Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2021

Programme Name: B. Tech. Civil Eng. (Infra. Dev.) **Semester : III**
Course Name : Transforms and Discrete Mathematics **Time : 03 hrs**
Course Code : MATH 2045 **Max. Marks : 100**
Nos. of page(s) : 02

SECTION A
(Attempt all questions; Each question carries 4 marks)

S. No.		CO
Q1.	Consider the set $S = \{1,2,3,4,6,9\}$ and a partial order relation '|' defined on S as "$a\|b$ if a divides b". Find the maximal elements, minimal elements, greatest element and least element of the partial ordered set $(S, \|)$.	**CO3**
Q2.	Find 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.	**CO4**
Q3.	Check the compound proposition $((p \vee q) \wedge (p \to r) \wedge (q \to r))$ is a tautology, contradiction, or contingency.	**CO2**
Q4.	Find inverse Laplace transform of $\frac{s^2-3s+4}{s^3}$.	**CO1**
Q5.	Determine the sequence $\{a_n\}$ having generating function as $\frac{x}{1-2x}$.	**CO4**

SECTION B
(All the questions are compulsory; Each question carries 10 marks)

Q6.	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**
Q7.	Find the Laplace transform of $\int_0^t \frac{e^{-t}\sin t}{t} dt$.	**CO1**
Q8.	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**

Q9.	Represent the following argument symbolically and determine whether the argument is valid. "*Robbery was the motive for the crime if the victim had money in his pockets. But robbery or vengeance was the motive for the crime. Therefore, vengeance must have been the motive for the crime*"	**CO2**
SECTION C **(Q10A. and Q10B are compulsory. Q11A and Q11B both have internal choices; Each question carries 10 marks)**		
Q10A.	Using truth table, find the principal conjunctive normal form (pcnf) and principal disjunctive normal form (pdnf) of $(p \wedge \sim q \wedge \sim r) \vee (q \wedge r)$.	**CO2**
Q10B	Establish the following equivalence using truth table $(p \vee q) \rightarrow r \equiv (p \rightarrow r) \wedge (q \rightarrow r)$.	**CO2**
Q11A	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 $\{a_{n+3}\}$.	**CO4**
Q11B	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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