ADDITIONAL CONTROLLER OF EXAMINATIONS ★ AU CHENNAI 600 025

Roll No. | | | | | | | | | | |

B.E. (FT) END SEMESTER EXAMINATIONS - APRIL / MAY 2025
(Computer Science and Engineering)
First Semester
MA6151 - MATHEMATICS I
(Regulation 2018 - RUSA)

Time: 3 Hours | Answer ALL Questions | Max. Marks: 100

PART - A (10 X 2 = 20 Marks)

1. Find $\lim_{x\to -2} \dfrac{x^3+2x^2-1}{5-3x}$.
2. If $f(x) = e^x(x^3+2x)$, find $f'(x)$.
3. If $z = u^2+v^2$ and $u = at^2$, $v = 2at$, find $\dfrac{dz}{dt}$.
4. Find $\dfrac{\partial z}{\partial x}$ and $\dfrac{\partial z}{\partial y}$ if $z = x^3+y^3-3xy$.
5. Find the derivative of $f(x) = \int_0^{x^4} \sec t dt$ using the fundamental theorem of calculus.
6. Evaluate the improper integral $\displaystyle\int_0^{\infty} \frac{dx}{x^2+4}$, if possible.
7. Evaluate $\displaystyle\int_1^2 \int_1^3 xy^2 dxdy$.
8. If $x = r\cos\theta$ and $y = r\sin\theta$ find the Jacobian of transformation, $\dfrac{\partial(x,y)}{\partial(r,\theta)}$.
9. Solve $(D^2+6D+9)y = 0$.
10. Convert the equation, $(1+x)^2\dfrac{d^2y}{dx^2}+(1+x)\dfrac{dy}{dx}+y = 2\sin(\log(1+x))$. to a differential equation with constant coefficient.

PART - B (8 X 8 = 64 Marks)

(Answer any 8 questions)

11. (i) For what value of c is $f(x) = \begin{cases} cx^2+2x, & x<2 \\ x^3-cx, & x\geq 2 \end{cases}$ continuous on $(-\infty,\infty)$.

    (ii) Show that there is a root of the equation $4x^3-6x^2+3x+2=0$ between 1 and 2.

12. Find the intervals of increase or decrease, local maximum and minimum value and the inflection points for $f(x) = x^3-12x+2$.

13. If $u(x,y) = \tan^{-1}\dfrac{x^2+y^2}{x+y}$, then using Euler's theorem show that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = \dfrac{1}{2}\sin\ 2u$

14. Find the dimensions of the rectangular box open at the top of maximum capacity whose surface area is 432 sq. cm.

15. (i) Evaluate $\int \sqrt{1+x-2x^2}dx$.

    (ii) Using integration by parts, evaluate $\int e^{3x}\cos 2x dx$

16. Using partial fractions, evaluate the integral given by $\int \dfrac{4xdx}{(x+1)(x-1)^2}dx$,

17. Change the order of integration in $\int_0^{4a}\int_{x^2/4a}^{2\sqrt{ax}} dy\ dx$ and hence evaluate.

18. Find the area lying inside the cardioid $r = a(1+\cos\theta)$ and outside the circle $r = a$.

19. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\ dz\ dy\ dx$

20. Using the method of variation of parameters, solve $\dfrac{d^2y}{dx^2} + 4y = \tan 2x$.

21. Solve $\dfrac{d^2y}{dx^2} + 2\dfrac{dy}{dx} + 4y = 2x^2 + 3e^{-x}$ using the method of undetermined coefficients.

22. Solve $x^2\dfrac{d^2y}{dx^2} - x\dfrac{dy}{dx} + y = \log x$.

PART - C (2 X 8 = 16 Marks)

23. Calculate the volume bounded by the planes $x = 0, y = 0, z = 0$ and $x + y + z = 1$.

24. Expand $e^x \log(1+y)$ in powers of x and y upto the third order term using Taylor's theorem.