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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (R,S) / S3 (WP) (R,S) / S1 (PT) (S,FE) Examination November 2024 (2019 Scheme)

Course Code: MAT203

Course Name: Discrete Mathematical Structures

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

1	Use truth table to prove that $p\wedge (p \rightarrow q) \rightarrow q]$ is a tautology.	(3)
2	Give a proof by contradiction for the following "for all integer n, if n^2 is odd then n is odd"	(3)
3	Find the number of arrangements of all the letters in "DATABASES"	(3)
4	In how many ways we can construct a secret code by assigning to each letter of the alphabet a different letter to represent it?	(3)
5	Define equivalence relation. Give an example.	(3)
6	Draw the Hasse diagram of $(D_{30}, /)$ where "/' is the divides operator.	(3)
7	Obtain a generating function for the sequence 1,2,3,4...	(3)
8	Solve the recurrence relation $a_n - na_{n-1} = 0$ where $a_0=1$.	(3)
9	Define group homomorphism.	(3)
10	Prove that the identity element of a group is unique.	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11(a)	Negate the statement "There exist real numbers x and y such that x and y are rational but $x + y$ is irrational".	(7)
(b)	Consider the open statement p(x): $x^2 \geq 1$. Discuss the truth value of the statement "$\forall x p(x)$" where the universe consists of set of all positive integers. What if the universe is set of all real numbers?	(7)
12(a)	Check the validity of the following argument. "If it does not rain or if there is no traffic dislocation, then the sports day will be held and cultural	(7)

programmes will go on"; "If the sports day is held, the trophy will be awarded" and "the trophy was not awarded" Therefore "It rained"

(b) Define converse, inverse, and contrapositive and write same for the following statement. "If x is odd then x^2-1 is even" (7)

Module 2

13(a) If n is a positive integer prove that ${}^{n}C_2 + {}^{n-1}C_2$ is a perfect square. (7)

(b) Determine the number of all non-negative integer solutions of the equation (7)

$$x_1 + x_2 + x_3 + x_4 = 7$$

14(a) Find the number of integers between 1 and 2000 that are not divisible by 2,3 or 5. (7)

(b) Prove that in a room full of 367 people there are at least two people with the same birthday. (7)

Module 3

15(a) Check whether the relation ***R*** defined as "x***R***y if and only if x-y is even" on set of all integers ***Z*** is an equivalence relation? If yes find the equivalence classes. (7)

(b) Define a lattice. Prove that P(S), the set of all subsets of a non-empty set S is a lattice under subset of ($\subseteq$)relation. (7)

16(a) Define least upper bound and greatest lower bound in a POSET. Consider the POSET (R, $\leq$) and A=$\{x \in R/0 \leq x \leq 1\}$. Find the LUB and GLB of A (7)

(b) Define function. Explain domain, codomain and range of a function with the help of an example. (7)

Module 4

17(a) Solve the recurrence relation which generate the Fibonacci numbers 0,1,1,2,3,5… (7)

(b) Solve $a_{n+1} = a_n + n$ $\quad$ n > 1 and a_2=1 (7)

18(a) Solve the recurrence relation (7)
$a_{n+2} - 4a_{n+1} + 3a_n = -200$, a_0 = 3000 and a_1 = 3300

(b) Solve $a_n = 2a_{n-1} - 2a_{n-2}$ where a_0=1 & a_1=2. (7)

Module 5

19(a) Prove that $R^{2\times2}$, the set of all 2×2 real matrices is a group under matrix addition. Is it an Abelian group? (7)

(b)	Consider the groups (Z^+, +) and (Z^+, ×) where Z^+ is the set of all positive integers. Check whether the function defined as $f(n)=3^n$ is a homomorphism of these two groups? Is it an isomorphism?	(7)
20(a)	If H and K are subgroups of a group G, prove that H∩K is a subgroup of G.	(7)
(b)	Define order of an element in a group. Find the order of each element of the group (Z_4, +) where "+" is the addition modulo 4.	(7)

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