CBCS SCHEME

USN

17MAT21

Second Semester B.E. Degree Examination, July/August 2022

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 : $(4D^4 - 4D^3 - 23D^2 + 12D + 36)$, y = 0, where $D = \frac{d}{dx}$. (06 Marks)

b. Solve $\frac{d^3y}{dx^3} + y = 65\cos(2x+1)$. (07 Marks)

c. Solve : $y'' + 4y = x^2 + e^{-x}$ by the method of undetermined co-efficients. (07 Marks)

OR

2 a. Solve $\frac{d^2y}{dx^2} - 4y = \cosh(2x-1) + 3^x$. (06 Marks)

b. Solve $(D^2 + D + 1)y = 1 - x + x^2$. (07 Marks)

c. Solve $\frac{d^2y}{dx^2} + y = \frac{1}{1+\sin x}$ by the method of variation of parameters. (07 Marks)

Module-2

3 a. Solve $x^3\frac{d^3y}{dx^3} + 3x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} = x^3$. (06 Marks)

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

c. Modify the following equations into Clairaut's form and hence obtain its general and singular solution. $xp^2 - py + Kp + a = 0$. (07 Marks)

OR

4 a. Solve $(3x+2)^2y'' + 3(3x+2)y' - 36y = 8x^2 + 4x + 1$. (06 Marks)

b. Solve $p(p+y) = x(x+y)$. (07 Marks)

c. Solve $(px - y)(py + x) = 2p$ by reducing it to Clairaut's form, by taking the substitution $X = x^2$, $Y = y^2$. (07 Marks)

Module-3

5 a. Form a PDE by eliminating arbitrary functions $\phi(x+y+z,\ \ x^2+y^2-z^2) = 0$. (06 Marks)

b. Solve $\frac{\partial^2 z}{\partial x\partial y} = \sin x\sin y$ for which $\frac{\partial z}{\partial y} = -2\sin y$ where x = 0 and z = 0 if y is an odd multiple of $\frac{\pi}{2}$. (07 Marks)

c. Derive one dimensional wave equation in the form $\frac{\partial^2 u}{\partial t^2} = C^2\frac{\partial^2 u}{\partial x^2}$. (07 Marks)

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.

OR

6 a. Form a PDE by eliminating arbitrary functions, $z = yf(x) + x\phi(y)$. (06 Marks)

b. Solve the equation $\frac{\partial^2 z}{\partial x^2} + z = 0$ given that $z = e^y$ and $\frac{\partial z}{\partial x} = 1$ when $x = 0$. (07 Marks)

c. Find various possible solution of one dimensional heat equation, by the method of separation of variables. (07 Marks)

Module-4

7 a. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} dz\, dy\, dx$. (06 Marks)

b. Evaluate $\int_1^2 \int_1^{x^2} (x^2 + y^2) dy\, dx$ by changing the order of integration. (07 Marks)

c. Derive the relation between Beta and Gamma function as $\beta(m,n) = \frac{\Gamma m \Gamma n}{\Gamma m+n}$. (07 Marks)

OR

8 a. Evaluate $\iint_R x^2 y\, dxdy$, where R is the region bounded by the lines $y = x$, $y + x = 2$ and $y = 0$. (06 Marks)

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

c. Show that $\int_0^\infty x.e^{-x^8} \times \int_0^\infty x^2.e^{-x^4} dx = \frac{\pi}{16\sqrt{2}}$. (07 Marks)

Module-5

9 a. Find the Laplace transform of $2^t + \frac{\cos 2t - \cos 3t}{t}$. (06 Marks)

b. If $f(t) = \begin{cases} t, & 0 \le t \le a \\ 2a - t, & a \le t \le 2a \end{cases}$, $f(t+2a) = f(t)$

Sketch the graph of $f(t)$ as a periodic function and show $L[f(t)] = \frac{1}{s^2}\tanh\left(\frac{as}{2}\right)$. (07 Marks)

c. Find the inverse Laplace transform of $\frac{s^2}{(s^2+a^2)^2}$, using convolution theorem. (07 Marks)

OR

10 a. Express $f(t) = \begin{cases} \cos t: & 0 < t \le \pi \\ 1: & \pi < t \le 2\pi \\ \sin t: & t > 2\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. (06 Marks)

b. Find the inverse Laplace transform of $\frac{5s+3}{(s-1)(s+1)^2}$. (07 Marks)

c. Solve the differential equation $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{2x}$, $y(0) = 2$, $y'(0) = 1$ using Laplace transform method. (07 Marks)

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