Reg. No. : | | | | | | | | | | | | |

Question Paper Code: R4M21

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Computer Science and Engineering

R21UMA421- TRANSFORMS AND DISCRETE MATHEMATICS

(Common to IT, CSE (CI), CSE (AIML) & CSE(SC) Engineering branches)

(Regulations R2021)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	Derive R from the premises $P \to Q, Q \to R$ and P	CO1-App
2.	Define tautology and contradiction.	CO6-U
3.	Compute the particular solution of the recurrence relation $a_n - 6a_{n-2} = 12n$.	CO2- App
4.	How many different word are there in the word MATHEMATICS	CO2-App
5.	Define Group and give an example.	CO6- U
6.	Find the order of all the element in $(Z_3, \oplus_3)$	CO3- App
7.	Define Fourier transform pair.	CO 6-U
8.	Find the Fourier sine transform of e^{-ax}, $a > 0$	CO 6- U
9.	Determine the Z – Transform of $z(n)$.	CO 6- U
10.	Find Z{ sin(nπ/2)}.	CO 6- U

PART – B (5 x 16= 80 Marks)

11.	(a)	(i) Calculate PCNF and PDNF for $P \to ((P \to Q) \wedge \neg(\neg Q \vee \neg P))$	CO1 App	(8)
		(ii) Using the rules of inference derive & using CP Rule. $P \to (Q \to R), Q \to (R \to S) \Rightarrow P \to (Q \to S)$	CO1 App	(8)
		Or		
	(b)	(i) Prove the following. $P \to (Q \wedge R), (Q \vee S) \to U, P \vee S \Rightarrow U$	CO1 App	(8)
		(ii) Use the indirect method to show that $R \to \neg Q, R \vee S, S \to \neg Q, P \to Q \Rightarrow \neg P$	CO1 App	(8)

12. (a) (i) Calculate the number of positive integers not exceeding 1200 that are divisible by 2 ,3 ,5 or by 7 — CO2- App (8)

(ii) Solve $a_n - 4a_{n-1} + 4a_{n-2} = 2^n, a_0 = 11, a_1 = 15$ — CO2 App (8)

Or

(b) (i) How many prime numbers not exceeding 100 are there? — CO2- App (8)

(ii) Using generating functions Solve $a_n = 5a_{n-1} + 3^n, a_0 = 3$ — CO2- App (8)

13. (a) (i) State and prove Lagrange's theorem. — CO3 U (8)

(ii) Prove that (G,*) is abelian if and only if $(a*b)^{-1} = a^{-1}*b^{-1}$ — CO3 U (8)

Or

(b) (i) A Group G is abelian iff$(a*b)^n=a^n*b^n$ — CO3 U (8)

(ii) Prove that the union of two subgroup of G need not a sub group. — CO3 U (8)

14. (a) Show that the Fourier Transform of — CO4 App (16)

$$f(x) = \begin{cases} a - |x| & if\ |x| \le a \\ 0 & if\ |x| > a \end{cases}$$ is $$\sqrt{\frac{2}{\pi}}\left[\frac{2\sin^2\frac{s}{2}}{s^2}\right]$$ and hence evaluate

(i) $\int_0^\infty \left(\frac{\sin t}{t}\right)^4 dt = \frac{\pi}{3}$ (ii) $\int_0^\infty \left(\frac{\sin t}{t}\right)^2 dt = \frac{\pi}{2}$

Or

(b) (i) Show that the Fourier transform of — CO4 App (8)

$e^{-\frac{x^2}{2}}$ is $e^{-\frac{s^2}{2}}$

(ii) Evaluate using transforms method $\int_0^\infty \frac{x^2 dx}{(x^2+4)(x^2+9)}$ — CO4 App (8)

15. (a) (i) Find the Z-transform of — CO5 App (8)

$$\frac{2n+3}{(n+1)(n+2)}$$

(ii) Find $Z[r^n \cos n\theta]$ and $Z[r^n \sin n\theta]$ — CO5 App (8)

Or

(b) (i) Using Convolution theorem find CO5 App (8)

$$Z^{-1}\left[\frac{14z^2}{(7z+4)(2z+1)}\right]$$

(ii) Solve the difference equation CO5 App (8)

$y_{n+2} - 4y_{n+1} + 3y_n = 5^n$ given that $y_0 = 0,\ y_1 = 0$