

PART - II

- NOTE:** (i) Part-II is to be attempted on the separate Answer Book.
 (ii) Attempt **ONLY FOUR** questions from PART-II by selecting **TWO** questions from **EACH SECTION**.
ALL questions carry **EQUAL** marks.
 (iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
 (iv) Write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
 (v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
 (vi) Extra attempt of any question or any part of the question will not be considered.
 (vii) **Use of Calculator is not allowed.**

(SECTION - A)

- Q. 2. (a) Evaluate the impact of excessive fertilizer use on soil chemistry and groundwater quality. (5)
 (b) Describe the structural organization of the solar system, including terrestrial planets, gas giants, dwarf planets. (5)
 (c) Discuss the environmental and chemical challenges associated with polymer degradation. Evaluate the effectiveness of biodegradable plastics in addressing global plastic pollution. (5)
 (d) Identify the major causes of food deterioration (biological, chemical, physical) and give examples for each. (5) (20)
- Q. 3. (a) Explain the key phases of Disaster Risk Management: mitigation, preparedness, response, and recovery. (5)
 (b) Describe the physical factors that trigger Avalanches in mountainous regions. Name the modern technologies used in avalanche prediction and monitoring. (5)
 (c) Discuss the structural diversity of lipids. Evaluate how variations in fatty acid composition influence membrane fluidity and cell signalling mechanisms. (5)
 (d) Describe the process of solar photovoltaic energy conversion. How do factors such as irradiance, panel orientation, and temperature influence solar power output? (5) (20)
- Q. 4. (a) Describe the principle of hydroelectric power generation. What environmental and geographical constraints limit the widespread development of hydropower? (5)
 (b) Describe the hydrosphere and the major components of Earth's water. How does the water cycle maintain the distribution of freshwater? (5)
 (c) Explain the causative agent, mode of transmission, and life cycle of the dengue virus. How does the Aedes mosquito contribute to the spread of the disease? (5)
 (d) Discuss the role of Decision Support Systems (DSS) in organizational management and strategic planning. (5) (20)
- Q. 5. (a) Describe the working principle of cellular networks. How do mobile devices maintain connectivity while moving between cells? (5)
 (b) Using the photoelectric effect, explain the particle nature of electromagnetic radiation. How did experimental observations challenge Classical Wave Theory and lead to the development of quantum mechanics? (5)
 (c) List the major social media platforms used for business and communication. How do they contribute to digital marketing? Explain. (5)
 (d) Explain how the GPS system determines the position of a receiver using satellites. (5) (20)

(SECTION - B)

- Q. 6. (a) A population of 120 individuals contains 45 engineers, 30 teachers, and the rest are administrators. A simple random sample of 6 individuals is selected.
 (i) What is the probability that exactly 3 engineers are included in the sample? 0.081
 (ii) What is the probability that the sample contains no teachers? 0.247 (5)
- (b) A researcher measures the same length five times: 12.478 m, 12.463 m, 12.481 m, 12.469 m, 12.472 m. 0.47206
 Determine the absolute error between the exact average and the rounded average. (5)

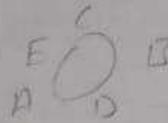
c) An argument claims: (5)
 "Artificial Intelligence will reduce employment because automation replaces human labor."

Identify assumptions, evaluate the strength of the argument, and provide a logically reasoned counter-argument. (5) (20)

(d) A number N leaves remainder 5 when divided by 12 and remainder 4 when divided by 7. (5) (20)
 Find the smallest positive integer N that satisfies these conditions. Then compute the remainder when N is divided by 9.

Q. 7. (a) Five researchers (A, B, C, D, E) sit in a circle. (5)

- A sits second to the right of C.
- B is not a neighbour of A.
- D sits opposite C.

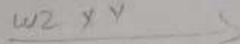


Construct a logically valid seating arrangement. Explain each step leading to your conclusion. (5)

(b) A mixture contains water and chemical X in the ratio 5 : 3. If 20 Liters of water are added, the ratio becomes 3 : 2. (5)
 Determine the original amount of the mixture and the initial quantities of both components.

(c) Four machines (X, Y, Z, W) must run in sequence with constraints:

- Y cannot run before X.
- Z must run immediately after W.
- X cannot be last.



Construct all valid permutations. Explain your reasoning systematically. (5) (20)

(d) A doctor uses a decision tree to diagnose a disease based on symptoms S1, S2, and S3. (5) (20)
 • If S1 is present, test for S2.
 • If S2 is absent, rule out the disease.
 • If S3 is present with S2, confirm diagnosis.
 Construct the decision tree and explain the reasoning behind each branching decision

Q. 8. (a) Unscramble following high-level logical reasoning and research methodology terms. (5)

- | | | |
|----------------|---------------|----------------|
| i) NALYLTCIAA | ii) EFNRECNE | iii) OCNDIUTNI |
| iv) NRBASACIOT | v) SHTESYPHOI | |

(b) Argument: (5)
 "Because many successful entrepreneurs dropped out of college, formal education is unnecessary for achieving high professional success."

Task:

(i) Identify the fallacy /faulty reasoning in the statement. Explain how it affects the credibility of the argument.

(ii) Narrate how verbal reasoning skills help detect and correct such flawed arguments.

(c) A mechanical reasoning scale measures the ability to understand physical principles. (5)
 Consider a system where two gears (Gear A and Gear B) are interlocked. Gear A has 12 teeth, and Gear B has 36 teeth.

- (i) Determine the rotation direction of Gear B if Gear A rotates clockwise.
- (ii) Compute how many complete rotations Gear A must make for Gear B to complete exactly 2 rotations.

(iii) Explain how mechanical reasoning scales evaluate a test-taker's ability to generalize such mechanical principles to unfamiliar problems.

(d) The average weight of 12 students in a group is 58 kg. When one new student joins the group, the new average becomes 60 kg. (5) (20)

Calculate the weight of the new student, showing all steps clearly.
