

Indian Maritime University
(A Central University, Govt of India)
Supplementary Examinations – March/April 2025
Programme Name: B Tech (ME)
Semester: II
Subject Code: UG11T4201
Subject Name: Mathematics II

Date: 13.03.2025

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

Multiple choice questions /Fill up the blanks

[10x1=10 Marks]

1. The Fourier coefficient b_n for the function

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

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

3. The differential equation $\left(\frac{dx}{dy}\right)^2 + 5y^{\frac{1}{3}} = x$ 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. If $L\{f(t)\} = f(s)$, then $L\{e^{-at}f(t)\}$ is.....

- A) $f(s-a)$
- B) $f(s+a)$
- C) $f(s)$
- D) None of these

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

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

8. $L(\sin t \cos t) =$ _____ (fill up the blank)

9. The value of Cauchy's Integral formula $\oint \frac{3z^2+7z+1}{(z-1)} dz$, where c is the circle $|z| = 1/2$ is

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

10 Which one of the following is true?

- a. Only the real part of an analytic function satisfies the Laplacian equation
- b. Only the imaginary part of an analytic function satisfies the Laplacian equation
- c. Neither the real part nor the imaginary part of an analytic function satisfies the Laplacian equation
- d. Both the real and imaginary parts of an analytic function satisfy the Laplacian equation.

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 : $L(t^2 e^{-3t})$

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

15. Evaluate using Cauchy's Integral formula $\oint \frac{e^{2z}}{(z+1)^4} dz$, where c is the circle $|z| = 1/2$.

Section C

Answer any 5 out of 7 questions.

16. a) Find the Fourier series expansion for the function $f(x) = 2x - x^2$ in $(0, 3)$.
(05)

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

17. a) Solve $(x^3y^2 + x) dy + (x^2y^3 - y)dx = 0$ (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 $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$ (05)

19. a) Use Laplace Transform method to solve :

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = e^{-t}, \text{ given } y(0) = y'(0) = 1$$

(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 $\frac{1}{s^2(s^2 + a^2)}$ (05)

b) Using Convolution theorem evaluate $L^{-1}\left[\frac{1}{(s+2)(s+3)}\right]$ (05)

21. a) Evaluate $\oint \frac{(z+3)}{(z+1)(z-2)} dz$ where c is the circle $|z| = 3$, using Cauchy Residue Theorem. (05)

b) Find the analytic function whose imaginary part is $e^x \sin y$. (05)

22. a) Expand $f(z) = \frac{1}{(z-1)(z-2)}$ in the region

(i) $|z| < 1$ (ii) $1 < |z| < 2$ using Laurent's series (7)

b) Find the orthogonal trajectory of family of straight lines $y = mx$ passing through the origin. (3)

