USN

17MAT21

Second Semester B.E. Degree Examination, Jan./Feb. 2021
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 $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} - 6y = e^{3x}$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 3\sin x$ **(07 Marks)**

c. Solve by the method of undetermined coefficients
$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 4y = 2x^2 + 3e^{-x}$ **(07 Marks)**

OR

2 a. Solve $(D^4 + 4D^3 - 5D^2 - 36D - 36)y = 0$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$ **(07 Marks)**

c. Solve by variation of parameters method $\frac{d^2y}{dx^2} + a^2y = \tan ax$ **(07 Marks)**

Module-2

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

b. Solve $xy\left(\frac{dy}{dx}\right)^2 - (x^2 + y^2)\frac{dy}{dx} + xy = 0$ **(07 Marks)**

c. Find the general and singular solution of $y = px - \sin^{-1}p$. **(07 Marks)**

OR

4 a. Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = \sin(2\log(1+x))$ **(06 Marks)**

b. Solve $p^2 + 2py\cot x = y^2$, where $p = \frac{dy}{dx}$ **(07 Marks)**

c. Solve $(px - y)(py + x) = a^2p$ by taking $x^2 = X$ and $y^2 = Y$. **(07 Marks)**

Module-3

5 a. Form the partial differential equation from $xyz = \phi(x + y + z)$ **(06 Marks)**

b. Solve $\frac{\partial^3 z}{\partial x^2 \partial y} + 18xy^2 + \sin(2x - y) = 0$ by direct integration. **(07 Marks)**

c. Find all possible solutions of the one-dimensional heat equation $U_t = c^2 U_{xx}$ by the method of separation of variables. **(07 Marks)**

OR

6 a. Form the partial differential equation from z = f (x + at) + g (x – at), where a is a constant. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} = a^2 z$, given that at x = 0, $\frac{\partial z}{\partial x} = a \sin y$ and z = 0. **(07 Marks)**

c. With suitable assumptions, derive the one dimensional wave equation as $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ **(07 Marks)**

Module-4

7 a. Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y\,dx\,dy$ by changing the order of integration. **(06 Marks)**

b. Evaluate $\int_{-1}^{1} \int_0^{z} \int_{x-z}^{x+z} (x+y+z)\,dx\,dy\,dz$ **(07 Marks)**

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

OR

8 a. Evaluate $\int_0^a \int_y^a \frac{x}{x^2+y^2}\,dx\,dy$ by changing to polar coordinates. **(06 Marks)**

b. Using double integration find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. **(07 Marks)**

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

Module-5

9 a. Find Laplace transform of t(Sinat + Cosat) **(06 Marks)**

b. Find the Laplace transform of the periodic function of period 2a given by

$$f(t) = \begin{cases} t, & 0 < t < a \\ 2a - t, & a < t < 2a \end{cases}$$ **(07 Marks)**

c. Using convolution theorem find $L^{-1}\left[\frac{s}{(s^2+a^2)^2}\right]$ **(07 Marks)**

OR

10 a. Express $f(t) = \begin{cases} \text{Cos}t, & 0 < t < \pi \\ \text{Cos}2t, & \pi < t < 2\pi \\ \text{Cos}3t, & t > 2\pi \end{cases}$ in terms of unit-step function and hence find L(f(t)). **(06 Marks)**

b. Find the inverse Laplace transform of

i) $\frac{s^2 - 3s + 4}{s^3}$ and ii) $\frac{s+2}{s^2 - 4s + 13}$ **(07 Marks)**

c. Solve by Laplace transform method $\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^t$ with x = 2, $\frac{dx}{dt} = -1$ at t = 0. **(07 Marks)**

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