

Printed Pages : 4



NAS-203

(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 199222**

Roll No.

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**B. Tech.**

(SEM. II) THEORY EXAMINATION, 2014-15  
ENGINEERING MATHEMATICS - II

Time : 3 Hours]

[Total Marks : 100

Note : Attempt all questions.

**SECTION A**1 Attempt all parts of this question : **10×2=20**

(a) Solve :  $(2D-1)^3 y = 0$

(b) Find the particular integral of

$$(D^2 - 2D + 4)y = \cos 2x.$$

(c) If  $x^3 = aP_3(x) + bxP_2(x)$ , find  $a$  and  $b$ .(d) Find  $J_{1/2}(x)$ .(e) Find the Laplace transform of  $\left[ \int_0^t \int_0^t \sin u \, du \, du \right]$ .

- (f) Find the inverse Laplace transform of  $\frac{e^{-\pi s}}{s^2 + 1}$ .
- (g) Solve :  $(D - 5D' + 4)^3 z = 0$
- (h) Write Dirichlets conditions.
- (i) Classify the equation  $u_{xx} + 3u_{xy} + u_{yy} = 0$ .
- (j) Find the steady state temperature distribution in a rod of 2m whose ends are kept at  $30^\circ\text{C}$  and  $70^\circ\text{C}$  respectively.

## SECTION B

2 Attempt any three parts of the following : **3×10=30**

- (a) Solve the simultaneous equations

$$\frac{dx}{dt} + 5x - 2y = t, \quad \frac{dy}{dt} + 2x + y = 0$$

being given  $x = 0, y = 0$  when  $t = 0$ .

- (b) Solve in series :  $2x^2 y'' + x(2x+1)y' - y = 0$ .
- (c) Use convolution theorem to find the inverse

Laplace transform of  $\frac{1}{(s^2 + a^2)^2}$ .

- (d) Expand  $f(x) = x \sin x$  as a Fourier series in  $0 < x < 2\pi$ .
- (e) Find the temperature distribution in a rod of length 'a' which is perfectly insulated including the ends and the initial temperature distribution is  $x(a-x), 0 < x < a$ .

## SECTION C

**Note :** Attempt any two parts from each (2×5)×5=50 question of this section.

3 (a) Solve :  $(D^2 - 3D + 2)y = x^2 + 2x + 1$

(b) Solve :  $x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = (\log x) \sin(\log x)$

(c) Solve by changing the independent variable :

$$\frac{d^2 y}{dx^2} + (3 \sin x - \cot x) \frac{dy}{dx} + 2y \sin^2 x = e^{-\cos x} \sin^2 x$$

4 (a) Show that  $J_{-n}(x) = (-1)^n J_n(x)$

(b) Show the following differential equation in terms of Bessel's function

$$y'' + \frac{y'}{x} + \left(1 - \frac{1}{9x^2}\right)y = 0$$

(c) Express  $2x^3 + 2x^2 - x - 3$  in terms of Legendre's polynomial.

5 (a) Express the function  $f(t) = \begin{cases} t-1 & , 1 < t < 2 \\ 3-t & , 2 < t < 3 \end{cases}$

in terms of unit step function, hence find its Laplace transform.

(b) Evaluate  $\int_0^{\infty} \frac{e^{-3t} \sin t}{t} dt$ .

- (c) Find the function  $f(t)$  whose Laplace transform

$$\text{is } \log\left(1 + \frac{1}{s^2}\right).$$

- 6 (a) Find the half range sine expansion of

$$f(t) = \begin{cases} t & , 0 < t < 2 \\ 4-t & , 2 < t < 4 \end{cases}$$

- (b) Solve :  $py + qx = xyz^2(x^2 - y^2)$

- (c) Solve :  $r + s - 2t = \sqrt{2x + y}$

- 7 (a) Solve by the method of separation of variables

$$x \frac{\partial^2 u}{\partial x \partial y} + 2yu = 0$$

- (b) Find the displacement of a finite string of length  $L$  that is fixed at both ends and is released from rest with an initial displacement  $f(x)$ .

- (c) Solve :  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ , subject to the conditions

$$u(x, 0) = 0, \quad u(x, 1) = 0, \quad u(\infty, y) = 0 \quad \text{and}$$

$$u(0, y) = u_0.$$