

Time Allowed : 3 Hours

Maximum Marks : 70

**General Instructions:** 

- There are a total of 27 questions and five sections in the question paper. All questions are compulsory.
- Section A contains question numbers 1 to 5, multiple choice questions of one mark each.  
Section B contains question numbers 6 to 12, short answer type I questions of two marks each.  
Section C contains question numbers 13 to 21, short answer type II questions of three marks each.  
Section D contains question number 22 to 24, case-based short answer type questions of three marks each.  
Section E contains question numbers 25 to 27, long answer type questions of five marks each.
- There is no overall choice in the question paper. However, internal choices are provided in two questions of one mark, one question of two marks, two questions of three marks and all three questions of five marks. An examinee is to attempt any one of the questions out of the two given in the question paper with the same question number.

**SECTION - A**

- Plasmids are suitable vectors for gene cloning because:
  - these are small circular DNA molecules which can integrate with host chromosomal DNA.
  - these are small circular DNA molecules with their own replication origin site.
  - these can shuttle between prokaryotic and eukaryotic cells.
  - these never carry antibiotic resistance genes.
- A restriction fragment containing a specific gene of interest can be identified by gel electrophoresis followed by transferring the DNA to a membrane as solid support matrix using a procedure called:
  - Gene amplification
  - Southern blot
  - Polymerase chain reaction
  - Western blot
- B-lymphocytes are primarily involved in:
  - Humoral immunity
  - Autoimmune disorders
  - Graft rejection
  - Cell-mediated immunity

**OR**

AIDS is caused by HIV that principally infects:

- all lymphocytes
  - activator B-cells
  - cytotoxic T-cells
  - T<sub>4</sub> lymphocytes
- What are protected areas?
  - The following given statements represent functions of IUDs.
    - Increase phagocytosis of sperms.
    - Release Cu ions that suppress sperm motility and fertilising capacity of sperms.
    - Make the uterus unsuitable for implantation.
    - Make the cervix hostile to sperms.
    - Prevent semen from entering the female reproductive tract.

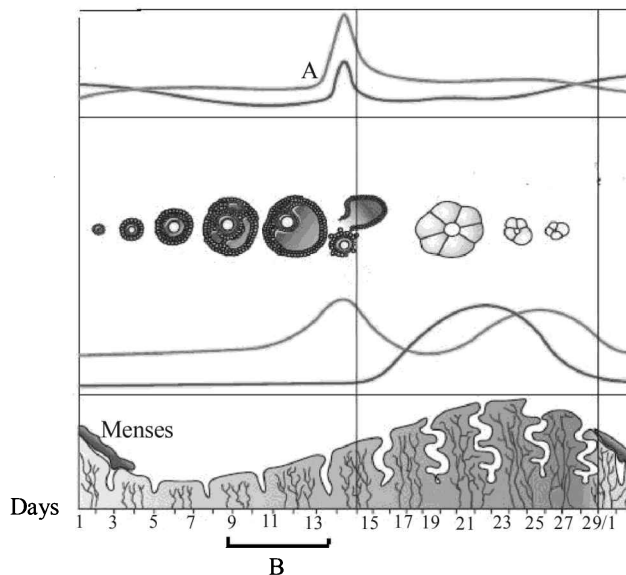
Choose the correct answer from the options given below:

- (i), (ii), (iii), (iv) and (v)
- (i), (ii), (iii) and (iv)
- (i) and (ii)
- (ii), (iii) and (iv)

**OR**

Menstrual cycle can be regulated by hormones secreted from pituitary gland and the ovary. Pituitary hormones, released from the anterior pituitary gland, promote ovulation and stimulate the ovaries to produce their hormones.

In the given figure of menstrual cycle, identify the hormone (marked as A) and the phase (marked as B).



- (a) A – LH; B – Proliferative phase  
 (b) A – FSH; B – Menstruation phase  
 (c) A – Oestrogen; B – Follicular phase  
 (d) A – Progesterone; B – Secretory phase

### **SECTION - B**

6. Write the location and function of Sertoli cells in humans.

**OR**

Give a detail account of male sex hormones.

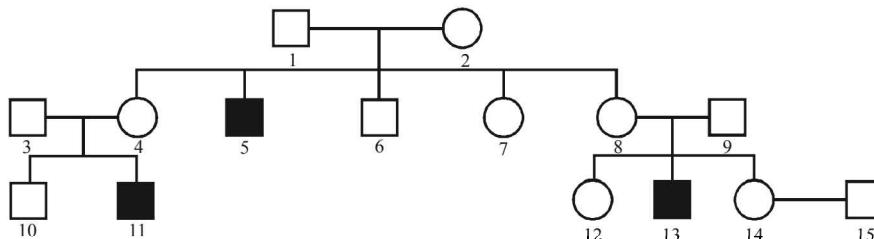
7. (a) Name the commonly used hormones present in contraceptive pills.  
 (b) Differentiate between contraceptive pills and implants.
8. Haemophilia victims are mostly men. Very rarely women are affected by this disorder. Explain, why is it so?
9. Certain molecular processes (i-iv) are given below.
- (i) DNA  $\longrightarrow$  DNA  
 (ii) DNA  $\longrightarrow$  hnDNA  
 (iii) mRNA  $\longrightarrow$  Protein  
 (iv) Repressor protein  
                   +  
       Operator  $\longrightarrow$  No transcription

Give the term to these processes after selecting them from the following terms: Recombination, gene regulation, transcription, translation, replication, gene transfer, DNA fingerprinting

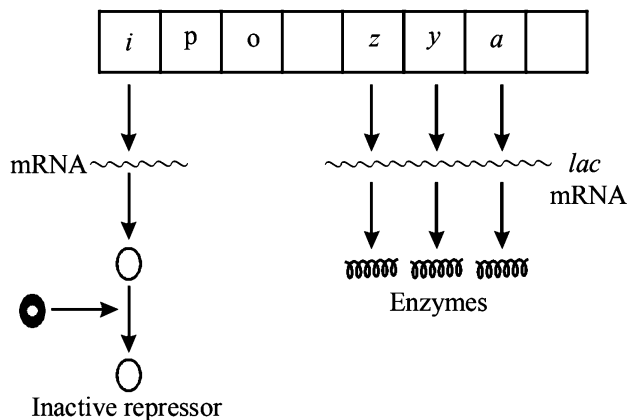
10. (a) What are biofertilisers?  
 (b) What would have happened if antibiotics were not discovered?
11. How is DNA isolated in purified form from a bacterial cell?
12. (i) Name the technique used for separation of DNA fragments.  
 (ii) Write the type of matrix used in this technique.  
 (iii) How is the separated DNA visualised and extracted for use in recombinant technology?

### SECTION - C

13. Haemophilia is a sex linked recessive disorder of humans. The pedigree chart given below shows the inheritance of haemophilia in one family. Study the pattern of inheritance and answer the questions given below.

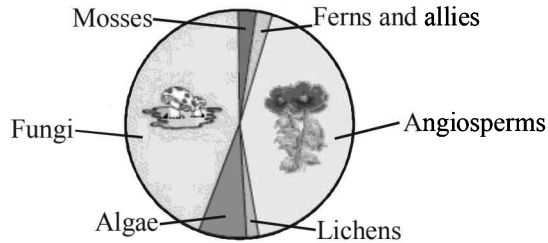


- (a) Give all the possible genotypes of the members 4, 5 and 6 in the pedigree chart.  
 (b) A blood test shows that the individual 14 is a carrier of haemophilia. The member numbered 15 has recently married the member numbered 14. What is the probability that their first child will be a haemophilic male? Show with the help of Punnett square.
14. Why are angiosperm anthers called dithecous? Describe the structure of microsporangium and draw a well labelled diagram.
15. Study the figure given below and answer the questions.



- (a) What does the figure express?  
 (b) When does the transcription of *lac* mRNA stop?  
 (c) Name the enzymes transcribed by the genes 'z' and 'a'.
- OR**
- (a) Name the scientist who suggested that the genetic code should be made of a combination of three nucleotides. Explain the basis on which he arrived at this conclusion.  
 (b) Name two salient features of genetic code.
16. How do plant benefit from having mycorrhizal symbiotic association?  
 17. Make a list of any three outbreeding devices that flowering plants have developed and explain how they help to encourage cross-pollination.
18. (a) A mixture of fragmented DNA was electrophoresed in an agarose gel. After staining the gel with ethidium bromide, no DNA bands were observed. What could be the reason?  
 (b) Do eukaryotic cells have restriction endonucleases? Justify your answer.

19. Observe the global biodiversity distribution of the major plant taxa in the given diagram and answer the question accordingly.



- Which group of plants are the most endangered?
- Why are mosses/ferns so few? Give reason.
- How do fungi that are heterotrophs sustain themselves as a large populations?
- Which group of plants is most advanced?

OR

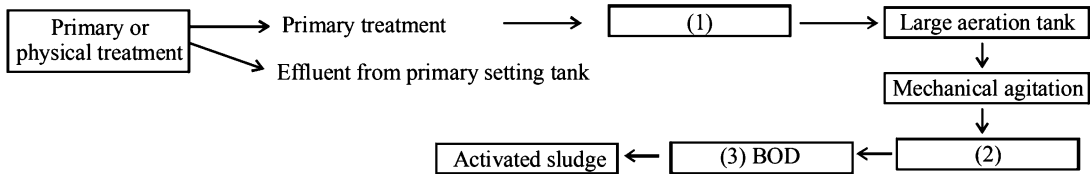
Define the terms:

- Allen's Rule
- Commensalism
- Mutualism

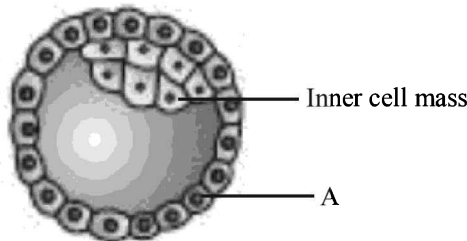
- Differentiate mutualism and commensalism.
- Describe the role of heat, primers and the bacterium *Thermus aquaticus* in the process of PCR.

**SECTION - D**

- With reference to the given outline representation, answer the following questions related with (1), (2) and (3).



- After the primary setting tank, the effluents are passed through which treatment (1)?
  - Which type of treatment will be done in treatment (1)?
  - Why the effluents are mechanically agitated?
  - What will happen in the level of BOD and why?
- What are the functions of (i) methylated guanosine cap, (ii) poly-A "tail" in a mature on RNA?
  - Study the given figure and answer the questions as directed.



- Name the stage of human embryo the figure represents.
- Identify 'A' in the figure and mention its function.
- Mention the fate of the inner cell mass after implantation in the uterus.
- Where are the stem cells located in this embryo?

**SECTION - E**

25. Mr. Oberoi angrily says to his daughter not to marry Mohan since their family is known to inherit haemophilia. The daughter objected to her father's order. Mr. Oberoi was adamant and threatened also. Brijmohan's daughter explained the biological interpretation of his fear and convinced her father.
- Briefly discuss the inheritance pattern of haemophilia.
  - Mohan was not haemophilic though his father is haemophilic. Explain the condition of Mohan by considering following three conditions of his mother:
    - Normal mother
    - Carrier mother
    - Haemophilic mother
  - Is there any fear of haemophilia if Mr. Oberoi daughter marries Mohan (non-haemophilic)?

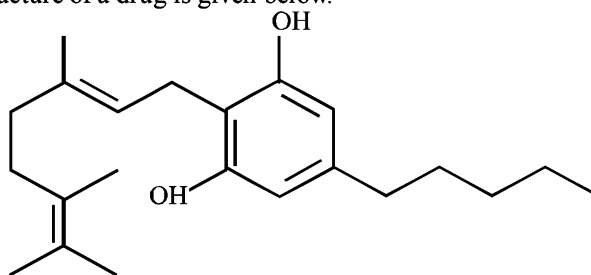
**OR**

How Hershey and Chase proved that DNA is the genetic material?

26. Briefly explain the lifecycle of plasmodium. What measures would you take to control malaria?

**OR**

- What measures do you suggest for prevention and control of alcohol and drug abuse among adolescents?
- The outline structure of a drug is given below.



- Which group of drugs does this represent? Name the plant from which it is obtained.
  - What are the modes of consumption of these drugs?
  - Name the organ of the body which is affected by consumption of these drugs.
27. Mention the factors which cause changes in the size of population of a species.
- OR**
- State how *ex-situ* conservation helps in protecting biodiversity. Name four types of *ex-situ* methods.
  - Explain the importance of sacred groves.