H Roll No. ....

TMA–201

B. TECH. (SECOND SEMESTER) END SEMESTER EXAMINATION, July/Aug., 2022

ENGINEERING MATHEMATICS–II

Time : Three Hours

Maximum Marks : 100

Note : (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are twenty.

(iv) Each sub-question carries 10 marks.

1. (a) Solve : (CO1)

$$(2xy + y - \tan y)dx + (x^2 - x\tan^2 y + \sec^2 y)\,dy = 0.$$

(b) Solve : (CO1)

$$\left(D^2 - 4D + 4\right)y = x^2 e^{2x} \sin 2x.$$

P. T. O.

(c) Solve : (CO1)

$$x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} - 4y = x^4.$$

2. (a) Evaluate $L\left[t^2 e^{2t} \sin t\right]$. (CO2)

(b) Find the inverse Laplace transform of

$$\frac{2s^2 + 5s - 4}{s^3 + s^2 - 2s}$$ (CO2)

(c) solve the differential equation using Laplace transform method. (CO2)

$$\frac{d^2 x}{dt^2} + 9x = \cos 2t, \quad x(0) = 1, x\left(\frac{\pi}{2}\right) = -1$$

3. (a) Expand the function $f(x) = x \sin x$, as a Fourier series in the interval $-\pi \leq x \leq \pi$.

(CO3)

(b) Find the Fourier series expansion of the periodic function of period 2π. (CO3)

$$f(x) = e^x, \quad 0 < x < 2\pi$$

(c) Obtain the Fourier series expansion of :

(CO3)

$$f(x)\begin{cases} x, & 0 < x < \pi \\ -x, & -\pi < x < 0 \end{cases}$$

4. (a) Solve : (CO4)

$$\frac{\partial^2 z}{\partial x^2} - 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = e^{2x-y} + e^{x+y} + \cos(x+2y)$$

(b) If a string of length l is initially at rest in equilibrium position and each of it's points is given the velocity $\left(\frac{\partial y}{\partial x}\right)_{t=0} = b\sin^3 \frac{\pi x}{l}$ find the displacement $y(x,t)$ (CO4)

(c) Find the temperature in a bar of length 2 whose ends kept at zero and lateral surface insulated if initial temperature is $\sin\frac{\pi x}{2} + 3\sin\frac{5\pi x}{2}$. (CO4)

5. (a) Prove that : (CO5)

$$\int_{-1}^{1} P_m(x) P_n(x) dx = 0, \text{ if } m \neq n$$

(b) Show that : (CO5)

$$x.J'_n(x) = n.J_n(x) - x.J_{n+1}(x)$$

(c) Show that : (CO5)

$$(2n+1)x P_n = (n+1) P_{n+1} + nP_{n-1}$$