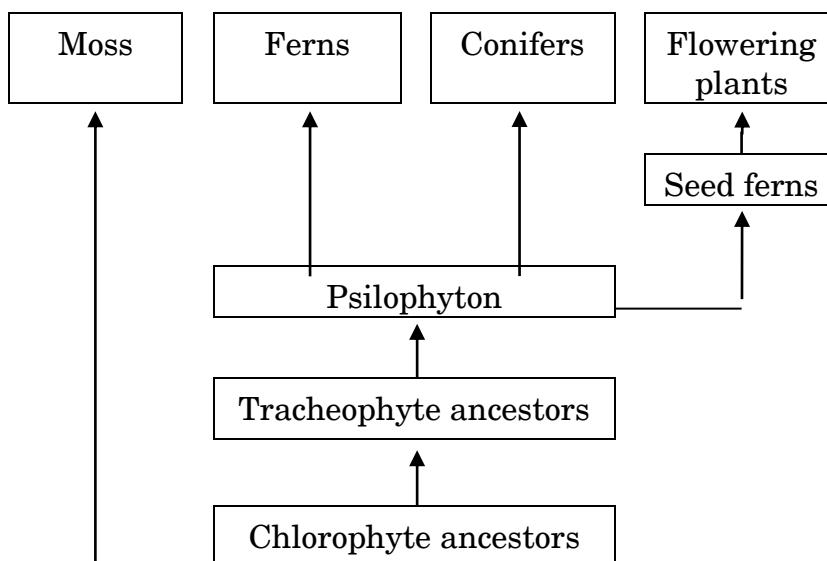
(b) Name the most commonly used bioreactor. List the advantages of the bioreactor. Also write the importance of sampling ports. 2

SECTION C

22. Draw a labelled diagram of a 'replicating fork' showing the polarity. Why does DNA replication occur within such 'fork' ? 3

23. List any three outbreeding devices that flowering plants have developed for cross-pollination and explain how they help to encourage cross-pollination. 3

24. Explain how the following microbes act as biocontrol agents : 3
- (a) *Bacillus thuringiensis*
- (b) *Nucleopolyhedrovirus*
25. Transgenic animals are produced by man. Explain any three ways in which such animals can be beneficial to humans. 3
26. Explain the level of biodiversity at genetic, species and ecological levels with the help of one example each. 3
27. Study the given chart showing evolution of plants. Answer the following questions : 3



- (a) Identify the plant which acts as an immediate ancestor of both ferns and conifers.
- (b) Name the nearest ancestors of flowering plants.
- (c) Name the most primitive group of plants.
- (d) Psilophyton provides common ancestry to which classes ?
- (e) Name the common ancestor of psilophyton and seed ferns.
- (f) Name the common ancestor of mosses and tracheophytes.

28. Given below is an equation describing the growth pattern of a population :

$$dN/dt = rN$$

- (a) Mention the type of growth model or growth pattern of the population described by the given equation.
- (b) What does 'r' in the equation signify ?
- (c) Mention the type of growth curve that will be obtained if the population density (N) is plotted against time (t).
- (d) According to you, will the resource availability be limited or unlimited for this type of growth in the given population ?

3

SECTION D

Questions No. 29 and 30 are Case-Based questions. Each question has 3 sub-questions with internal choice in one sub-question.

29. Read the following passage and answer the questions that follow :

4

The process of copying genetic information from template strand of DNA into RNA is called transcription. It is mediated by RNA polymerase. Transcription takes place in the nucleus of eukaryotic cells. In transcription, only a segment of DNA and only one of the strands is copied into RNA.

- (a) Why is the strand of DNA with 3' → 5' polarity transcribed and not the other strand of 5' → 3' polarity ?
- (b) (i) Why is hnRNA required to undergo splicing ?

1

1

OR

- (b) (ii) Mention the two additional processes which hnRNA needs to undergo after splicing to become functional.
- (c) Why is only one strand of the DNA transcribed ? Give two reasons.

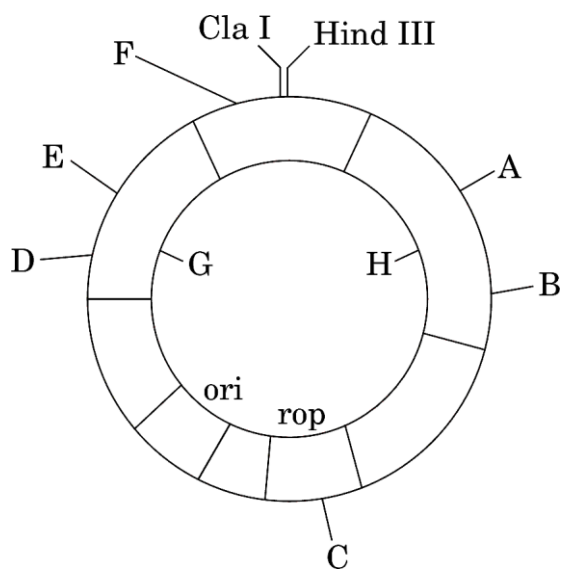
1

1+1=2

30. Read the following passage and answer the questions that follow :

4

We know that plasmids and bacteriophages are the most commonly used vectors in biotechnology experiments. If we can link an alien piece of DNA to the plasmid DNA, the alien DNA can be multiplied equal to the copy number of the plasmid. Engineered vectors are used these days. Study the diagram of the *E. coli* cloning vector pBR322 and answer the questions that follow :



- (a) Why are plasmids and bacteriophages used as cloning vectors ? 1
- (b) (i) Identify : $\frac{1}{2} + \frac{1}{2} = 1$
- (I) The gene in the cloning vector that controls the copy number of the vector.
- (II) The restriction site – C in the 'rop' gene.

OR

- (b) (ii) Identify and name two selectable markers shown in the diagram. 1
- (c) Name the two restriction sites each in the two genes you have identified as selectable markers. 2

SECTION E

31. (a) Work out separate monohybrid crosses up to F_2 generation between two pea plants and two *Antirrhinum* plants, both having contrasting traits with respect to the colour of the flower. Comment on the patterns of inheritance in the crosses carried out in such two cases. 5

OR

- (b) Answer the following questions : 2+3=5
- (i) How does a chromosomal disorder differ from a Mendelian disorder ? Write one example for each.
 - (ii) Name the phenomenon that leads to situations like 'XO' abnormality in humans. Also name this genetic disorder. How are individuals with an XO chromosomal abnormality affected ? Write its symptoms as well as karyotype.

32. (a) (i) Draw the structure of an antibody molecule and label any four of its parts.
- (ii) Differentiate between active and passive immunity. Write any three differences. 2+3=5

OR

- (b) (i) (I) Write the scientific names of the two species of filarial worms causing filariasis.
- (II) How do they affect the body of infected persons ?
- (III) How does the disease spread ?
- (ii) Mention the source and the role of the following in providing defence against infection in the human body :
- (I) Histamine
- (II) Interferons 1+1+1+2=5

- 33.** (a) Briefly explain the events of fertilisation and implantation in an adult human female.

5

OR

- (b) (i) Arrange the following hormones in sequence of their secretion in a pregnant woman :
hCG; LH; FSH; Relaxin.
- (ii) Mention the source and the functions of the above mentioned hormones.

1+4=5