Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – June 2026

Programme Name: B Tech (ME)

Semester: II

Subject Code: UG11T5201

Subject Name: Engineering Mathematics II

Date: 01.06.2026	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

Section A

(Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable: 10x1=10)

1. If $f(z) = u(x,y) + iv(x,y)$, where $z = x + iy$, Then the Cauchy-Riemann Equations are

   a) $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ *and* $\frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$

   b) $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial y}$ *and* $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial y}$

   c) $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ *and* $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$

   d) $\frac{\partial u}{\partial x} = -\frac{\partial v}{\partial y}$ *and* $\frac{\partial u}{\partial y} = \frac{\partial v}{\partial x}$

2. If f(z) has a pole of order m at z_0 then $g(z) = \frac{f'(z)}{f(z)}$ at z_0 has,

   (a) a simple pole

   (b) a pole of order m

   (c) a pole of order m+1

   (d) a pole of order m-1

3. The Laplace transform of e^{3t+5} is

   $a)$ $\frac{e^{-5}}{s+3}$

   b) $\frac{e^{5}}{s-3}$

c) $\frac{e^{-5}}{s-3}$

d) $\frac{e^{5}}{s+3}$

4. The Laplace transform of the unit step function $u(t-a)$ is

a) $\frac{1}{s}$

b) $\frac{e^{as}}{s}$

c) $\frac{1}{s-a}$

d) $\frac{e^{-as}}{s}$

5. The value of b_n in the Fourier series expansion of the function $f(x) = x^2$, $-\pi < x < \pi$ is,

(a) 0

(b) $\frac{\pi^2}{3}$

(c) -4

(d) 4

6. If a function is odd, then its Fourier series contains only

a) Cosine terms

b) Constant term

c) Sine terms

d) Exponential terms

7. The Parseval's relation for Fourier Transform is

a) $\int_{-\infty}^{\infty} |f(x)|^2 dx = \int_{-\infty}^{\infty} |F(s)|^2 ds$

b) $\int_{-\infty}^{\infty} |f(x)|\, dx = \int_{-\infty}^{\infty} |F(s)|\, ds$

c) $\int_{-\infty}^{\infty} f(x)\, dx = \int_{-\infty}^{\infty} F(s) ds$

d) $f(x) = \int_{-\infty}^{\infty} F(s)\, ds$

8. $F_s[xf(x)]$ is equal to

a) $-\frac{d}{ds}F_s[f(x)]$

b) $\frac{d}{ds}F_s[f(x)]$

c) $-\frac{d}{ds}F_c[f(x)]$

d) $\frac{d}{ds}F_c[f(x)]$

9. For the ODE $y' = x + y$ with $y(0) = 1$, the first approximation $y_1(x)$ using Picard's method is

a) e^x

b) 1+x

c) $1+x+x^2+(x^3/6)$

d) $1+x+(x^2/2)$

10. The first approximation of root of $f(x) = x^2 - 4$ using Regula Falsi in [1, 3] is

a) 1.5
b) 1.75
c) 2
d) 2.5

Section B

(Five Questions of 02 Marks each 5x2=10)

11. Find the Residue of $f(z) = \frac{z}{(z-1)^2}$ at its pole.
12. Find Laplace transform of t^2e^{-3t}
13. Find the expression for a_n in the Fourier series expansion of $f(x)=x^2$, $0<x<2\pi$.
14. Obtain Fourier Sine transform of e^{-ax}.
15. Write Newton-Raphson formula for finding $\sqrt{a}$ where a is a positive number.

Section C

(Seven Questions of 10 Marks each of which any 05 questions to be answered: 5x10 = 50)

16. a) Evaluate $\int_c \frac{z-2}{z(z-1)} dz$ where c is the circle $|z| = 3$ using Cauchy's integral formula [5]

b) Using contour integration evaluate $\int_0^{2\pi} \frac{d\theta}{13 + 5\sin\theta}$ [5]

17. a) Find $L\left[e^{-t}\int_0^t \frac{\sin t}{t} dt\right]$ [5]

b) Using Convolution theorem find $L^{-1}\left[\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right]$ [5]

18. a) Solve by using Laplace Transform, $\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y = e^{-t}$, given that

$y(0) = 1,\ y'(0) = 0$ [5]

b) If $f(x) = \frac{1}{2}(\pi - x)$, find the Fourier series of 2π in $(0, 2\pi)$. Hence deduce that

$$1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots = \frac{\pi}{4}$$ [5]

19. a) Find the Laurent's expansion of $\frac{e^{2z}}{(z-1)^3}$ about z=1.

[5]

b) Find the real positive root of $3x - \cos x - 1 = 0$ by Newton's method correct to six decimal places. [5]

20. a) Find the Half Range Sine Series for $f(x) = x(\pi - x)$ in $(0, \pi)$.

Deduce that $\frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} - \cdots = \frac{\pi^3}{32}$ [5]

b) Find the Fourier series x^2 in $(-\pi,\ \pi)$. Use Parsevals identity to prove that

$$\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \cdots = \frac{\pi^4}{90}$$ [5]

21. a) Find the Fourier Transform of $f(x) = \begin{cases} 1 - x^2, & |x| \le 1 \\ 0, & |x| > 1 \end{cases}$ and hence show that

$$\int_0^\infty \left(\frac{\sin x - x\cos x}{x^3}\right) \cos\left(\frac{x}{2}\right) dx = \frac{3\pi}{16}$$ [5]

21. b) Find the Fourier Cosine Transform of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & x > 2 \end{cases}$ [5]

22. a) Using R-K method of fourth order find y(0.1) and y(0.2) for the initial

value problem $\frac{dy}{dx} = x + y^2, y(0) = 1$ [6]

22. b) Using Gauss Seidal Method, solve the following equations

$20x + y - 2z = 17;\ \ 3x + 20y - z = -18;\ \ 2x - 3y + 20z = 25$ [4]