

BIOLOGY (Theory)

[Time allowed: 3 hours]

[Maximum marks:70]

General Instructions:

- (i) *All questions are compulsory.*
- (ii) *This question paper consists of four sections A, B, C and D. Section A contains 8 questions of one mark each, Section B is of 10 questions of two marks each, Section C is of 9 questions, of three marks each and Section D is of 3 questions of five marks each.*
- (iii) *There is no overall choice. However, an internal choice has been provided in one question of 2 marks, one question of 3 marks and all the three questions of 5 marks weightage. A student has to attempt only one of the alternatives in such questions.*
- (iv) *Wherever necessary, the diagrams drawn should be neat and properly labelled.*

- Q9.** (a) Highlight the role of thymus as a lymphoid organ.
(b) Name the cells that are released from the above mentioned gland. Mention how they help in immunity. (2)

- Ans:** (a) Thymus is one the primary lymphoid organ of the immune system. Maturation of lymphocytes occurs in the thymus. **T-cells** produced in the bone marrow get matured in the **thymus** and are released from here.
(b) **T- cells** do not themselves produce antibodies, but help B-cells to produce them. They are also responsible for cell-mediated immune response (CMI).

- Q10.** Why do clown fish and sea anemone pair up? What is this relationship called? (2)

- Ans:** Clown fish maintains a commensalistic relation with the sea anemone. In this interaction, one species benefits and the other is neither harmed nor benefited. Sea anemone has stinging tentacles that provide protection to clown fish from predators. The anemone does not appear to derive any benefit from the clown fish.

- Q11.** Some organisms suspend their metabolic activities to survive in unfavourable conditions. Explain with the help of any four examples. (2)

- Ans:** 1. 1. In bacteria, fungi and lower plants, various kinds of thick-walled spores(cysts) are formed which help them to survive in unfavourable conditions – these germinate on availability of suitable environment.
2. In higher plants, seeds and some other vegetative reproductive structures serve as means to tide over periods of stress besides helping in dispersal – they germinate to form new plants under favourable moisture and temperature conditions. They do so by reducing their metabolic activity and going into a state of ‘**dormancy**’.

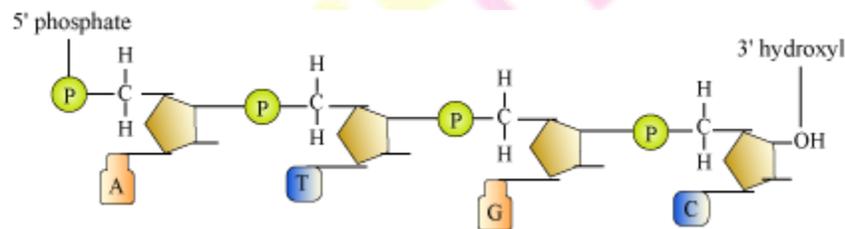
3. In animals, the organism, if unable to migrate, might avoid the stress by escaping in time. The familiar case of bears going into **hibernation** during winter is an example of escape in time. Some snails and fish go into **aestivation** to avoid summer-related problems (heat and desiccation).
4. Under unfavourable conditions, many zooplankton species in lakes and ponds are known to enter **diapause**, a stage of suspended development.

- Q12.** (a) State the role of DNA ligase in biotechnology.
 (b) What happens when *Meloidogyne incognita* consumes cells with RNAi gene? (2)

Ans: (a) **DNA ligase** enzyme is used to join two DNA fragments from their ends.
 (b) When *Meloidogyne incognita* (parasite) consumes cells with RNAi gene, parasite cannot survive and this prevents infestation. The introduced RNAi gene DNA forms both sense and anti-sense RNA. Two strands being complementary to each other bend and form *ds* RNA, leading to RNAi. Thus, the mRNA of nematode is silenced and the parasite cannot survive there.

- Q13.** Draw a schematic diagram of a part of double stranded dinucleotide DNA chain having all the four nitrogenous bases and showing the correct polarity. (2)

Ans: Schematic diagram of a double stranded dinucleotide DNA chain having all the four nitrogenous bases with polarity.



- Q14.** Name of parasite the causes filariasis in humans. Mention its two diagnostic symptoms. How is this transmitted to others? (2)

Ans: *Wuchereria* (*W. bancrofti* and *W. malayi*), are the filarial worms that cause filariasis in humans.

Diagnostic symptoms:

- The disease majorly affects the lymph system, collection of fluid causes swelling in arms breasts, legs and genital regions in men. This swelling is known as lymphedema.
- Inflammation in lower limbs.

Transmission: The pathogens are transmitted to a healthy person through the bite by the female mosquito vectors.

- Q15.** Name the source of streptokinase. How does this bioreactor molecule function in our body? (2)

OR

How do mycorrhizae act as biofertilizers? Explain. Name a genus of fungi that forms a mycorrhizal association with plants.

Ans: Streptokinase enzyme is produced by the bacterium *Streptococcus*. It is modified by genetic engineering and is used as a clot buster for removing clots from the blood vessels of patients who have suffered from myocardial infraction.

OR

Fungi are also known to form symbiotic associations with plants, this association is called mycorrhiza. The fungal symbiont in these associations absorbs phosphorus from soil and passes it to the plant. Plants having such associations show other benefits also, such as resistance to root-borne pathogens, tolerance to salinity and drought, and an overall increase in plant growth and development.

The fungi belonging to the genus *Glomus* form mycorrhizal associations with plants.

- Q16.** (a) State the difference between meiocyte and gamete with respect to chromosome number.
(b) Why is a whiptail lizard referred to as parthenogenetic? (2)

Ans: (a) The gamete contains haploid set of chromosomes while the meiocyte contains a diploid set.
(b) Whiptail lizard is parthenogenetic because in this animal, an unfertilized egg develops into a new individual. This process of reproduction without fertilization is called parthenogenesis.

- Q17.** Explain the work carried out by Cohen and Boyer that contributed immensely in biotechnology. (2)

Ans: Stanley *Cohen* and Herbert *Boyer* conducted one of the first genetic engineering *experiments*. They invented the technique of DNA cloning. Cohen developed a method of removing plasmids from the cell and then reinserting them in other cells. Combining this process with that of DNA splicing enabled Boyer and Cohen to recombine segments of DNA in desired configurations and insert the DNA in bacterial cells, which could then act as manufacturing plants for specific proteins. Stanley Cohen and Herbert Boyer accomplished this in 1972.

- Q18.** Where is sporopollenin present in plants? State its significance with reference to its chemical nature. (2)

Ans: Sporopollenin is present in exine of pollen grains in plants. It is one of the most resistant organic substances and can withstand high temperature, strong acids and alkali. No enzyme that degrades sporopollenin is so far known. This sporopollenin helps the pollen grain to be well preserved.