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Question Paper Code: R1M04

B.E./B.Tech. DEGREE EXAMINATION, NOV/DEC 2024

First Semester

Computer Science and Business Systems

R21UMA104- DISCRETE STRUCTURES AND ANALYSIS

(Regulations R2021)

(Statistical tables may be permitted)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- Let P: I am in Chennai.; Q: I love cricket.; then $P \rightarrow Q$ CO6-U
 - If I am in Chennai then I love cricket
 - If I love cricket then I am in Chennai
 - I am not in Chennai
 - I love cricket
- $(Q \vee \neg P)$ is a CO6-U
 - Contradiction
 - Tautology
 - Contingency
 - PDNF
- How many ways can letters of the word "SMART" be arranged CO2- App
 - 55
 - 66
 - 77
 - 120
- The particular integral of $a_n - 4a_{n-1} + 7a_{n-2} = 12$ CO2- App
 - 4
 - 3
 - 7
 - 0
- $(Z, .)$ is CO6- U
 - Monoid
 - Semigroup
 - Abelian Group
 - Group
- The inverse of the element [3] in a group (Z_5, \oplus_5) CO4- App
 - [2]
 - [4]
 - [3]
 - [1]

7. The value of CO4- App

$$\lim_{x \rightarrow 0} \frac{\sin 2x}{2x}$$

- (a) 4 (b) 2 (c) 1 (d) None

8. CO4- App

$$\int_2^6 \frac{dx}{x}$$

- (a) log 4 (b) log 6 (c) log 8 (d) log 3

9. The value of integral $\int_1^b \int_1^a \frac{dx dy}{xy}$ CO4- App

- (a) log a + log b (b) log a (c) log b (d) log a log b

10. The value of integral $\int_0^1 \int_0^3 \int_0^5 dx dy dz$ is equal to CO5- App

- (a) 10 (b) 9 (c) 7 (d) 12

PART – B (5 x 2= 10Marks)

11. Define proposition. CO1 - App

12. Derive the complementary function of $a_n + 2a_{n-1} + a_{n-2} = 25$ CO2 – App

13. Define Abelian Group and give an example. CO3 – App

14. Evaluate: The value of CO4 – App

$$\lim_{\theta \rightarrow 0} \left(\frac{\tan \theta}{\theta} \right)$$

15. Solve CO5 – App

$$\int_0^1 \int_1^2 x(x+y) dy dx$$

PART – C (5 x 16= 80Marks)

16. (a) (i) Calculate PCNF and PDNF for $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$ CO1 – App (8)

(ii) Using the rules of inference derive & using CP Rule. CO1 – App (8)

$$P \rightarrow (Q \rightarrow S), \neg R \vee P, Q \Rightarrow R \rightarrow S$$

Or

- (b) (i) Prove the following by Indirect method. CO1 – App (8)

$$(x)(P(x) \vee Q(x)) \Rightarrow (x)P(x) \vee (\exists x)Q(x)$$
- (ii) Show that the premises “one student in this class knows how to write programs in JAVA” and “Everyone who knows how to write programs in JAVA can get a high-paying job” imply the conclusion “someone in this class can get high paying job.” CO1 – App (8)
17. (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 bit of strings of length 8 contain (i) exactly four 1’s (a) at most four 1’s (b) atleast four 1’s (c) an equal number of 0’s and 1’s? CO2 –App (8)
- (ii) Using generating functions Solve $a_n = 6a_{n-1} + 2^n, a_0 = 5$ CO2 –App (8)
18. (a) (i) Let G and G' be any two groups with identities e and e' respectively. If $f: G \rightarrow G'$ be a homomorphism. Then $\ker f$ is a normal subgroup CO3 –U (8)
- (ii) A group G is abelian iff $(a * b)^2 = a^2 * b^2$ CO3 –U (8)
- Or
- (b) (i) A non-empty subset H of a group $(G, *)$ is a subgroup if only if $a * b^{-1} \in H$ for all $a, b \in H$ CO3 –U (8)
- (ii) Prove that intersection of two subgroup is also a subgroup of G CO3 –U (8)
19. (a) (i) If $y = a \cos(\log x) + b \sin(\log x)$ Show that $x^2 y_2 + xy_1 + y = 0$ CO4 –App (8)
- (ii) Evaluate: CO4 –App (8)
- $$\lim_{t \rightarrow 1} \left(\frac{t^4 - 1}{t^3 - 1} \right)$$
- Or

(b) (i) Compute $\int_0^{\frac{\pi}{2}} \frac{x}{\sin x + \cos x} dx$ CO4 –App (8)

(ii) Compute $\int_0^{\frac{\pi}{2}} \log(\cot x) dx$ CO4 –App (8)

20. (a) Change the order of integration and hence evaluate $\int_0^4 \int_{\frac{x^2}{4}}^{2\sqrt{x}} x dx dy$ CO5 –App (16)

Or

(b) Using the Triple integration, compute the volume of the Sphere $x^2 + y^2 + z^2 = a^2$ CO5 –App (16)