

Indian Maritime University
(A Central University, Govt of India)

Sep/Oct'25 SE

Programme Name: B Tech (ME)

Semester: II

Subject Code: UG11T4201

Subject Name: Mathematics II

Date: 09.09.2025	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.
- (iii) Scientific calculator is permitted.

Section A

Answer All Questions [10x1=10 Marks]

1. The Fourier coefficient b_n for the function

$$f(x) = |x|, -\pi < x < \pi$$

- A. 1
- B. π
- C. 0
- D. $\frac{\pi}{2}$

2. Find the Euler's coefficient a_0 when a function $f(x) = x, -\pi \leq x \leq \pi$ is expressed as Fourier Series.

- A. $\frac{-4(-1)^n}{\pi}$
- B. $\frac{4(-1)^n}{\pi}$
- C. $\frac{2(-1)^n}{\pi}$
- D. 0

3. The differential equation $(\frac{dy}{dx})^2 + 5y^2 = x$ is

- A. linear of degree 3
- B. non-linear of order 1 and degree 6
- C. non-linear of order 1 and degree 2
- D. linear of degree 2

4. The orthogonal trajectory of $xy = c$ is

- A. $x^2 - y^2 = c'$
- B. $x^2 + y^2 = c'$
- C. $x^2 - y^2 = 2x$
- D. $x^2 + y^2 = 2y$

5. The complimentary function of $y'' - 2y' + y = xe^x \sin x$ is

- A. $c_1 e^x + c_2 e^{-x}$
- B. $(c_1 x + c_2) e^x$
- C. $(c_1 x + c_2) e^{-x}$
- D. $(c_1 + c_2) e^x$

6. $L(t) =$ _____

7. $L^{-1} \left[\frac{1}{(s^2 + a^2)^2} \right] =$ _____

- A. e^{at}
- B. e^{-at}
- C. $t e^{-at}$
- D. $t e^{at}$

8. $L(\sin t \cos t) =$ _____

9. The value of Cauchy's Integral formula $\oint \frac{z^{3n-4} dz}{(z-1)^{n+1}}$, where c is the circle $|z| = 1/2$ is

- A. $2\pi i$
- B. 0
- C. πi
- D. $\frac{\pi i}{2}$

10. A point where function is not analytic is called _____ point.

Section B

Answer the following: [5x2 = 10 Marks]

11. Find a_0 , for $f(x) = \begin{cases} 0, & -\pi \leq x \leq 0 \\ \sin x, & 0 \leq x \leq \pi \end{cases}$

12. Solve $2 \cos x \frac{dy}{dx} + 4y \sin x = \sin 2x$

13. Find Laplace Transforms of $(\sin t \cdot \cos t)^2$

14. Solve $\frac{d^2y}{dx^2} - 4 \frac{dy}{dx} + 4y = 0$

15. Evaluate using Cauchy's Integral formula $\oint \frac{e^{2z}}{(z+1)^2} dz$, where c is the circle $|z| = 1/2$.

Section C

[5x10 = 50 Marks]

Answer any 5 out of 7 questions.

16. a) Express $f(x) = \frac{x}{2}$ as a Fourier series in the interval $(-\pi, \pi)$. (05)

b) Find the Fourier series of $f(x) = x^2$ in the interval $(0, 2\pi)$. (05)

17. a) Solve by method of variable separable $\frac{dy}{dx} = e^{3x-2y} + x^2 e^{-2y}$ (05)

b) Solve the given linear differential equation $2 \cos x \frac{dy}{dx} + 4y \sin x = \sin 2x$ (05)

18. a) Solve $(D^2 + 3D + 2)y = \sin 2x$ (05)

b) Solve by method of variation of parameters $(D^2 - 6D + 9)y = \frac{e^{2x}}{x^2}$ (05)

19. a) Find the Laplace transform of $L\left\{\int_0^t e^x x^2 dx\right\}$ (05)
b) Evaluate $\int_0^{\infty} e^{-2t} \left(\frac{e^{at} - \cos bt}{t}\right)$ (05)
20. a) Find the Inverse Laplace transforms of $\frac{1}{z^2(z^2+a^2)}$ (05)
b) Using Convolution theorem evaluate $L^{-1}\left[\frac{1}{(s+2)(s+3)}\right]$ (05)
21. a) Evaluate $\oint_{|z|=3} \frac{(z+3)}{(z+1)(z-2)} dz$ where c is the circle $|z|=3$. (05)
b) Use Cauchy Riemann equation to show that the function $e^x (\cos y + i \sin y)$ is analytic. Find its derivative. (05)
22. Expand $f(z) = \frac{1}{(z-1)(z-2)}$ in the region
(a) $|z| < 1$ using Taylor's series (05)
(b) $1 < |z| < 2$ using Laurent's series (5+5)