(Following Roll No. to be filled by candidate)

Roll No. 1504310027

B TECH
SECOND SEMESTER EXAMINATION 2015-2016
EAS203
ENGINEERING MATHEMATICS-II

Time: 3 Hours **Max. Marks: 100**

Note:

- Attempt All Questions. All questions carry equal marks.
- Marks and number of questions to be attempted from the section is mentioned before each section.
- Assume missing data suitably. Illustrate the answers with suitable sketches.

1. Attempt any Four parts of the following: **[4x5]**

(a) Using method of variation of parameters to solve $\frac{d^2y}{dx^2}+4y=4\sec^2 2x$

(b) Solve $\frac{d^3y}{dt^3}-2\frac{d^2y}{dt^2}+\frac{dy}{dt}=e^{2t}\cos 3t$

(c) Find the general solution of $\frac{d^2y}{dx^2}+\frac{dy}{dx}+\left(\frac{dy}{dx}\right)^3=0$.

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

(e) Solve the following system of linear equations

$\frac{dx}{dt}+2x+4y=1+4t$ and $\frac{dy}{dt}+x-y=\frac{3}{2}t^2$.

(f) A particle moves in a straight line OA, starting from the rest at A, with acceleration towards O equal to μ times the distance of the particle from O. Find the time it will take to arrive at O.

2. Attempt any Two parts of the following : **[2x10]**

(a) Use Frobenius series method to solve $2x^2y''+xy'-(x+1)y=0$ about $x=0$.

(b) (i) Express $J_5(x)$ in terms of $J_0(x)$ and $J_1(x)$.

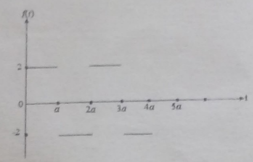
(ii) Solve the differential equations $xy''-3y'+xy=0$, in terms of Bessel's function

(c) (i) Express x^4-3x^2+x in terms of Legendre polynomials.
(ii) State and prove Rodrigue's formula for Legendre Polynomials.

3. Attempt any Two parts of the following : **[2x10]**

(a)(i) Find the Laplace Transform of $f(t)=t\int_0^t \frac{1}{u}e^{-4u}\sin 3u\,du$

(ii) Find the Laplace transform of the function which is given in the following figure



(b)(i) Use Convolution theorem to find the function whose Laplace Transform is $\frac{s}{(s^2+a^2)^2}$

(ii) Solve the following Simultaneous differential equations using Laplace Transform

$$\frac{dx}{dt}-y=e^t,\quad \frac{dy}{dt}+x=\sin t \qquad x(0)=1,\ y(0)=0$$

(c) Solve $y''+9y=\begin{cases}8\sin t, 0<t<\pi\\ 0, t>\pi\end{cases}$ with conditions $y(0)=0, y'(0)=4$.

4. Attempt any Two parts of the following : **[2x10]**

(a) Find the Fourier series of the periodic function $f(x)$ defined as

$f(x)=\begin{cases}x, 0\le x\le 1\\ 2-x, 1\le x\le 2\end{cases}$. Hence find the sum of the series $1+\frac{1}{3^2}+\frac{1}{5^2}+\frac{1}{7^2}+\dots$.

(b) Solve $\frac{\partial^2 z}{\partial x^2}-\frac{\partial^2 z}{\partial x\partial y}-2\frac{\partial z}{\partial x}=\sin(3x+4y)-e^{2x+4y}+xy$

(c) (i) Solve $y^2(x+y)p+x^2(y+x)q=z(x^2+y^2)$.

(ii) Find the half range cosine series expansion of $f(x) = x(\pi - x)$ defined in $0 < x < \pi$.

5. Attempt any Two parts of the following: [2x10]

(a) Solve $2u + \frac{\partial u}{\partial y} = \frac{\partial^2 u}{\partial x^2}$ using method of separation of variables subject to $u = 0, \frac{\partial u}{\partial x} = 1 + e^{-3y}$ when $x = 0$ for all values of y.

(b)Find the temperature distribution in a rod of length a which is perfectly insulated including the ends and the initial temperature distribution is;

u(x, 0) = x(a-x) , 0<x<a.

(c)Find the deflection $u(x,t)$ of a tightly stretched vibrating string of unit length that is initially at rest and whose initial position is given by $\sin \pi x + \frac{1}{3}\sin(3 \pi in + \frac{1}{5}\sin(5 \pi in(5 \le x \le 1$.

$\sin \pi x + \frac{1}{3} \sin 3\pi x + \frac{1}{5} \sin 5\pi x \quad 0 \le x \le 1$