JSPM's

Rajarshi Shahu College of Engineering, Tathawade, Pune- 411033
(An autonomous institute affiliated to Savitribai Phule Pune University)

Examination: Mid Semester Examination (MSE)
Academic Year: 2023-24 (Semester: II)

Class: F. Y. B. Tech. (IT)

Subject Code:ES1204
Subject Name and pattern: DISCRETE MATHEMATICS(2023 PAT.)
Duration: 1 Hour 15 Minutes   **Max. Marks: 30 Marks**

Instructions to the Candidates
1. Solve [Q.1 or Q.2], [Q.3 or Q.4], [Q.5 or Q.6]
2. Assume suitable and necessary data wherever required.
3. Draw neat sketch or diagram wherever required.
4. Use of non-programable electronic pocket calculator is allowed.
5. Figures to the right indicate full marks.

Q.1		**Solve the following:**			
	a	Find principle conjunctive normal form (PCNF) and principle disjunctive normal form (PDNF) of the statement $(\sim p \leftrightarrow \sim q) \leftrightarrow (q \leftrightarrow r)$ statement using truth table.	[5]	BL3	CO1
	b	"If the average of four different integers is 9, then at least one number should be greater than 10". Find the converse, inverse, and contrapositive. Hence determine if each resulting statement is true or false.	[5]	BL3	CO1

OR

Q.2		**Solve the following:**			
	a	i) Obtain conjunctive normal form (CNF) of the statement $\sim (p \lor q) \leftrightarrow (p \land q)$ by algebraic method. ii) Obtain disjunctive normal form (DNF) of the statement $(q \lor (p \land r)) \land \sim ((p \lor r) \land q)$ by algebraic method.	[5]	BL3	CO1
	b	Use rules of inference to check the validity of following argument: It is not sunny this afternoon and it is colder than yesterday. We will go to playground only if it is sunny. If we do not go to ground then we will go to a movie. If we go to movie then we will return home by sunset. Conclusion is we will return home by sunset.	[5]	BL3	CO1

Q.3 Solve the following:

a In a town of 10000 families it was found that 40% of families buy [5] BL3 CO2
newspaper A, 20% family buy newspaper B, 10% family buy
newspaper C, 5% family buy newspaper A and B, 3% family buy
newspaper B and C and 4% family buy newspaper A and C. If 2%
family buy all the newspaper. Find
   1. Number of families which buy all three newspapers.
   2. Number of families which buy newspaper A only.

b Draw the Hasse diagram representing the partial ordering relation [5] BL3 CO2
$P = \{(A, B)|A \subseteq B\}$ on the power set of S, where S = {1,2,3}. Also,
find maximal and minimal elements.

<center>OR</center>

Q.4 Solve the following:

a If f, g, h are defined on set of integers Z such that $f(x) = x^2$, [5] BL3 CO2
$g(x) = x + 1$, $h(x) = x - 1$ then verify $f \circ (g \circ h) = (f \circ g) \circ h$.
Also find $(f \circ g)(a)$.

b Let $A = \{2, 7, 14, 28, 56, 84\}$ be a set. Draw Hasse diagram of a poset [5] BL3 CO2
$(A, |)$. Also, determine whether poset $(A, |)$ is a lattice.

Q.5 Solve the following:

a Let $(Z,*)$ and the binary operation $*$ on set Z is defined as [5] BL3 CO3
$a*b = a+b+1$ for $a, b \in Z$ then show that $(Z,*)$ is an abelian group.

b Let $G = \left\{\begin{bmatrix} a & b \\ c & d \end{bmatrix} : a, b, c, d \in Z\right\}$ is a group with matrix addition and [5] BL3 CO3
$(Z, +)$ be a group. The mapping $f: (G, +) \rightarrow (Z, +)$ is defined
as $f\left\{\begin{bmatrix} a & b \\ c & d \end{bmatrix}\right\} = a$, then show that f is a homomorphism.

<center>OR</center>

Q.6 Solve the following:

a Let $(Z_6, +_6)$ be a group. Show that Z_6 is a cyclic group. Also find all its [5] BL3 CO3
generators.

b Find the code words generated by the encoding function $e: B^2 \rightarrow B^5$ [5] BL3 CO3
with respect to parity check matrix $H = \begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 \end{bmatrix}$