

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIRST SEMESTER INTEGRATED M.C.A DEGREE EXAMINATION (S), FEBRUARY 2023
(2020 SCHEME)****Course Code: 20IMCAT103****Course Name: Basic Mathematics****Max. Marks: 60****Duration: 3 Hours****PART A****(Answer all questions. Each question carries 3 marks)**

1. If $U = \{x: x \text{ is an English alphabet}\}$ and $A = \{x: x \text{ is a vowel of English alphabet}\}$, then write the complement of A.
2. Define a cartesian product of two sets with example.
3. Let $A = \{1,2,3,4\}$ and R be a relation defined on A such that $R = \{(a, b); a \text{ divides } b\}$. List the elements in R.
4. Define a reflexive relation with an example and how many reflexive relations are there on a set with n elements.
5. Does the formula $f(x) = \frac{1}{x^2-3}$, define (i) a function from $R \rightarrow R$ (ii) a function from $R \rightarrow R$
6. Let f_1 and f_2 be functions from R to R such that $f_1(x) = x^2$ and $f_2(x) = x - x^2$. What are the functions $f_1 + f_2$ and $f_1 f_2$
7. Find the derivative of $y = 3x^5 + 4x^2$
8. Find $y'(x)$ for $y(x) = (x^2 + 2)(2x - 1)$
9. Compute $\int (x^2 + \sqrt{x}) dx$
10. State the fundamental theorem of calculus.

PART B**(Answer one full question from each module, each question carries 6 marks)****MODULE I**

11. a) Verify De Morgan law $\overline{A \cap B} = \bar{A} \cup \bar{B}$ (4)
- b) Define a complement of a set with an example. (2)

OR

12. a) Prove the distributive law $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ for all sets A, B and C. (4)
- b) Find the cartesian product of $A = \{1,2\}$ and $B = \{a, b, c\}$. (2)

MODULE II

13. a) Let $R_1 = \{(1,1), (2,2), (3,3)\}$ and $R_2 = \{(1,1), (1,2), (1,3), (1,4)\}$ be the relations defined on sets $A = \{1, 2, 3\}$ and $B = \{1, 2, 3, 4\}$ respectively, then find (4)

(i) $R_1 \cup R_2$

(ii) $R_1 \cap R_2$

(iii) $R_1 - R_2$

(iv) $R_2 - R_1$

- b) What are the elements in the relation R defined on $\{1,2,3,4\}$ represented by the given matrix (2)

$$\begin{bmatrix} 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \end{bmatrix}$$

OR

14. a) (3)

Let R be the relation on the set of real numbers such that xRy if and only if $|x - y| < 1$. Show that R is not an equivalence relation.

- b) In the poset $(\mathbb{Z}^+, /)$ are the integers 3 and 9 comparable? What about 5 and 7? (3)

MODULE III

15. Let $f: \mathbb{Z} \rightarrow \mathbb{Z}$ be the function defined by $f(x) = x + 1$. Is f an invertible function? If it is invertible, what is its inverse? (6)

OR

16. a) Define composition of functions. (2)

- b) Let $f, g: \mathbb{Z} \rightarrow \mathbb{Z}$ be two functions defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$. Find $f \circ g$ and $g \circ f$. (4)

MODULE IV

17. a) Calculate the value of the derivative for $y(x) = \left(x - \frac{1}{x}\right)^2$ at $x=1$. (3)

- b) Evaluate $\frac{d^2y}{dx^2}$ for $y = 3\tan x + 5\sin^2 x$. (3)

OR

18. a) Use implicit differentiation to find $\frac{dy}{dx}$ for $x^2y + xy^2 = 6$. (3)

- b) Evaluate $h'(x)$ for $h(x) = x \tan(2\sqrt{x}) + 7$. (3)

MODULE V

19. a) Evaluate the indefinite integral $\int \frac{9r^2}{\sqrt{1-r^3}} dr$ (3)
b) Compute $\int [5x + \frac{2}{3x^5}] dx$ (3)

OR

20. a) State the mean value theorem for definite integral. (2)
b) Find the area of the region bounded by $y = 3x - x^2$ and the x-axis (4)
