(b) Show that the solution of the wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$, where $u = P_0 \cos pt$ ($P_0$ is constant) when $x = l$ and $u = 0$, when $x = 0$ is given by :

$$u(x, t) = P_0 \cos (pl/c) \cos pt \cos (px/c).$$

(c) Reduce $\frac{\partial^2 z}{\partial x^2} = (1 + y)^2 \frac{\partial^2 z}{\partial y^2}$ to canonical form.

5. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) Solve in series the Bessel's equation of order 2, near $x = 0$ :

$$x^2 y'' + xy' + \left(x^2 - 4\right) y = 0.$$

(b) To show :

$$\left(1 - 2xz + z^2\right)^{-1/2} = \sum_{n=0}^{\infty} z^n P_n(x), |x| \le 1 | z | \le 1.$$

(c) To show that :

$$P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} \left(x^2 - 1\right)^n$$



22/5/19
9.30 - 12.30

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Roll No. ..............................

# TMA–201

## B. TECH. (Non-CS)
## (SECOND SEMESTER)
## END SEMESTER EXAMINATION, 2019

ENGINEERING MATHEMATICS—II

**Time : Three Hours**

**Maximum Marks : 100**

**Note :** (i) This question paper contains five questions with alternative choice.

(ii) All questions are compulsory.

(iii) Instructions on how to attempt a question are mentioned against it.

(iv) Each part carries **ten** marks. Total marks assigned to each question are **twenty.**

1. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) Solve :

$$(y^2 + 2x^2 y)\, dx + (2x^3 - xy)\, dy = 0.$$

(b) Solve :

$$(D^2 - 2D + 3)y = x^3 + \sin x,$$

where $D = \frac{d}{dx}$.

(c) Solve $(D^2 - 2D + 1)\, y = e^x \log x,\ x > 0$ by the method of variation of parameters, where $D = \frac{d}{dx}$.

2. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) Draw the graph of the periodic function :

$$f(t) = \begin{cases} t, & 0 < t < \pi \\ \pi - t, & \pi < t < 2\pi \end{cases}$$

and find its Laplace transform.

(b) State convolution theorem and hence prove that :

$$L^{-1}\left[\frac{1}{s^3\left(s^2+1\right)}\right] = \frac{t^2}{2} + \cos t - 1.$$

(c) Solve the simultaneous equation :

$$\frac{dx}{dt} - y = e^t,$$

$$\frac{dy}{dt} + x = \sin t.,$$

given $x(0) = 1, y(0) = 0$.





3. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) Find the Fourier series of the periodic function $f$ with period $2\pi$, defined as follows :

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

What is the sum of the series at $x = 0, \pm\pi, 4\pi, -5\pi$

(b) Obtain the Fourier series, in the interval $\left[-\frac{1}{2}, \frac{1}{2}\right]$, of the function $f$ given by :

$$f(x) = \begin{cases} x - [x] - \frac{1}{2}, & \text{where } x \text{ is not an integer} \\ 0 & \text{, otherwise} \end{cases}$$

where $[x]$ is the greatest integer $\le x$.

(c) Find the Fourier series generated by the periodic function $|x|$ of period $2\pi$. Also compute the value of the series at $0, 2\pi, -3\pi$.

4. Attempt any *two* questions of choice from (a), (b) and (c). (2×10=20 Marks)

(a) Using the method of separation of variables, solve :

$$\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u,$$

where $u(x, 0) = 6e^{-3x}$.