Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2020

Programme Name: B. Tech. Civil Eng. (Infra. Dev.) **Semester : III**
Course Name : Transforms and Discrete Mathematics **Time : 03 hrs**
Course Code : MATH 2039 **Max. Marks : 100**
Nos. of page(s) : 02

SECTION A
(Attempt all questions; Each question carries 5 marks)

S. No.		**CO**
Q1.	Consider the set $S = \{1,2,3,4,6,9\}$. The maximal and minimal elements of the partial ordered set $(S,/)$ are A. maximal elements 4,6,9 and minimal element 1 B. maximal element does not exist and minimal element 1 C. maximal element 9 and minimum element 1 D. None of these.	**CO3**
Q2.	The linear homogeneous recurrence relation with constant coefficients having its general solution as $a_n = c_1 3^n + (c_2 + c_3 n)2^n$, where c_1, c_2, c_3 are arbitrary constants is given by A. $a_{n+3} - 7a_{n+2} + 16a_{n+1} - 12a_n = 0$ B. $a_{n+3} + 7a_{n+2} + 16a_{n+1} + 12a_n = 0$ C. $a_{n+3} - 11a_{n+2} + 16a_{n+1} - 12a_n = 0$ D. $a_{n+3} - 7a_{n+2} + 12a_n = 0$	**CO4**
Q3.	The proposition $(p \vee q) \wedge (\sim p) \wedge (\sim q)$ is A. Tautology B. Contradiction C. Contingency D. equivalent to p	**CO2**
Q4.	Inverse Laplace transform of $\frac{s^2-3s+4}{s^3}$ is A. $1 - 3t + 2t^2$ B. $1 + 3t - 2t^2$ C. $1 - 2t + 3t^2$ D. $1 + 2t - 3t^2$	**CO1**
Q5.	If z-transform of u_n, $Z[u_n] = U(z)$, then $Z[a^{-n}u_n]$ is A. $U(az)$ B. $U\left(\frac{a}{z}\right)$ C. $U\left(\frac{z}{a}\right)$ D. $U(z)$	**CO1**
Q6.	The sequence $\{a_n\}$ having generating function $\frac{x}{1-2x}$ is given by ($n = 1,2,3, ...$) A. 2^{n-1} B. 2^n C. 2^{n+1} D. n^2	**CO4**

SECTION B (Q7-Q10 are compulsory and Q11 has internal choice; Each question carries 10 marks)		
Q7.	Consider the partial ordered set $A = \{1,2,3,4,5,6,7,8\}$ with the partial order relation $R = \{(1,3),(2,3),(3,4),(3,5),(4,6),(4,7),(5,6),(5,7),(6,8),(7,8)\}$. a. Draw Hasse diagram of (A, R). b. Find lower and upper bounds of the subset $B = \{3,4,5\}$ of A. c. Find greatest lower bound (glb) and least upper bound (lub) of B.	**CO3**
Q8.	Find the Laplace transform of $\int_0^t \frac{e^{-t}\sin t}{t}\,dt$.	**CO1**
Q9.	Let D_n denote the set of all the positive divisors of n. By constructing closure tables for lub ($\vee$) and glb ($\wedge$) show that D_{15} is a lattice.	**CO3**
Q10.	Represent the following argument symbolically and determine whether the argument is valid. "*If I study, then I will pass the examination. If I do not go to cinema, then I will study. However, I failed in the examination. Therefore, I went to cinema*."	**CO2**
Q11.	Using truth table, find the principal conjunctive normal form (pcnf) of $(p \vee \sim q \wedge \sim r) \vee (q \wedge r)$. **OR** Establish the following equivalence using truth table $(p \vee q) \to r \equiv (p \to r) \wedge (q \to r)$.	**CO2**
SECTION C **(Q12a. and Q12b. both have internal choices; Each question carries 10 marks)**		
Q12.	a. Solve the following recurrence relation using generating function $y_{n+2} - 2y_{n+1} + y_n = 2^n, y_0 = 2, y_1 = 1$. **OR** Given that generating function of the sequence $\{a_n\}$ is $G(x)$. Find the generating function of $\{a_{n+1}\}, \{a_{n+2}\}$ and $\{a_{n+3}\}$. b. Solve the recurrence relation of the Fibonacci sequence of the numbers $y_n = y_{n-1} + y_{n-2}, n \geq 2$ with the initial conditions $y_0 = 0$ and $y_1 = 1$. **OR** Solve the recurrence relation of the Lucas sequence of the numbers $y_n = y_{n-1} + y_{n-2}, n \geq 2$ with the initial conditions $y_0 = 1$ and $y_1 = 3$.	**CO4**

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