CBCS SCHEME

USN | | | | | | | | | | |

15MAT21

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

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full 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) $L(t^5e^{4t}\cosh 3t)$ 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 $f(t)=\begin{cases} t^2 & 0<t\le 2 \\ 4t & t\ge 2\end{cases}$ 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)**

* * * * *