PART I (40 marks)

*Answer **all** questions.*

Question 1.

(a) Read the following questions carefully. For each question there are four alternatives A, B, C and D. Choose the correct alternative and write it in the space provided. **[5]**

(i) The oxidation of water during photosynthesis results in the release of

A carbodioxide.
B hydrogen.
C oxygen.
D energy.

Answer: ……

(ii) The sequential stages of embryo formation in human is

A cleavage → gastrulation → blastulation.
B cleavage → blastulation → gastrulation.
C blastulation → cleavage → gastrulation.
D gastrulation → blastulation → cleavage.

Answer: ……

(iii) The causative agent of a disease that is characterized by prolonged cough and sputum with blood is

A Mycobacterium tuberculosis.
B Mycobacterium salmonella.
C Mycobacterium diphtheriae.
D Mycobacterium leprae.

Answer: ……

(iv) How is unconditional reflex different from conditional reflex?

A Unconditional reflex has a constant reflex arc.
B Unconditional reflex establishes new reflex arc.
C Unconditional reflex has an additional reflex arc.
D Unconditional reflex has an associated reflex arc.

Answer: ……

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(v) When supplied with gibbereline, long day plants under unfavourable photoperiod flower due to the formation of

A ethylene.
B florigen.
C ABA.
D IAA.

Answer: ……

(b) Match each item of Column A with the most appropriate item of Column B. Rewrite the correct pairs by writing the number and the corresponding alphabet in the spaces provided. For example, (ix) – (k) **[4]**

Column A	**Column B**
(i) Gamma rays	(a) genotype
(ii) Germinal variations	(b) haploid
(iii) Heritable	(c) diploid
(iv) Mustard gas	(d) phenotype
(v) n-chromosome	(e) somatic cell
(vi) Non-heritable	(f) physical mutagens
(vii) Somatogenic variation	(g) germ cells
(viii) 2n-chromosome	(h) chemical mutagens
	(i) variation
	(j) polyploidy

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(c) ***Correct the following statement by changing the underlined words. Rewrite ONLY the correct answer. DO NOT copy the whole sentence.*** **[5]**

(i) Meristematic tissues are <u>differentiated</u>.

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(ii) <u>Periodontitis</u> is a gum disease caused by the deficiency of vitamin C.

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(iii) Hypersecretion of growth hormone in an adult leads to <u>gigantism</u>.

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(iv) Absence of free <u>hydrogen</u> helped in preserving organic compounds on primitive earth.

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(v) Heterosis is the exhibition of <u>inferior</u> traits of the hybrid over both of its parents.

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(d) ***Give suitable reasons for the following:*** **[5]**

(i) Chelators are used in nutrient solutions when pH is alkaline.

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(ii) Freshly shed seeds remain dormant.

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(iii) Gaseous exchange continues to occur in the lungs even after maximum expiration.

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(iv) Presence of ectomycorrhiza results in greater plant vigour.

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(v) Passive immunity provides immediate relief.

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(e) Fill-in-the-blanks with appropriate words. **[5]**

(i) The phenomenon of producing photoperiodic influence on the flowering of plant is known as ……

(ii) The elimination of nitrogenous waste as urea is called ……

(iii) The loss or non-development of chlorophyll resulting in the yellowing of leaves is called ……

(iv) The colloidal aggregates of macromolecules in the sea of primitive earth are the ……

(v) The green crops which produce ethanol are called ……

(f) State whether the following statements are true or false. **[2]**

(i) Tapetum is a nutritive tissue found in the anther of a plant.

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(ii) Smooth muscles occur in antagonistic pairs.

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(iii) The length of dark period is not important in inducing flowering in short day plants.

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(iv) Proteins produced by micro-organisms are recombinant protein.

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(g) ***Give the scientific terms of the following:*** **[2]**

(i) The overall changes in the structure of the plant.

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(ii) The irreversible state of muscle contraction.

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(iii) Pollination in which the pollen grains are transferred from the anther to the stigma of the same flower.

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(iv) Organisms containing transgene.

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(h) ***Mention one significant difference between each of the following based on what is given in the brackets.*** **[4]**

(i) Multiplicative growth and auxetic growth (*nature of growth*)

Multiplicative growth	**Auxetic growth**

(ii) Acrenchyma and chlorenchyma (*presence of chloroplast*)

Acrenchyma	**Chlorenchyma**

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(iii) Callus culture and suspension culture (*nature of medium*)

Callus culture	**Suspension culture**

(iv) Mechanical control and Cultural control of pest (*method*)

Mechanical control	**Cultural control**

(i) Answer the following questions.

(i) Why are the walls of arteries thicker than the walls of the veins? **[2]**

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(ii) Write down ***two*** importance of imbibition to plants. **[2]**

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(iii) Mention ***two*** functions of mast cell of connective tissue in animals. **[2]**

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(iv) What is frame shift mutation? **[2]**

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PART II
SECTION A (30 marks)
Answer any three questions.

Question 2.

(a) (i) Define muscle fatigue. **[1]**

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(ii) Respiration in human involves inspiration and expiration. List and explain the stages of inspiration. **[3]**

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(b) (i) The use of respiratory inhibitors in plants reduces the rate of active water absorption. Explain the correlation between respiration and active water absorption. **[2]**

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(ii) What will happen to plants if there is deficiency of,

1. potassium? **[1]**

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2. calcium? **[1]**

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(c) (i) Differentiate between macro elements and micro elements with the help of an example each. **[1]**

Macro elements	**Micro elements**

(ii) What will happen to sieve tubes if the companion cells are removed from the phloem of the plants? **[1]**

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Question 3.

(a) (i) Mention the site of dark reaction of photosynthesis in the chloroplast. **[1]**

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(ii) Explain Hatch-Slack cycle operating in C_4 plants with Kranz anatomy. **[2]**

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(b) (i) Draw a labelled diagram of the internal structure of human testis. **[3]**

(ii) Write ***two*** differences between geotropism and hydrotropism. **[2]**

Geotropism	**Hydrotropism**

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(c) Compare the role of beta-cells and alpha-cells in the human pancreas. **[2]**

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Question 4.

(a) (i) What is gerontology? **[1]**

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(ii) Describe any ***four*** types of xylem tracheids based on secondary thickening. **[2]**

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(b) (i) State ***two*** differences between arc auxanometer and pfeffer's auxanometer. **[2]**

Arc auxanometer	**Pfeffer's auxanometer**

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(ii) How does lymphatic system help maintain osmotic concentration of blood? **[3]**

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(c) Why is there no breakage of continuity of water column in xylem vessels even in presence of air bubbles? **[2]**

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Question 5.

(a) (i) What is Emerson's first effect? **[1]**

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(ii) Explain the structure of mature RBC and mention its advantages. **[2]**

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(b) (i) With the help of diagrams, show the three types of entry of pollen tube into the ovule. **[3]**

(ii) Differentiate between small intestine and large intestine based on their role in digestion. **[2]**

Small intestine	**Large intestine**

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(c) With the help of a diagram, explain the mechanism of negative geotropism and positive geotropism in plant. **[2]**

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Question 6.

(a) (i) What is meant by bolting in plants? **[1]**

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(ii) Explain how synaptic delay differs from synaptic fatigue during the conduction of nerve impulse. **[2]**

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(b) (i) Draw a labelled diagram of the internal structure of a human kidney. **[3]**

(ii) The primary endosperm nucleus of angiosperms is triploid. Why? **[1]**

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(c) (i) What is 'grand period of growth' in plants? **[1]**

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(ii) Give reasons for the following: **[2]**

1. The contraction of muscles in humans does not require oxygen.

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2. Red muscle fibres of human can contract for prolonged durations without fatigue.

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SECTION B (30 marks)

Answer any two questions.

Question 7.

(a) (i) Expand the abbreviation ARC. **[1]**

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(ii) The process of rehabilitation for drug abusers has short term impact. Do you agree? Justify. **[2]**

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(b) (i) With the help of an example, show that man and ape exhibit monophyletic origin. **[2]**

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(ii) Mention ***four*** factors that lead to genetic erosion. **[2]**

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(c) (i) Write ***two*** advantages and disadvantages of biofertilizers. **[2]**

Advantages	**Disadvantages**

(ii) Organic farming is much emphasized in our country. Suggest ***four*** methods of biological pest control. **[2]**

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(iii) Give an example of transversion in substitution mutation. **[1]**

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(d) (i) Preservation of germplasm is subjected to cryopreservation. Why? **[1]**

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(ii) Why is malignant tumour considered more dangerous than benign tumour? **[2]**

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Question 8.

(a) (i) What is meant by heritable mutations? **[1]**

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(ii) Explain somatic cell hybridization in plants. **[2]**

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(b) (i) Why modern atmosphere does not contain methane and ammonia? **[2]**

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(ii) The production of biogas has dual benefit. Do you support the statement? Justify your answer with reasons. **[1]**

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(iii) Mention ***two*** advantages of tissue culture method for preserving germplasm. **[2]**

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(c) (i) People suffering from G-6-PD deficiency have higher survival value in malaria infected regions. Support your answer based on the theory of natural selection. **[2]**

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(ii) How is somatic mutation insignificant from evolutionary point of view? **[3]**

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(d) The practice of amniocentesis must be abolished. Do you support the statement? Justify your answer with ***four*** reasons. **[2]**

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Question 9.

(a) (i) Mutation breeding brings about desirable traits in plants. Do you support the statement? Justify with reasons. **[2]**

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(ii) What happens when plant callus cells are kept in a medium containing benzylaminopurine (BAP)? **[1]**

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(iii) How does Darwin's Finches support speciation by adaptive radiation? **[2]**

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(b) (i) Give ***four*** reasons why human beings are considered more advanced than apes. **[2]**

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(ii) Why is it important to explore under utilized crops like Laucaena? **[1]**

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(iii) How does non-specific defense mechanism resist infection? **[2]**

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(c) (i) What were eobionts on primitive earth? **[1]**

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(ii) Lamarck's theory of evolution is now considered as an erroneous assumption. Do you agree? Justify. **[2]**

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(iii) Mutations are raw materials for evolution. Why? **[2]**

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Question 10.

(a) (i) What is meant by sibling species? **[1]**

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(ii) Oparin suggested that conditions on primitive earth were favourable for chemical evolution. Describe the formation of complex organic compound on primitive earth. **[2]**

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(b) (i) Why are local cows artificially inseminated with semen of a bull with desirable characters? **[2]**

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(ii) Explain the stages of obtaining hexaploid wheat by polyploidy. **[3]**

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(c) (i) 'Magnetic resonance imaging should be commercialized in Bhutan'.
Do you agree with the statement? Justify your answer. **[2]**

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(ii) Fore limbs of bird and man are homologous. Explain. **[2]**

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(d) (i) Why did Haldane describe primitive sea water as the 'hot dilute soup'? **[2]**

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(ii) Why is social forestry advantageous in terms of energy supply? **[1]**

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