

Indian Maritime University
(A Central University, Govt of India)

Mar/Apr 26 SE
Programme Name: B Tech (ME)

Semester: II

Subject Code: UG11T5201

Subject Name: ENGINEERING MATHEMATICS II

Date: 11.03.2026

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

$$\int_C f(z) dz = \underline{\hspace{2cm}}$$

- a) $2\pi i$
b) $2\pi i f(z)$
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 $[0, \infty)$
c) Strictly increasing on $[0, \infty)$
d) Constant for all $t > 0$

4. $L(\delta(t)) = \underline{\hspace{2cm}}$

- a) 1
- b) -1
- c) 0
- d) ∞

5. Find b_n when we have to find the half range sine series of the function x in the interval 0 to 3.

- a) $\frac{6}{n\pi}$
- b) $-\frac{6}{n\pi}$
- c) $\frac{6}{n\pi}(-1)^n$
- d) $-\frac{6}{n\pi}(-1)^n$

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 $0 < x < \pi$ 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 $1 + 2 \left(\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \dots \right) = \frac{\pi}{2}$
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
 $\frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \dots = \frac{\pi^4}{90}$ **[5]**
19. a) Find the fourier transform of $e^{-a^2 x^2}, a < 0$. 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 $x e^{-ax}$. **[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
 $\frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} + 5y = e^{-t} \sin t$ 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]

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

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