CBCS SCHEME

USN

Second Semester B.E/B.Tech. Degree Examination, Dec.2025/Jan.2026
Engineering Mathematics – II

Time: 3 hrs. Max. Marks: 100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 6e^{3x}$. **(06 Marks)**

b. Solve $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} - 4\frac{dy}{dx} - 4y = 3e^{x}$. **(07 Marks)**

c. Solve by the method of variation of parameter $y'' + y = \frac{1}{1+\sin x}$. **(07 Marks)**

OR

2 a. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 25y = e^{2x} + \sin x + x$. **(06 Marks)**

b. Solve $y'' + 4y' + 5y = -2\cosh x$; find y when $y = 0$ and $\frac{dy}{dx} = 1$ at $x = 0$. **(07 Marks)**

c. Solve by the method of undetermined coefficient $(D^2 - 3D + 2)y = x^2 + e^x$. **(07 Marks)**

Module-2

3 a. Solve $x^2y'' - 3xy' + 4y = 1 + x^2$. **(06 Marks)**

b. Solve $xyp^2 - (x^2 + y^2)p + xy = 0$. **(07 Marks)**

c. Solve $(px - y)(py + x) = a^2p$ by taking $x^2 = x$ and $y^2 = y$. **(07 Marks)**

OR

4 a. Solve $(2+x)^2y'' + (2+x)y' + y = \sin(2\log(2+x))$. **(06 Marks)**

b. Solve $yp^2 + (x - y)p - x = 0$. **(07 Marks)**

c. Obtain the general and singular solution of the equation $\sin px \cos y = \cos px \sin y + p$. **(07 Marks)**

Module-3

5 a. Find the partial differential equation of all spheres $(x-a)^2 + (y-b)^2 + z^2 = c^2$. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$ for which $\frac{\partial z}{\partial y} = -2\sin y$ when x = 0 and z = 0 when y is an odd multiple of $\frac{\pi}{2}$. **(07 Marks)**

c. Derive one dimensional wave equation with usual notations. **(07 Marks)**

OR

6 a. Form the partial differential equation by eliminating the arbitrary function from $z = y\phi(x) + x\psi(y)$. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial y^2} = z$; given that when $y = 0$, $z = e^x$ and $\frac{\partial z}{\partial y} = e^{-x}$. **(07 Marks)**

c. Find the various possible solution for one dimensional heat equation by the method of separation of variables. **(07 Marks)**

Module-4

7 a. Evaluate $\iint r \sin\theta \, dr \, d\theta$ over the cardioids $r = a(1 - \cos\theta)$ above the initial line. **(06 Marks)**

b. Evaluate $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x \, dz \, dx \, dy$. **(07 Marks)**

c. Derive the relation between Beta and Gamma function as $B(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(07 Marks)**

OR

8 a. Evaluate by changing the order of integration $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dy dx$. **(06 Marks)**

b. Find by double integration, the area lying between the parabola $y = 4x - x^2$ and the line $y = x$. **(07 Marks)**

c. Show that $\int_0^{\pi/2} \sqrt{\cot\theta} \, d\theta = \frac{1}{2} \left|\left(\frac{1}{4}\right) \left|\left(\frac{3}{4}\right)\right.\right.$ **(07 Marks)**

Module-5

9 a. Find the Laplace transform of $\left[\frac{\text{Cos}at - \text{Cos}bt}{t}\right]$. **(06 Marks)**

b. Express the function $f(t) = \begin{cases} \text{Sin}t & 0 < t \le \frac{\pi}{2} \\ \text{Cos}t & t > \frac{\pi}{2} \end{cases}$ in terms of unit step function and hence find Laplace transform. **(07 Marks)**

c. Find $L^{-1}\left(\frac{s+2}{s^2 - 2s + 5}\right)$. **(07 Marks)**

OR

10 a. Find the Laplace transform of the periodic function $f(t) = t^2$, $0 < t < 2$. **(06 Marks)**

b. Using convolution theorem obtain the Inverse Laplace transform of $\frac{1}{s^3(s^2+1)}$. **(07 Marks)**

c. Solve by using Laplace transform $y'' + 4y' + 4y = e^{-t}$. Given that $y(0) = 0$, $y'(0) = 0$. **(07 Marks)**

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