B **650B1** **Total pages: 2**

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SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER INTEGRATED MCA DEGREE EXAMINATION(R,S), NOVEMBER 2024

(2020 SCHEME)

Course Code : 20IMCAT103

Course Name : Basic Mathematics

Max. Marks : 60 **Duration:3 Hours**

Scientific calculator is allowed in the examination hall.

PART A

(Answer all questions. Each question carries 3 marks)

1. Define a singleton set with an example?
2. What is the Cartesian product $A \times B \times C$ where $A = \{0, 1\}, B = \{1, 2\}$ and $C = \{0, 1, 2\}$?
3. Give an example of a relation on a set that is neither symmetric nor antisymmetric?
4. Let$A = \{a, b, c, d\}$ and $R = \{(a, a), (a, d), (d, a), (d, d), (b, b), (b, c), (c, b), (c, c)\}$. Write the matrix of R and sketch its graph?
5. Give the Geometrical meaning of Injective, Surjective and Bijective functions.
6. Explain one-one and onto function with pictorial presentation.
7. Find $\frac{d}{dx}(\frac{4}{x^2})$?
8. When do we say that a function has derivative at a point.
9. Evaluate $\int_0^1 xe^x \, dx$
10. Evaluate $\int_0^1 (x^2 + x^3) \, dx$

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

11. State and prove De Morgan's Law. 6

OR

12. (a) Prove the first distributive law which states that $A \cap (B \cap C) = (A \cap B) \cap (A \cap C)$ 6
    (b) Find the Cartesian product of $A = \{1, 2\}$ and $B = \{a, b, c\}$.

MODULE II

13. (a) Show that the *"greater than or equal"* relation is a partial ordering on the set of integers. 6
    (b) Let $A = \{2, 3, 4\}$ and $B = \{3, 4, 5, 6, 7\}$. Assume a relation R from A to B such that $(x, y) \in R$ when $a \; divides \; b$ (with zero remainder). Determine relation R, its domain, co-domain and range.

OR

14. Describe the classification of relations with example. 6

MODULE III

15. Let the function $f(x) = 2x + 1$ from R to R. Is f invertible and if it is invertible, then find its inverse? 6

OR

16. (a) Let f_1 and f_2 be two functions from $R \to R$ such that $f_1(x) = x^2$ and $f_2(x) = x - x^2$.Find $f_1 + f_2$ and $f_1 f_2$? 6
(b) Let $f : N \to N$defined by $f(n) = 3n, n \in N$. Express the function diagrammatically. Also write domain, range and co domain of the function.

MODULE IV

17. (a) Use implicit differentiation to find $\frac{dy}{dx}$ for $x^2y + xy^2 = 6$. 6
(b) Evaluate $h'(x)$ for $h(x) = x\tan(\frac{2}{\sqrt{x}}) + 7$.

OR

18. (a) Find $f'\left(\frac{\pi}{2}\right)$ if $f(x) = \sqrt{1 + \cos x}$. 6
(b) Find the derivative of $y = (x^2 + 1)(x^3 + 3)$.

MODULE V

19. (a) Find the area of the region between the x-axis and the graph of $f(x) = x^3 - x^2 - 2x, -1 \leq x \leq 2$ 6
(b) Evaluate $\int_1^4 \left(\frac{3}{2}\sqrt{x} - \frac{4}{x^2}\right) dx$.

OR

20. (a) Use a substitution to find an anti derivative and then apply the Fundamental Theorem to evaluate the integral $\int_0^1 t\sqrt{t^2 + 1}\, dt$ 6
(b) Evaluate $\int_{\frac{\pi}{4}}^{\frac{\pi}{2}} cot\theta\ cosec^2\theta\ d\theta$

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