

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER INTEGRATED MCA DEGREE EXAMINATION (S), FEBRUARY 2024 (2020 SCHEME)

Course Code: 20IMCAT103

Course Name: Basic Mathematics

Max. Marks: 60

Duration: 3 Hours

Use of non-programmable calculators can be permitted.

PART A

(Answer all questions. Each question carries 3 marks)

1. Express the set O of odd positive integers less than 10 in the set builder notation?
2. What do the statements $\forall x \in \mathcal{R}$ such that $x^2 \geq 0$ and $\exists x \in \mathcal{Z}$ such that $x^2 = 1$ mean?
3. Define a Partially ordered set?
4. Give an example of a relation on a set that is neither symmetric nor antisymmetric?
5. What are the two conditions for a rule to be a function.
6. Give an example for a function to be one -one but not onto.
7. Find $\frac{dy}{dx}$ if $y = \frac{x^3}{2} + 1$
8. Give a geometrical meaning of Differentiability
9. Evaluate $\int x^2 e^x dx$.
10. Show that the value of $\int_0^1 \sqrt{1 + \cos x} dx$ cannot possibly be 2.

PART B

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

MODULE I

11. a) What is the power set of an empty set. (2)
- b) State and prove De Morgan's Law. (4)

OR

12. There are 2504 computer science students at a school. Of these, 1876 have taken a course in pascal, 999 have taken a course in Fortran and 345 have taken a course in C. Further, 876 have taken courses in both pascal and Fortran, 231 have taken courses in both Fortran and C and 290 have taken courses in both pascal and C. if 189 of these students have taken courses in Fortran, pascal and C, how many of these 2504 (6)

students have not taken a course in any of these three programming languages?

MODULE II

13. a) List the ordered pairs in the relation R from $A = \{0,1,2,3,4\}$ to $B = \{0,1,2,3\}$, where $(a,b) \in R$ if $\gcd(a,b) = 1$. (3)
 [Hint: \gcd = greatest common divisor]
 b) Represent the relation $R = \{(1,1), (2,2), (3,3), (4,4), (1,2), (2,1), (3,4), (4,3)\}$ on $\{1,2,3,4\}$ with a matrix and digraph. (3)

OR

14. Let R be the relation on the set of integers such that aRb if and only if $a = b$ or $a = -b$. Show that R is an equivalence relation (6)

MODULE III

- 15 (a) Let f_1 and f_2 be functions from \mathbb{R} to \mathbb{R} such that $f_1(x) = x^2$ and $f_2(x) = x - x^2$. What are the functions $f_1 + f_2$ and $f_1 f_2$? (2)
 (b) Let $f: \mathbb{N} \rightarrow \mathbb{N}$ defined by $f(n) = 3n, n \in \mathbb{N}$. Express the function diagrammatically. Also write domain, range and codomain of the function. (4)

OR

16. Let $f: \mathbb{Z} \rightarrow \mathbb{Z}$ such that $f(x) = x + 1$. Is f an invertible function? If so, find its inverse? (6)

MODULE IV

17. a) Find the derivative of $y = \sqrt{x^2 + 1}$ (2)
 b) Find an equation for the tangent to the curve $y = x + \frac{2}{x}$ at the point $(1,3)$. (4)

OR

18. a) Find y'' if $y = \frac{1}{3x-2}$ (3)
 b) Use implicit differentiation to find $\frac{dy}{dx}$ if $x^2y + xy^2 = 6$. (3)

MODULE V

19. a) Evaluate $\int (x^2 + 2x - 3)^2 (x + 1) dx$ (3)
 b) Find the area of the region between the curve $y = 4 - x^2, 0 \leq x \leq 3$ and the x-axis. (3)

OR

20. a) State the fundamental theorem of Calculus (2)
 b) Use a substitution to find an antiderivative and then apply the Fundamental Theorem to evaluate the integral $\int_0^1 t\sqrt{t^2 + 1} dt$ (4)
