

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

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NOTE

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| <p>(I) कृपया जाँच कर लें कि इस प्रश्न-पत्र में मुद्रित पृष्ठ 23 हैं।</p> <p>(II) प्रश्न-पत्र में दाहिने हाथ की ओर दिए गए प्रश्न-पत्र कोड को परीक्षार्थी उत्तर-पुस्तिका के मुख-पृष्ठ पर लिखें।</p> <p>(III) कृपया जाँच कर लें कि इस प्रश्न-पत्र में 33 प्रश्न हैं।</p> <p>(IV) कृपया प्रश्न का उत्तर लिखना शुरू करने से पहले, उत्तर-पुस्तिका में यथा स्थान पर प्रश्न का क्रमांक अवश्य लिखें।</p> <p>(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।</p> | <p>(I) Please check that this question paper contains 23 printed pages.</p> <p>(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.</p> <p>(III) Please check that this question paper contains 33 questions.</p> <p>(IV) Please write down the Serial Number of the question in the answer-book at the given place before attempting it.</p> <p>(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.</p> |
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General Instructions :

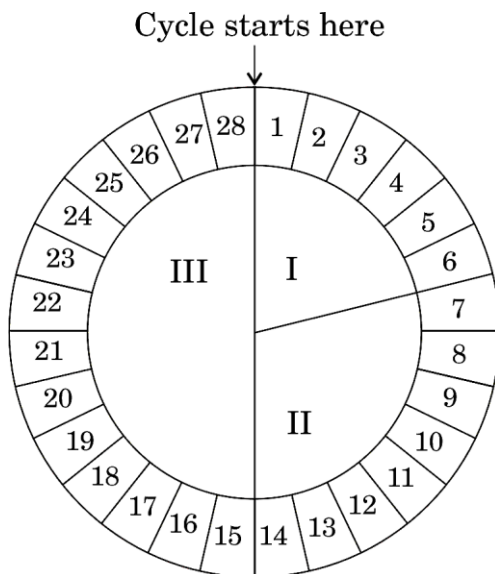
Read the following instructions carefully and follow them :

- (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. In a human female, menstrual cycle of 28 days is represented by the diagram given below.

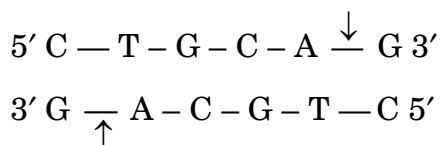


Select the correct statement related with this diagram.

- (A) Primary follicle of ovary matures into Graafian follicle in phase II.
- (B) The hormone secreted in large amounts in phase III is also responsible for maintaining pregnancy in human females.
- (C) Corpus luteum secretes progesterone in phase I, however it degenerates completely in phase III.
- (D) Both (A) and (B).
2. The cells of endosperm have 24 chromosomes. What will be the number of chromosomes in the gametes ?
- (A) 8 (B) 16
- (C) 23 (D) 32

3. During different phases of menstrual cycle, hormones are secreted. Choose the option showing the correct sequence of hormones.
- (A) FSH, Progesterone, Estrogen
 - (B) Estrogen, FSH, Progesterone
 - (C) FSH, Estrogen, Progesterone
 - (D) Estrogen, Progesterone, FSH
4. 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
5. 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)
6. S is the stimulant of central nervous system and interferes with the transport of T, a neurotransmitter. Identify S and T and choose the correct option.
- (A) S – Cocaine, T – Dopamine
 - (B) S – Heroin, T – Acetylcholine
 - (C) S – Heroin, T – Dopamine
 - (D) S – Cocaine, T – Acetylcholine

7. Select the odd option in the context of convergent evolution.
- (A) Eyes of Octopus and Mammals
 (B) Flippers of Penguins and Dolphins
 (C) Flying Squirrel and Flying Phalanger
 (D) Thorns of Bougainvillea and Tendrils of Cucurbita
8. *Monascus purpureus* is a yeast used commercially in the production of which one of the following ?
- (A) Ethanol (B) Streptokinase
 (C) Citric acid (D) Statins
9. 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.

- (A) $5' \text{ C — T — G}$ $\text{C — A — G } 3'$
 $3' \text{ G — A — C — G — T}$ $\text{C } 5'$
- (B) $5' \text{ C — T}$ $\text{G — C — A — G } 3'$
 $3' \text{ G — A — C — G}$ $\text{T — C } 5'$
- (C) $5' \text{ C — T — G — C}$ $\text{A — G } 3'$
 $3' \text{ G — A — C — G}$ $\text{T — C } 5'$
- (D) $5' \text{ C — T — G — C — A}$ $\text{G } 3'$
 $3' \text{ G}$ $\text{A — C — G — T — C } 5'$
10. Which of the following ecosystem is most productive in terms of net primary productivity ?
- (A) Desert (B) Tropical rainforests
 (C) Oceans (D) Estuaries

11. Bt-toxin genes have been expressed in plants in order to provide resistance against :

- (i) lepidopterans and fungi
- (ii) animals and bacteria
- (iii) coleopterans and dipterans
- (iv) lepidopterans

Options :

- | | |
|--------------------|------------------------|
| (A) (ii) and (iii) | (B) (i), (ii) and (iv) |
| (C) (iii) and (iv) | (D) (ii) and (iv) |

12. According to IUCN, some of the extinctions include :

- (i) Dodo
- (ii) Indian gazelle
- (iii) Thylacine
- (iv) Steller's Sea Cow

Options :

- | | |
|-------------------------------|--------------------|
| (A) (i), (ii), (iii) and (iv) | (B) (ii) and (iv) |
| (C) (i), (iii) and (iv) | (D) (iii) and (iv) |

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) :* Genetically modified microbes help in crop protection.

Reason (R) : *Bacillus thuringiensis* (Bt) bacteria control insects by producing prototoxins.

14. *Assertion (A)* : Trichoderma species are free living fungi that are very common in the root ecosystems.

Reason (R) : They are effective bio-control agents of several plant pathogens.

15. *Assertion (A)* : The endometrium undergoes cyclic changes during the menstrual cycle.

Reason (R) : Perimetrium contracts strongly during delivery of the baby.

16. *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.

SECTION B

17. Draw a labelled diagram of the embryonic stage that gets implanted in the human uterus. State the functions of two labelled parts. 2

18. (a) Mention the functions of each of the following : 2

(i) Tassels of Corn Cob

(ii) Scutellum

OR

(b) Farmers prefer apomictic seeds over hybrid seeds. Give any two reasons. 2

19. (a) Suggest how a virus-free healthy plant can be obtained from a diseased sugarcane plant. 2

OR

(b) In order to force bacteria to take up the recombinant DNA, they must be made competent. Explain how it can be achieved. 2

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

OR

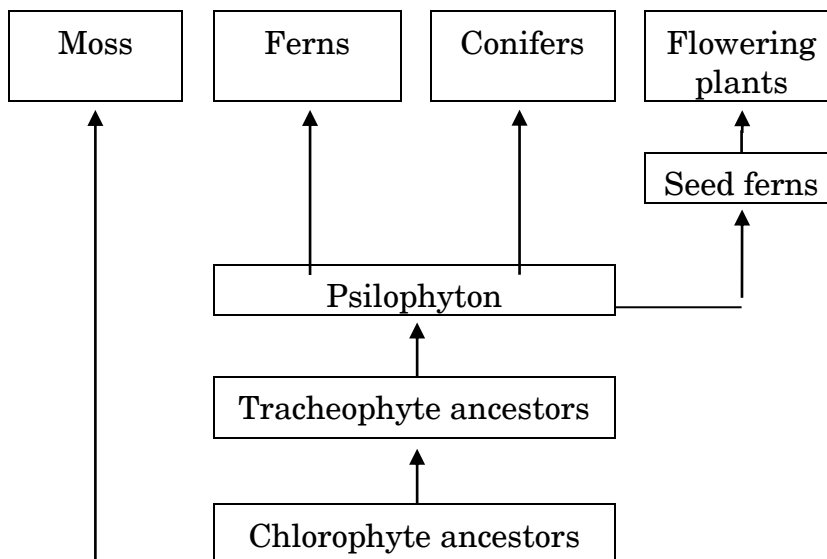
- (b) Ecological pyramids are widely accepted but they still have some limitations. Write any two limitations. 2
21. One of the salient features of the genetic code is that it is nearly universal from bacteria to humans. Mention two exceptions to this rule. Why are some codes said to be degenerates ? 2

SECTION C

22. (a) Draw a sectional view of seminiferous tubule of a human. Label the following cells in the seminiferous tubule :
(i) Cells that divide by mitosis to increase their number
(ii) Cells that undergo meiosis I
(iii) Cells that undergo meiosis II
(iv) Cells that help in the process of spermiogenesis
(b) Mention the role of Leydig cells. 3
23. Explain the polygenic inheritance pattern with the help of a suitable example. 3
24. Mention a product of human welfare obtained with the help of each one of the following : 3
- (a) *Saccharomyces cerevisiae*
(b) *Propionibacterium shermani*
(c) *Aspergillus niger*
(d) *Trichoderma polysporum*
(e) *Acetobacter aceti*
(f) *Streptococcus*

25. 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.
26. (a) Write the scientific name of the nematode that infects tobacco plants. Also name the part of the plant that it infects.
- (b) How is *Agrobacterium* used to protect tobacco plants from attack by this pest ?
27. Explain the level of biodiversity at genetic, species and ecological levels with the help of one example each.
28. Explain Gause's 'Competitive Exclusion Principle' with the help of a suitable example.

3

3

3

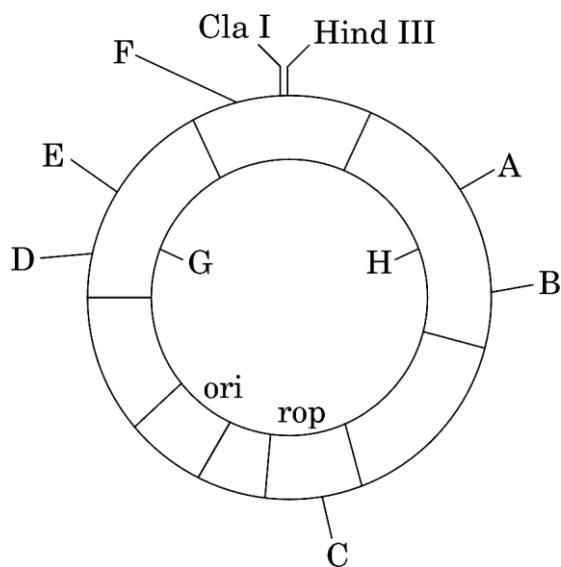
SECTION D

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

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

30. 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 ? 1
- (b) (i) Why is hnRNA required to undergo splicing ? 1

OR

- (b) (ii) Mention the two additional processes which hnRNA needs to undergo after splicing to become functional. 1
- (c) Why is only one strand of the DNA transcribed ? Give two reasons. 1+1=2

SECTION E

31. (a) Work out separate monohybrid crosses up to F₂ 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