CBCS SCHEME

USN

17MAT21

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Solve $y'' + 5y' + 6y = e^{-2x} + \cos x$ **(07 Marks)**

b. Solve $\dfrac{d^2y}{dx^2} + y = \sec x \ \tan x$ using variation of parameters method. **(07 Marks)**

c. Solve $(D^2 + 2D + 2)\,y = x^2 - 2x$ **(06 Marks)**

OR

2 a. Solve $(D^2 - D - 2)\,y = 2^x$ **(07 Marks)**

b. Solve $y''' + 3y'' - 4y = 5\cos(2x)$ using inverse differential operator's method. **(07 Marks)**

c. Solve $\dfrac{d^2y}{dx^2} + y = \sin x$, using undetermined coefficients method. **(06 Marks)**

Module-2

3 a. Solve $x^2\dfrac{d^2y}{dx^2} - 3x\dfrac{dy}{dx} + 5y = 3\sin(\log x)$ **(07 Marks)**

b. Find the solution to $yp^2 + (x - y)p - x = 0$ by solving it for p. **(07 Marks)**

c. Reduce $(xp - y)(x + py) = 2p$ into Clairaut's equation using $x^2 = u$, $y^2 = v$. And hence find the general solution. **(06 Marks)**

OR

4 a. Solve $(2x+1)^2\dfrac{d^2y}{dx^2} - 2(2x+1)\dfrac{dy}{dx} - 12y = 3(2x+1)$. **(07 Marks)**

b. Find the solution to the equation $xyp^2 - (x^2 + y^2)\,p + xy = 0$ by solving it for p. **(07 Marks)**

c. Express $(y - xp)(p - 1) = p$ in Clairaut's equation and find its general and singular solution. **(06 Marks)**

Module-3

5 a. Solve $\dfrac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$; given that $\dfrac{\partial z}{\partial y} = -2\sin y$ when $x = 0$ and $z = 0$ when y is odd multiple of $\dfrac{\pi}{2}$. **(07 Marks)**

b. With usual assumptions, derive one - dimensional wave equation. **(07 Marks)**

c. Obtain the partial differential equation by eliminating arbitrary constants a, b, from $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 2z$ **(06 Marks)**

OR

6 a. Solve $\frac{\partial^2 z}{\partial x^2} = a^2 z$; given that $z = 0$ and $\frac{\partial z}{\partial x} = a \sin y$ when $x = 0$. (07 Marks)

b. Obtain all possible solutions of heat equation, by method of separation of variables. (07 Marks)

c. Construct the partial differential equation by eliminating arbitrary function from $Q(x + y + z,\ x^2 + y^2 - z^2) = 0$ (06 Marks)

Module-4

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

b. Evaluate $\int_0^a \int_0^{\sqrt{a^2-x^2}} y^2 \sqrt{x^2 + y^2}\, dx\, dy$ by changing into polar coordinates. (07 Marks)

c. Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\Pi}$, using gama function. (06 Marks)

OR

8 a. Evaluate $\int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2)\, dy dx$ by changing its order. (07 Marks)

b. Find the area bounded by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ using double integration. (07 Marks)

c. Prove that $\beta(m, n) = \frac{\Gamma(m)\ \Gamma(n)}{\Gamma(m + n)}$ (06 Marks)

Module-5

9 a. i) Find $L\{e^{-t}\, t \sin(2t)\}$ (07 Marks)

ii) Find $L^{-1}\left\{\log\left(\frac{s+a}{s-b}\right)\right\}$

b. Express f(t) in unit –step function and find its Laplace transform. Given that

$$f(t) = \begin{cases} t & \text{for } \ 0 < t < 4 \\ 5 & \text{for } \ t > 4 \end{cases}$$ (07 Marks)

c. Solve $\frac{d^2y}{dt^2} + 5\frac{dy}{dt} + 6y = 5e^{2t}$ given that $y(0) = 2$ and $\frac{dy(0)}{dt} = 1$, using Laplace transforms. (06 Marks)

OR

10 a. i) Find $L\left\{\frac{1-\cos t}{t}\right\}$ ii) Find $L^{-1}\left\{\frac{2s-1}{s^2 + 2s + 17}\right\}$ (07 Marks)

b. Find the Laplace transform of the periodic function.

$f(t) = \frac{t}{T}$ such that $f(t + T) = f(t)$. (07 Marks)

c. Find the inverse Laplace transform of $\frac{1}{(s+1)(s^2+4)}$, using convolution theorem. (06 Marks)

* * * * *