2025

(Nov–Dec)

FYUP : 3rd Semester Examination

SKILL ENHANCEMENT COURSE

[Analytical Thinking (Mathematics)]

SEC–234

Marks : 56

Time : 2½ hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *four* questions : 4×4=16

1. *(a)* If $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 9\}$ and $C = \{3, 4, 5, 6\}$, determine $A \cap (B \cup C)$. 2

(b) If $X = \{a, b, c\}$, determine the power set of X. 2

2. *(a)* If $A = \{1, 4\}$, $B = \{4, 5\}$ and $C = \{5, 7\}$, determine the set $(A \times B) \cup (A \times C)$. 2

(b) Let R be a relation on $A = \{1, 2, 3\}$, defined by $(a, b) \in R$ if $a \leq b$. Is R a symmetric relation? Justify your answer. 2

3. (a) How many 2-digit numbers can be formed using the digits 1 to 9 when repetition is allowed? 2

(b) Evaluate ${}^{n}P_{r}$, when $n = 5$ and $r = 3$. 2

4. (a) When a coin is tossed three times, what is the sample space? 2

(b) In a deck of 52 cards, what is the probability of drawing a red suit? 2

5. (a) Define a proposition with an example. 2

(b) Express in symbolic form the proposition, "I will not carry an umbrella if it does not rain." 2

6. (a) What is a quantified statement? Cite one example. 2

(b) What is the conclusion that can be derived from the two premises? 2

- Every student must appear for the examination to be promoted.
- John did not appear the examination.

SECTION—B

Answer any *four* questions : 10×4=40

7. (a) Express the set $A = \{x | x$ is an integer, $-3 < x < 3\}$ in roster form. 2½

(b) Express the set

$B = \{-5, -4, -3, -2, -1, 0, 1, 2\}$

in set-builder form. 2½

(c) For any two sets A and B, prove that $(A \cap B)' = A' \cup B'$. 5

8. (a) Let U be the universal set, and $A \subset U$. Define the complement of A and draw its Venn diagram. 2

(b) Let $U = \{x | x$ is a letter in English alphabet$\}$ be a universal set, and $A = \{x | x$ is a vowel$\}$. What is A'? 2

(c) Let $\mathbf{Z}$ denote the set of integers, and the relation R in $\mathbf{Z}$ be defined by $(a, b) \in R$ if and only if $a - b$ is an even integer. Show that R is an equivalence relation. 6

9. (a) How many arrangements can be made with the letters of the word 'TENNESSEE'? 5

(b) A collection of 10 electric bulbs contains 3 defective ones. In how many ways can a sample of 4 bulbs be selected which contain 2 good bulbs and 2 defective ones? 5

10. (a) How many permutations can be made out of the letters of the word 'COMPUTER'? How many of these begin with 'C' and end with 'R'? 6

(b) Find the probability of the occurrence of a number greater than 2 in a throw of a die, if it is known that only even numbers can occur. 4

11. (a) Using a truth table, show that $\sim (p \Rightarrow q) \equiv p \wedge \sim q$. 4

(b) Express the statement, "There is a place in Meghalaya with lots of waterfalls", in symbolic logic notation. 3

(c) Write the statement, "Neither Alice nor Bob passed the exam", in symbolic form and write its negation. 3

12. (a) Write the truth table of $[(p \vee q) \wedge \sim q] \Rightarrow p$. 4

(b) Write the statement, "There exists water on Mars" in predicate logic notation. 3

(c) Write the negation of "I won't be home tonight". 3

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