Printed Pages—4 **NAS203**

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

PAPER ID : 199222 **Roll No.** | | | | | | | | | | |

B.Tech.

(SEM. II) THEORY EXAMINATION 2013-14

ENGINEERING MATHEMATICS–II

EAS203

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

PAPER ID : 199208 **Roll No.** | | | | | | | | | | |

B.Tech.

(SEM. II) THEORY EXAMINATION 2013-14

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 $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$.

(b) Find the particular integral of $(D^2 - 4D + 4)y = \cos 2x$.

(c) Evaluate $\int_{-1}^{1} x^3 P_2(x)dx$.

(d) Find the values of m and n for which

$$\int_0^1 x J_0^2(\alpha x)dx = \frac{1}{2}[J_n(\alpha)]^2.$$

(e) Find the Laplace transform of unit step function u(t).

(f) Find the inverse Laplace transform of $F(s) = \frac{3}{s^2 + 2s - \theta}$.

(g) If $f(x) = 1$, $0 < x < \pi$ is expanded in half range cosine series then find the value of a_0.

(h) Solve $r - t + p - q = 0$.

(i) Classify the following partial differential equation along the line $y = x$:

$$y u_{xx} + (x + y) u_{xy} + x u_{yy} = 0.$$

(j) Find the steady state temperature distribution in a rod of length 20 cm, whose ends are kept at 0°C and 60°C.

SECTION–B

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

(a) An RCL circuit connected in series with an inductance of 1 henry, a resistance of 16 ohms and a capacitance of 0.01 farad has an applied voltage of 10 sin 10 t volts. Find an expression for the current through the circuit at any time t if there is no initial current and no initial charge on the capacitor.

(b) Find the Frobenius series solution of the following differential equation about $x = 0$:

$$(1 - x^2)y'' - xy' + 4y = 0.$$

(c) Apply Laplace transform technique to solve :

$$\frac{d^2x}{dt^2} + 16x = 2\sin 4t, \quad x(0) = -\frac{1}{2}, \; x'(0) = 0$$

(d) Find the Fourier series expansion of the following function :

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

Hence find the sum of the series $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$.

(e) The initial temperature distribution in a square plate of unit length is 100°C. Find the temperature distribution u(x, t) if all the sides are maintained at zero degree temperature.

SECTION–C

3. Attempt any **two** parts of the following : **(2×5=10)**

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

(b) Use method of variation of parameter to find the particular integral of :

$$\frac{d^2y}{dx^2} + 4y = \sec 2x.$$

(c) Solve :

$$\frac{dx}{dt} = -4(x + y); \; \frac{dx}{dt} + 4\frac{dy}{dt} = -4y$$

with conditions $x(0) = 1, y(0) = 0$.

4. Attempt any **two** parts of the following : **(2×5=10)**

(a) Prove that $J_{n-1}(x) + J_{n+1}(x) = \frac{2n}{x} J_n(x)$. Hence compute $J_{3/2}(x)$.

(b) Prove that $nP_n(x) = xP_n'(x) - P_{n-1}'(x)$.

(c) Find the Fourier-Legendre expansion upto $p_3(x)$ for the following function :

$$f(x) = \begin{cases} 0, & -1 < x < 0 \\ 1, & 0 < x < 1 \end{cases}$$

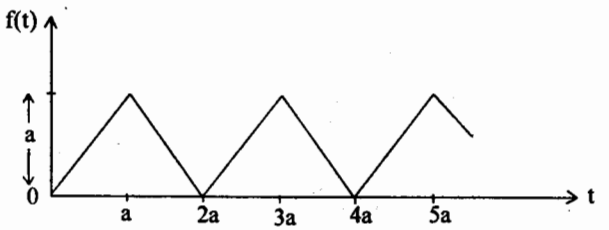
5. Attempt any **two** parts of the following : **(2×5=10)**

(a) Find the Laplace transform of $\int_0^t \frac{\cos 2t - \cos 3t}{t} dt$.

(b) Find the function whose Laplace transform is :

$$F(s) = \log \frac{s^2 + 1}{s(s + 1)}$$

(c) Find the Laplace transform of the periodic function shown in the figure :



6. Attempt any **two** parts of the following : **(2×5=10)**

(a) Solve $y^2p - xyq = x(z - 2y)$

(b) Solve $(D^2 - DD' - 2D'^2)\, z = (y - 1)e^x$.

(c) Find the half range sine series for $f(x) = x + x^2$, $0 < x < 1$.

7. Attempt any **one** part of the following : **(1×10=10)**

(a) Apply method of separation of variables to solve

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

satisfying the conditions $z(x, 0) = 0$, $z(x, \pi) = 0$, $z(0, y) = 4 \sin 3y$.

(b) Find the deflection of the vibrating string which is fixed at the ends $x = 0$ and $x = 2$ and the motion is started by displacing the string into the form $\sin^3\left(\frac{\pi x}{2}\right)$ and releasing it with zero initial velocity.