Indian Maritime University

(A Central Univer2sity, Govt of India)

End Semester Examinations – June 2025

Programme Name: B Tech (ME)

Semester: II

Subject Code: UG11T5201

Subject Name: ENGINEERING MATHEMATICS II

Date: 03.06.2025	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.

Section A **1*10=10marks**

Ten MCQs of 01 Mark each – Choose the correct answer as applicable.

1.If a function f is analytic throughout a simple connected domain D, then $\int_C f(z)dz =$____

a) 2πi
b) 2πif(z)
c) 1
d) 0

2. If the principle part of f(z) at z_0 is zero, then the point z_0 is known as ____

a) Pole
b) Removable singular point
c) Simple pole
d) Essential singular point

3. The laplace transform of a function f(t) is defined by $L(f(t)) = \int_0^\infty e^{-st} f(t)dt$

For this improper integral to converge(and hence to transform to exist), f(t) must be _____

a) Integrable over [0,1] only
b) Of exponential order and piecewise continuous on [0,∞)
c) Strictly increasing on [0,∞)
d) Constant for all t>0

4. $L(\delta(t)) =$ __

a) 1
b) -1
c) 0
d) ∞

5. For the Fourier series expansion, at the point of discontinuity, the sum of the series is equal to
   a) $\frac{1}{4}$ [f(x+0)−f(x−0)]
   b) $\frac{1}{4}$ [f(x+0)+f(x−0)]
   c) $\frac{1}{2}$[f(x+0)−f(x−0)]
   d) $\frac{1}{2}$ [f(x+0)+f(x−0)].

6. Find a_n if the function $f(x) = x - x^3$ in $(-l, l)$.

a) finite value
b) infinite value
c) zero
d) can't be defined

7. Let $y = y(t)$ and $L(y) = \bar{y}$. If $y(0) = 1, y'(0) = 0$ then the value of $L(ty'')$ is____
a) $1 - 2s\bar{y} - s^2\frac{d\bar{y}}{ds}$
b) $1 - 2s\bar{y} + s^2\frac{d\bar{y}}{ds}$
c) $1 - 2s\bar{y} - s\frac{d\bar{y}}{ds}$
d) $1 + 2s\bar{y} - s^2\frac{d\bar{y}}{ds}$

8. $F_s(e^{-ax} * e^{-ax}) =$ ___
a) $\frac{s}{(s^2+a^2)^2}$
b) $\frac{-s}{(s^2+a^2)^2}$
c) $\frac{s^2}{(s^2+a^2)^2}$
d) $\frac{-s^2}{(s^2+a^2)^2}$

9. The Newton Raphson method fails, if__________
a) $f(x_0) = 0$
b) $f'(x_0) = 0$
c) $f''(x_0) = 0$
d) $f'''(x_0) = 0$

10. In Gauss Jordan method which of the following transformations are allowed?
a) Row transformation
b) column transformation
c) square transformation
d) Diagonal transformation

Section B (5*2=10)

Five Questions of 02 Marks each

11. An analytic function whose imaginary part is constant must itself be a constant.
12. Find $L(t\cos t)$.
13. The cosine series for $f(x) = x\sin x$ for 0<x<π is given as $x\sin x = 1 - \frac{1}{2}\cos x - 2\sum_{n=2}^{\infty}\frac{(-1)^n}{n^2-1}\cos nx$. Deduce that $1 + 2\left(\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \cdots\right) = \frac{\pi}{2}$
14. State and prove first shifting property in Fourier Transform.
15. Solve $y' = y + x,\ y(0) = 1$ by picard's method upto second approximation.

Section C 5 x 10= 50 marks

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16.a) Evaluate $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$, where $C: |z| = 3$, using Cauchy's integral formula. [4]

b) Evaluate $\int_0^{2\pi} \frac{d\theta}{13 + 5\sin\theta}$ using contour integration. [6]

17.a) Find the laplace transform of the triangular wave of period $2a$ given by $(t) = \begin{cases} t, & 0 < t < a \\ 2a - t, & a < t < 2a \end{cases}$. [5]

b) Find $L^{-1}\left(\frac{1}{(s^2+a^2)^2}\right)$ by using convolution theorem. [5]

18. a) Find the Fourier series expansion of $f(x) = 2x - x^2$ in $(0,3)$ [5]

b) Find the fourier series for $f(x) = x^2$ in $-\pi < x < \pi$ and hence show that $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \cdots = \frac{\pi^4}{90}$ [5]

19. a) Find the fourier transform of $e^{-a^2x^2}, a < 0$. Hence deduce that $e^{-\frac{x^2}{2}}$ is self-reciprocal with respect to fourier transform. [5]

b) Find the fourier sine and cosine transform of xe^{-ax}. [5]

20.a) Using Runge-kutta method find an approximate value of y for x = 0.2 in steps of 0.1 if $\frac{dy}{dx} = x + y^2$, given that $y = 1$, where $x = 0$ [5]

b) Solve by Gauss seidal iterative method, the equations $20x + y - 2z = 17;\ 3x + 20y - z = -18;\ 2x - 3y + 20z = 25.$ [5]

21.a) Use Laplace transform method to solve $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5y = e^{-t}\sin t$ with $y(0) = 0, y'(0) = 1.$ [5]

b) Find the Laurent's expansion of $\frac{z^2-1}{z^2+5z+6}$ about z=0 in the region $2 < |z| < 3$. [5]

22.a) Expand $f(x) = \begin{cases} \frac{1}{4} - x, & 0 < x < \frac{1}{2} \\ x - \frac{3}{4}, & \frac{1}{2} < x < 1 \end{cases}$ as fourier half range sine series. **[4]**

b) Find the real root of the equation $x^3 - 2x - 5 = 0$ by method of false position correct to three decimal places. **[6]**