

**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.  $\pi$       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.  $\frac{4(-1)^{n-1}}{n\pi}$   
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.  $\pi i$       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  $L\left\{\int_0^t e^x x^2 dx\right\}$  (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  $\frac{1}{s^2(s^2+a^2)}$  (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 Taylor's series

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

