CBCS SCHEME

USN [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

17MAT21

# Second Semester B.E. Degree Examination, Dec.2023/Jan.2024
# 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 : $(D^2 + 2D + 1)y = \sin 2x$ **(06 Marks)**

b. Solve : $(D^3 + 6D^2 + 11D + 6)y = e^x + 1$ **(07 Marks)**

c. By the method of undetermined coefficients solve:
$(D^2 + 4)y = e^{-x}$ **(07 Marks)**

**OR**

2 a. Solve : $(D^2 - 6D + 9)y = 6e^{3x} + 7^{-2x}$ **(06 Marks)**

b. Solve : $(D^2 - 4D + 4)y = 8(e^{2x} + \sin 2x)$ **(07 Marks)**

c. By the method of variation of parameters solve:
$(D^2 + 1)y = \sec x$ **(07 Marks)**

## Module-2

3 a. Solve : $x^2y'' + xy' + 9y = 3x^2 + \sin(3 \log x)$ **(06 Marks)**

b. Solve : $yp^2 + (x - y)p - x = 0$ **(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 : $(x + 1)^2y'' + (x + 1)y' + y = 2 \sin[\log (1 + x)]$ **(06 Marks)**

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

c. Obtain general solution and singular solution of $xp^2 - py + kp + a = 0$ **(07 Marks)**

## Module-3

5 a. Obtain the partial differential equation by eliminating f and g from the relation
$z = f(x + at) + g(x - at)$ **(06 Marks)**

b. Solve : $\frac{\partial^2 z}{\partial x^2} - a^2 z = 0$ under the conditions z = 0 when x = 0 and $\frac{\partial z}{\partial x} = a \sin y$ when x = 0. **(07 Marks)**

c. Derive an expression for the one dimensional heat equation. **(07 Marks)**

**OR**

6 a. Form a partial differential equation from $\phi(x + y + z, xy + z^2) = 0$ **(06 Marks)**

b. Solve : $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$ given that $\frac{\partial z}{\partial y} = -2\sin y$ when x = 0 and z = 0 when $y = (2n+1)\pi/2$ **(07 Marks)**

c. Use the method of separation of variable to solve the wave equation
$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$$ **(07 Marks)**

## Module-4

7 a. Evaluate by changing the order of integration

$$\int_0^1 \int_{\sqrt{y}}^1 dx\,dy$$ **(06 Marks)**

b. Evaluate : $\int_{-1}^{1} \int_{0}^{z} \int_{x-z}^{x+z} (x+y+z)\,dy\,dx\,dz$ **(07 Marks)**

c. Prove that : $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ using definition of $\Gamma(n)$. **(07 Marks)**

**OR**

8 a. Evaluate

$$\int_0^\infty \int_0^\infty e^{-(x^2+y^2)}\,dx\,dy$$ by changing into polar coordinates. **(06 Marks)**

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

c. Prove that $\beta(m, n) = \frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$ **(07 Marks)**

## Module-5

9 a. Find : (i) $L[t \cos 2t]$

(ii) $L\left[\frac{\cos 2t - \cos 3t}{t}\right]$ **(06 Marks)**

b. A periodic function of period 2a is defined by $f(t) = \begin{cases} E & \text{for } 0 \le t \le a \\ -E & \text{for } a \le t \le 2a \end{cases}$

Show that $L[f(t)] = \frac{E}{s} \tanh\left(\frac{as}{2}\right)$ where E is a constant. **(07 Marks)**

c. Solve: $y'' + 6y' + 9y = 12$ subject to the conditions $y(0) = 0$, $y'(0) = 0$ by using Laplace transform method. **(07 Marks)**

**OR**

10 a. Find $L^{-1}\left[\frac{4s+5}{(s+2)(s+1)^2}\right]$ **(06 Marks)**

b. Find $L^{-1}\left[\frac{1}{(s+a)(s+b)}\right]$ by using convolution theorem. **(07 Marks)**

c. Express the function in terms of unit step function and hence find their Laplace transform

where $f(t) = \begin{cases} 1, & 0 < t < 1 \\ t, & 1 < t < 2 \\ t_2, & t > 2 \end{cases}$ **(07 Marks)**

* * * * *