H-137

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SUBJECT CODE NO:- H-137
FACULTY OF SCIENCE AND TECHNOLOGY
S.E. (CSE/IT)
Discrete Mathematics
(REVISED)

[Time: Three Hours] **[Max. Marks: 80]**

Please check whether you have got the right question paper.

N.B
1) Q.1 from Section A and Q.6 from Section B are compulsory.
2) Solve any two questions from remaining in each Section.
3) Draw diagram and graphs wherever required.

Section A

Q.1 Solve any five:- 10

a) Define power set. Find the power set of A={a, ϕ}
b) Explain distributive law of sets.
c) Determine whether each of these statements is true or false:-
   i) $\{\phi\} \subset \{\phi, \{\phi\}\}$
   ii) $\{\phi\} \epsilon \{\{\phi\}\}$
d) Define sample space and give suitable example.
e) What is negation of each of these prepositions?
   i) There is no population in New Delhi.
   ii) $2 + 1 = 3$
f) Define modus ponens rule with example.
g) What is universal quantifier?
h) Negate the following statement:-
   $\exists\, x\, [r(x)\ \wedge S(x)]$
   Where r(x) and S(x) are open statements.

Q.2 a) Draw a Venn diagram for each of these combinations of the sets A, B and C. 08
   i. $A \cap (B \cup C)$
   ii. $(A - B) \cup (A - C) \cup (B - C)$

b) At the high school science fair, 34 students received award for scientific projects. 14 awards were given for projects in biology. 13 in chemistry and 21 in physics. If 03 students received awards in all three subject areas, how many received awards for exactly 07
   1) One subject area?
   2) Two subject area?

Q.3 a) Construct truth tables to determine whether each of the following is a tautology, contingency or contradiction. 08
   1)$(p \to q) \leftrightarrow (q \vee \urcorner p)$
   2)$(\urcorner p \wedge (p \to q)) \to \urcorner q$

b) Ramesh is studying ORACLE or he is not studying JAVA. If Ramesh is studying JAVA, Then he is not studying ORACLE. Therefore he is studying ORACLE. Write above statement in symbolic form and test the validity of the argument using laws of logic. 07

Q.4 a) Prove by using mathematical induction:- 08

$$\sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6}$$

b) Define well-ordering principle and mathematical induction theorem. 07

Q.5 a) Translate each of these statements into logical expression using predicates quantifiers and logical connectives: 08

1) No one is perfect.
2) All your friends are perfect.
3) One of your friends is perfect.
4) Everyone is your friend and is perfect.

b) Define recursive definition. Prove that 07

$$\sum_{i=1}^{n} F_{i^2} = F_n * F_{n+1}$$

Section B

Q.6 Solve any five:- 10

a) If A={1,2,3,4} , B={2,5} determine:-
1)$A \times B$
2)$B \times A$

b) What is the difference between onto and one to one function?

c) Let R be a relation on set A={1,2,3,4} defined by R={(1,1),(2,2),(3,3),(4,4),(4,3),(4,2),(4,1),(3,2),(3,1)}. Find zero-one matrix and directed graph of relation R.

d) Let A={2,3,4}, B={a,b,c} and f={(2,a),(3,b),(4,b)}. Find domain co-domain and range of the function.

e) Define Lagrange's theorem.

f) Find the hamming distance between x and y.
i)x=1101 , y=1001
ii)x=0010111 , y=1001011

g) What is a ring with proper divisors of zero?

h) Consider the algebraic system $\{(0,1),*\}$, Where $*$ is a multiplication operation. Determine whether system is closed and associative.

Q.7 a) Let A= {1,2,3,4,6,8,12} and R be the relation on A defined by aRb if a divides b. 08
1) Determine whether R is a partial order relation or not.
2) If yes draw its hasse diagram.

b) State pigeonhole principle and show that if seven numbers from 1 to 12 are chosen then two of them will add upto 13. 07

Q.8 a) Let $f(x) = x + 2$, $g(x) = x - 2$ and h(x) = 3x for x∈R where R is a set of real numbers. Find gof , foh, fohog, and hog. 08

b) Define Stirling number of second kind. If $|A| = 7$ and $|B| = 4$, find the number of onto functions from A to B. Hence find S (7,4). 07

Q.9 a) Consider the encoding function $E: Z_2^3 \rightarrow Z_2^6$ and parity check matrix. 08

$$H=\begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

Determine code words for 010, 100, 110, and 111.

b) Let G be the set of all non zero real numbers and let $a * b = \frac{ab}{z}$. Show that $(G,*)$ is an abelian group. 07

Q.10 a) Explain decoding with coset leaders. 07

b) Prove that Z with binary operation ⊕ and ⊙ defined by $x \oplus y = x + y - 1$. And $x \odot y = x + y - xy$. is a commutative ring with unity? 08