CBCS SCHEME

USN

17MAT21

Second Semester B.E. Degree Examination, June/July 2024
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 $(D^2+1)y = 3x^2+6x+12$. **(06 Marks)**

b. Solve $(D^3+2D^2+D)y = e^{-x}$. **(07 Marks)**

c. By the method of undetermined coefficients, solve $(D^2+D-2)y = x+\sin x$. **(07 Marks)**

OR

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

b. Solve $(D^3-D)y = (2x+1)+4\cos x$. **(07 Marks)**

c. By the method of variation of parameters, solve $(D^2+1)y = \operatorname{cosec} x$. **(07 Marks)**

Module-2

3 a. Solve $(x^2D^2 + xD + 1)y = \sin(2\log x)$ **(06 Marks)**

b. Solve $x^2p^2 + 3xyp + 2y^2 = 0$ **(07 Marks)**

c. Find the general and singular solution of Clairaut's equation $y = xp + p^2$. **(07 Marks)**

OR

4 a. Solve $(2x+1)^2 y'' - 2(2x+1)y' - 12y = 6x$. **(06 Marks)**

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

c. Find the general solution of $(p-1)e^{3x} + p^3 e^{2y} = 0$ by using the substitution $X = e^x$, $Y = e^y$. **(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 $\dfrac{\partial^2 z}{\partial x\partial y} = \sin x\sin y$ for which $\dfrac{\partial z}{\partial y} = -2\sin y$ when $x = 0$ and $z = 0$ when y is an odd multiple of $\dfrac{\pi}{2}$. **(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 $\dfrac{\partial^2 z}{\partial y^2} = z$; given that when $y = 0$, $z = e^x$ and $\dfrac{\partial z}{\partial y} = e^{-x}$. **(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 $\int_0^\infty \int_x^\infty \frac{e^{-y}}{y} dydx$. **(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 $\int_0^{\pi/2} \sqrt{\cot\theta}\, d\theta = \frac{1}{2}\Gamma\left(\frac{1}{4}\right)\Gamma\left(\frac{3}{4}\right)$. **(07 Marks)**

Module-5

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

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

c. Find $L^{-1}\left(\frac{s+2}{s^2 - 2s + 5}\right) \int_0^{\pi/2} \sqrt{\cot\theta}\, d\theta = \frac{1}{2}\Gamma\left(\frac{1}{4}\right)\Gamma\left(\frac{3}{4}\right)$. **(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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