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

[Time: Three Hours]

[Max. Marks: 80]

- N.B Please check whether you have got the right question paper.
- 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 or graphs wherever required.

Section A

- Q.1 Solve any five:- 10
- a) Define set with proper example.
 - b) Explain absorption law of set theory.
 - c) If we toss a fair coin, what is the probability that we will get a head?
 - d) Write the following set in a tabular form.
 - i) $A = \{x: x^2 = 9\}$
 - e) Which of these sentences are propositions? What are the truth values of those that are propositions?
 - i) The Earth is flat.
 - ii) Answer this question.
 - f) Write the following statement in symbolic form.
 - i) Indians will win the world cup if their fielding improves.
 - ii) I will score good marks in the exam if and only if I study hard.
 - g) Define rule of universal specification.
 - h) What is law of syllogism?
- Q.2 a) Prove the following using Venn diagram:- 08
 $A \Delta (B \Delta C) = (A \Delta B) \Delta C$
- b) A ticket is drawn from a set of 20 tickets, numbered 1 to 20 and kept aside. Then another ticket is drawn. Find the probability that both the tickets shows even numbers. 07
- Q.3 a) Explain De’Morgan’s law of sets. 07
- b) Prove that $5^n - 1$ is divisible by 4, for $n \geq 1$. 08
- Q.4 a) Show that S is valid conclusion from the premises $p \rightarrow q, p \rightarrow r, \neg (q \wedge r)$ and $S \vee P$ 08
- b) Define quantifiers. Rewrite following arguments using quantifiers, variables and predicate symbols:- 07

- i) All birds can fly.
- ii) Some men are genius
- iii) There is a student who likes mathematics but not geography.

- Q.5 a) Prove that $(p \rightarrow (q \rightarrow r)) \Rightarrow ((p \rightarrow q) \rightarrow (p \rightarrow r))$ 07
- b) I am happy if my program runs. A necessary condition for the program to run is it should be error free. I am not happy. Therefore the program is not error free. Determine whether the above is a valid argument or not. 08

Section B

- Q.6 Solve any five:- 10

- a) Explain antisymmetric relation with example.
- b) Let $A = \{1,2,3,4\}$ and $B = \{a, b, c\}$ and let $R = \{(1, a), (1, b), (2, c), (3, a), (4, b)\}$ and $S = \{(1, b), (1, c), (2, a), (3, b), (4, b)\}$. Find \bar{R} , \bar{S} .
- c) Let $f: X \rightarrow Y$, where $f(x) = 3x + 5$. Find its inverse function.
- d) Let $A = \{7,8,9\}$. Determine all the partitions of the set.
- e) Define monoid.
- f) Explain homomorphism.
- g) Define left and right coset with example.
- h) Construct parity check matrix associated with generator matrix

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

- Q.7 a) Let $A = \{1,2,3,4,5,6,7\}$ and R be the relation on set A. 08
- $R = \{(x, y) \mid (x - y) \text{ is divisible by } 3\}$
- i) Show that R is an equivalence relation.
 - ii) Find equivalence classes generated by elements of A.
- b) Define composite function. Function f and g are defined on set $X = \{1,2,3\}$ as 07
- $f = \{(1,2), (2,3), (3,1)\}$ and $g = \{(1,2), (2,1), (3,3)\}$. Find fog and gof. Are they equal?

Q.8 a) Explain pigeon hole principle with example. 07

b) Draw the hasse diagram representing the positive divisors of 36. 08

Q.9 a) Consider the generator matrix:- 08

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

Determine parity check matrix and decode following received words.

- 1) 111101
- 2) 110101

b) Explain elements of coding theory. 07

Q.10 a) Explain integral domain and field. 07

b) Show that $(2, 5)$ encoding function $E: B^2 \rightarrow B^5$ defined by. 08

$$E(00) = 00000$$

$$E(01) = 01110$$

$$E(10) = 10101$$

$$E(11) = 11011$$

is a group code.