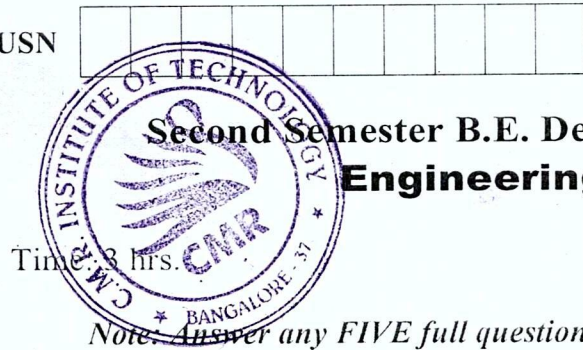


USN

15MAT21



Second Semester B.E. Degree Examination, June/July 2025
Engineering Mathematics – II

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE question from each module.

Module-1

- 1 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$ (05 Marks)
- b. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{-2x} \sin 2x$ (05 Marks)
- c. Solve $\frac{d^2y}{dx^2} + y = \sec x \tan x$ by the method of variation of parameters. (06 Marks)

OR

- 2 a. Solve $y'' - 2y' + y = x \cos x$ (05 Marks)
- b. Solve $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = e^x + 1$ (05 Marks)
- c. Solve $y'' - 5y' + 6y = e^{3x} + x$ by the method of undetermined coefficients. (06 Marks)

Module-2

- 3 a. Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = 1 + x^2$ (05 Marks)
- b. Solve $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$ (05 Marks)
- c. Solve the equation $(px-y)(x-py) = 2p$ by using the substitution $x^2 = X$ and $y^2 = Y$. (06 Marks)

OR

- 4 a. Solve $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = \sin 2[\log(1+x)]$ (05 Marks)
- b. Solve $y = 3px + 6p^2y^2$ by solving for x . (05 Marks)
- c. Find the general and singular solution of $(y - px)(p - 1) = p$. (06 Marks)

Module-3

- 5 a. Obtain the partial differential equation by eliminating the arbitrary function given $Z = y f(x) + x \phi(y)$. (05 Marks)
- b. Solve $\frac{\partial^3 z}{\partial x^2 \partial y} + 18xy^2 + \sin(2x - y) = 0$. (05 Marks)
- c. Derive one dimensional heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. (06 Marks)

OR

- 6 a. Obtain the partial differential equation by eliminating the arbitrary function from $\phi(x^2 + y^2, z - xy) = 0$. (05 Marks)
- b. Solve $\frac{\partial^2 z}{\partial y^2} + z = 0$ given that $z = \cos x$ and $\frac{\partial z}{\partial y} = \sin x$ when $y = 0$. (05 Marks)
- c. Find the solution of the wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ by the method of separation of variables for constant $K = 0$. (06 Marks)

Module-4

- 7 a. Evaluate $\int_{-1}^1 \int_0^z \int_{x-z}^{x+z} (x+y+z) dy dx dz$ (05 Marks)
- b. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy dy dx$ by changing the order of integration. (05 Marks)
- c. Evaluate $\int_0^2 \frac{x^2}{\sqrt{2-x}} dx$ by using Gamma and Beta functions. (06 Marks)

OR

- 8 a. Evaluate $\int_0^a \int_0^{\sqrt{a^2-y^2}} y \sqrt{x^2 + y^2} dx dy$ by changing into polar coordinates. (05 Marks)
- b. Find the volume of the sphere $x^2 + y^2 + z^2 = a^2$ using triple integrals in first octant. (05 Marks)
- c. Obtain the relation between beta and gamma functions in the form $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. (06 Marks)

Module-5

- 9 a. Find : i) $L(t^5 e^{4t} \cosh 3t)$ and ii) $L\left(\frac{e^{-at} - e^{-bt}}{t}\right)$. (05 Marks)
- b. If $f(t)$ is a periodic function of period T , then show that $L\{f(t)\} = \frac{1}{1 - e^{-sT}} \int_0^T e^{-st} f(t) dt$. (05 Marks)
- c. Express $f(t) = \begin{cases} t^2 & 0 < t \leq 2 \\ 4t & t \geq 2 \end{cases}$ in terms of unit step function hence find its Laplace transformation. (06 Marks)

OR

- 10 a. Find $L^{-1}\left\{\frac{2s-1}{s^2+4s+29}\right\}$ (05 Marks)
- b. Find $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$ by using convolution theorem. (05 Marks)
- c. Solve using Laplace transformation $\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + y = 0$ under the given conditions $y(0) = 1$ $y'(0) = 0$. (06 Marks)
