A   Reg. No. :

Answer All Questions

PART A - (10 x 1 = 10 Marks)

1. The truth value of "10+3=7 or 5 is not prime" , The truth value of " 2+3=5   CO1- U
   and   is a negative integer"

   (a) T, F   (b) F, T   (c) F, F   (d) T, T

2. P: Rahim is Rich, Q: Rahim is happy. Then 'Rahim is poor but happy' Is   CO1- U
   best represented by?

   (a) $\neg P \vee \neg Q$ (b) $P \wedge \neg Q$ (c) $P \wedge Q$ (d) $\neg P \wedge Q$

3. If 'm' Pigeon occupies 'n'(m>n) holes then at least one hole has more than   CO2- U
   ---- Pigeons

   (a) $\left\lceil \dfrac{n-1}{m} \right\rceil$ (b) $\left\lceil \dfrac{m-1}{n} \right\rceil$ (c) $\left\lceil \dfrac{m-1}{n} \right\rceil + 1$ (d) $\left\lceil \dfrac{n-1}{m} \right\rceil + 1$

4. The numbers between 1 and 100, including both, are divisible by 2 or 6 is   CO2- App
   _____

   (a) 50   (b) 16   (c) 66   (d) 34

5. A group (M,*) is said to be abelian if _____   CO3- U

   (a) (x+y)=(y+x)   (b)(x*y)=(y*x)   (c)(x+y)=x   (d) (y*x)=(x+y)

6. The union of two subgroup of G is a   CO6- U

   (a) Subgroup   (b) Semigroup   (c) group   (d) Monoid

7. Fourier transform of $\sqrt{2\pi}$, $-1 < x < 1$ CO4- App

(a) $\dfrac{\cos s}{s}$
(b) $\sqrt{2\pi}\,\dfrac{\cos s}{s}$
(c) $\sqrt{2\pi}\,\dfrac{\sin s}{s}$
(d) $\dfrac{2\sin s}{s}$

8. A function is called self-reciprocal under Fourier transform, if   CO6- U

   (a) It is reciprocal to itself   (b) Its Fourier transform is the same function

   (c) Its Fourier transform is its reciprocal   (d) None of the above

9.   CO5 - U

   The Z –transform of $\dfrac{a^n}{n!}$

   (a) e^{aZ}
   (b) $e^{\frac{Z}{a}}$
   (c) e^{Z}
   (d) $e^{\frac{a}{Z}}$

10. The Z transform of $4(-1)^n$ is   CO6 - U

   (a) $\dfrac{z}{z-1}$
   (b) $\dfrac{z}{z+4}$
   (c) $\dfrac{4z}{z-1}$
   (d) $\dfrac{4z}{z+1}$

PART – B (5 x 2= 10 Marks)

11. Prove that $\neg P \to (P \to Q)$ is Tautology.   CO1 App

12. Derive the complementary function of $a_n - 2a_{n-1} + a_{n-2} = 2$ CO2-App

13. Define Monoid and give an example   CO3-U

14. Define Fourier transform pair   CO4-U

15. State Initial value and Final value theorem of Z transform   CO5-U

PART – C (5 x 16= 80 Marks)

16. (a)   (i) Calculate PCNF and PDNF for $(P \wedge \neg Q) \vee (P \wedge R) \vee (Q \wedge R)$ using   CO1-App   (8)
          truth table.
          (ii) Using the rules of inference derive & using CP Rule   CO1-App   (8)
          $P \to (Q \to S),\ \neg R \vee P,\ Q \Rightarrow R \to S$

                                        Or

    (b)   (i) Prove the following by Indirect Method.   CO1-App   (8)
          $P \to Q,\ Q \to R,\ \neg(P \wedge R),\ P \vee R \Rightarrow R$
          (ii) Prove the following by Indirect method.   CO1-App   (8)
          $(x)(P(x) \vee Q(x)) \Rightarrow (x)P(x) \vee (\exists x)Q(x)$

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17. (a) (i) Using mathematical induction prove that $(a^n - b^n)$ is divisible by   CO2- App   (8)
$(a - b)$.

     (ii) Solve: $a_{n+2} + 3 a_{n+1} + 2 a_n = 3^n, a_0 = 0, a_1 = 1$ CO2- App   (8)

<div align="center">Or</div>

 (b) (i) Using generating functions Solve: CO2- App   (8)

$a_n - 7 a_{n-1} + 10 a_{n-2} = 0, a_0 = 10, a_1 = 41$.

     (ii) Calculate the number of positive integers not exceeding 250   CO2- App   (8)
that are divisible by 2, 3, 5 or by 7.

18. (a) (i) State and prove Lagrange's theorem.   CO3- U   (10)

     (ii) Prove that $(a * b)^2 = a^2 * b^2$ iff $(G,*)$ is abelian group   CO3- U   (6)

<div align="center">Or</div>

 (b) (i) The binary operation $*$ is defined on Q^+ such that   CO3- U   (8)

$a * b = \dfrac{ab}{2}, a, b \in Q^+$, Show that $(Q^+, *)$ is an abelian Group.

     (ii) Prove that Kerf is a normal subgroup.   CO3- U   (8)

19. (a) Compute the Fourier Transform of   CO4- App   (16)

$$f(x) = \begin{cases} a - |x| & if\ |x| \le a \\ 0 & if\ |x| > a \end{cases} \text{ and hence evaluate}$$

(i) $\displaystyle\int_0^\infty \left(\frac{\sin x}{x} \right)^4 dx$ (ii) $\displaystyle\int_0^\infty \left(\frac{\sin x}{x} \right)^2 dx$

<div align="center">Or</div>

 (b) Evaluate   CO4- App   (16)

(i) $\displaystyle\int_0^\infty \frac{dx}{(x^2 + 16)(x^2 + 36)}$ (ii) $\displaystyle\int_0^\infty \frac{x^2\, dx}{(x^2 + 49)^2}$ using Fourier transform

20. (a) (i) Solve the difference equation $y_{n+2} + 4 y_{n+1} + 3 y_n = 3^n$ given that   CO5- App   (8)
$y_0 = 0, y_1 = 1$

     (ii) Find the Z transform of $\left(\dfrac{1}{(n+1)(n+2)} \right)$ CO5- App   (8)

<div align="center">Or</div>

 (b) (i) Find the Z transform of $\sin n\theta$ and $\cos n\theta$.   CO5- App   (8)

     (ii) Using Convolution theorem find $z^{-1}\left[\dfrac{10z^2}{(5z - 2)(2z + 1)} \right]$.   CO5- App   (8)

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