

Indian Maritime University
(A Central University, Govt of India)
Supplementary Examinations – March/April 2024
Programme Name: B Tech (ME)
Semester: II
Subject Code: UG11T4201
Subject Name: Mathematics II

Date: 08.03.2024

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

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

- 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. $L(t) =$ _____

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

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. 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 $(\sin t - \cos t)^2$

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

15. Evaluate using Cauchy's Integral formula $\oint \frac{e^{2z}}{(z+1)^4} dz$, 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 $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$ (05)

19. a) Find the Laplace transform of $L\{\int_0^t e^x x^2 dx\}$ (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 $|z| = 3$. (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 Taylors series

(b) $1 < |z| < 2$ using Laurent's series (5+5)

