CBCS SCHEME

USN | | | | | | | | | |

15MAT21

Second Semester B.E. Degree Examination, June/July 2023
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 $(D^4 + 4D^3 - 5D^2 - 36D - 36)\, y = 0$ **(05 Marks)**

b. Solve $(D^3 + 4D)\, y = \sin 2x$ **(05 Marks)**

c. Solve $y'' + 2y' + y = x^2 + 2x$ by the method of undetermined coefficients. **(06 Marks)**

OR

2 a. Solve $\frac{d^2y}{dx^2} + 4y = 1 + x^2$ **(05 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \sin x$ **(05 Marks)**

c. Solve by the method of variation of parameters $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$ **(06 Marks)**

Module-2

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

b. Solve $x\left(\frac{dy}{dx}\right)^2 + (y - x)\frac{dy}{dx} - y = 0$ **(05 Marks)**

c. Solve $y = 2px + \tan^{-1}(xp^2)$ **(05 Marks)**

OR

4 a. Solve $(1+x)^2\, y'' + (1+x)y' + y = 2\sin[\log(1+x)]$ **(06 Marks)**

b. Solve $2xyp = 4y^2 + p^3$ **(05 Marks)**

c. Find the general and singular solutions of $y = xp + \sin^{-1}p$ **(05 Marks)**

Module-3

5 a. Form the partial differential equation from the following equation by eliminating arbitrary constant a and b
$(x-a)^2 + (y-b)^2 + z^2 = 16$ **(05 Marks)**

b. Solve $\log\left(\frac{\partial^2 z}{\partial x \partial y}\right) = x + y$ **(06 Marks)**

c. Derive one dimensional heat equation in the form $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$ **(05 Marks)**

OR

6 a. Form partial differential equations from the following relation by eliminating arbitrary functions $z = f(x + ay) + g(x - ay)$ **(05 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} - 6\frac{\partial z}{\partial x} + 9z = 0$ given that $z = 0$, $\frac{\partial z}{\partial x} = e^y$ when $x = 0$ **(05 Marks)**

c. Find the various possible solution of wave equation $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$ by using the method of separation of variables. **(06 Marks)**

Module-4

7 a. Evaluate by changing the order of integration

$$\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dydx$$ **(05 Marks)**

b. Find the area bounded by the parabola $y = x^2$ and the line $y = x$. **(05 Marks)**

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

OR

8 a. Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2 yz \, dxdydz$ **(05 Marks)**

b. Evaluate $\int_{-a}^{a} \int_0^{\sqrt{a^2-x^2}} \sqrt{x^2 + y^2}\, dydx$ by changing to polar coordinates. **(05 Marks)**

c. Prove that $\int_0^\infty x^2 e^{-x^4} dx \times \int_0^\infty e^{-x^4} dx = \frac{\pi}{8\sqrt{2}}$ **(06 Marks)**

Module-5

9 a. Find $L[t\, e^{-t} \sin 3t]$ **(05 Marks)**

b. If $f(t) = \begin{cases} 1 & 0 < t < a \\ -1 & a < t < 2a \end{cases}$ and $f(t + 2a) = f(t)$ then find $L[f(t)]$ **(05 Marks)**

c. Using Laplace Transform method solve

$$\frac{d^2y}{dt^2} - 2\frac{dy}{dt} + y = e^{2t} \text{ with } y(0) = 0 \text{ and } y'(0) = 1$$ **(06 Marks)**

OR

10 a. Express $f(t) = \begin{cases} t^2 & \text{for } 0 < t \le 2 \\ 0 & \text{for } t > 2 \end{cases}$ in terms of unit step function and hence find $L[f(t)]$. **(05 Marks)**

b. Find $L^{-1}\left[\frac{s+2}{s^2 - 4s + 13}\right]$ **(05 Marks)**

c. Find : i) $L^{-1}\left[\log\left(\frac{s+a}{s+b}\right)\right]$ ii) $L^{-1}\left[\frac{e^s}{s+1}\right]$ **(06 Marks)**

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