

Total No. of Questions : 6

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**EC-182**

**B.E. II Sem. (CGPA) Civil Engineering  
Exam. 2012-13**

**ENGINEERING MATHEMATICS-II**

Paper : CE-201

Time Allowed : Three Hours

Maximum Marks : 60

Note: Attempt all questions. All questions carry equal marks.

Q.1. i) Solution of the equation  $y = px + p^3$  is  $y = cx + c^3$

ii) P.I. of the differential equation

$\frac{d^2y}{dx^2} + 6\frac{dy}{dx} = \frac{e^{3x} + e^{2x}}{2}$  is  $\frac{1}{2} (e^{3x} + e^{2x})$

iii)  $y = x$  is a part of C.F. of the equation

$$\frac{d^2y}{dx^2} + p\frac{dy}{dx} + Qy = R \text{ if}$$

- a)  $1 + p + Q = 0$       b)  $1 - p + Q = 0$   
c)  $2 + 2px + Qx^2 = 0$       d)  $P + Qx = 0$

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iv) L.T. of  $f(t) = e^{6t} - e^{-2t}$  is \_\_\_\_\_

v) For the Fourier series,  $f(x) = x$  for  $0 < x < 2\pi$

then find the Fourier coefficient as?

Q.2. a) Solve  $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$

b) Solve  $p^2 + 2py \cot x = y^2$

OR

a) Solve  $(3xy^2 - y^3)dx - (2x^2y - xy^2)dy = 0$

b) Solve  $y = 2px + y^2 p^3$

Q.3. a) Solve  $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = e^x + \cos x$

b)  $\frac{d^2y}{dx^2} - 4y = x \sin hx$

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OR

a) Solve  $x^2 \frac{d^2y}{dx^2} + 2x \frac{dy}{dx} - 20y = (x+1)^2$

(3)

b) Solve the following simultaneous equations:

$$\frac{dx}{dt} + \frac{dy}{dt} + 3x = \sin t \text{ and}$$

$$\frac{dx}{dt} + y - x = \cos t$$

Q.4. a) Solve the differential equation

$$x \left( x \frac{d^2y}{dx^2} + (x-2) \frac{dy}{dx} - 2y = \frac{x^3}{x} \right) \quad | + P$$

b) Solve in series

$$(1-x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 4y = 0$$

OR

a) Express

$f(x) = x^4 + 2x^3 + 2x^2 - x - 3$  in terms of legendre's polynomials.

b) Prove that

$$\frac{d}{dx} \left( J_n^2 + J_{n+1}^2 \right) = 2 \left( \frac{n}{x} J_n^2 - \frac{n+1}{x} J_{n+1}^2 \right)$$

Q.5. a) Evaluate the following:

$$\text{i)} \quad L^{-1} \left\{ \frac{1}{s^4(s^2 + 1)} \right\}$$

$$\text{ii)} \quad L^{-1} \left\{ \frac{e^{-4s}}{(s-2)^4} \right\}$$

b) Solve by L.T. method:

$$y(s) = (D^3 - 3D^2 + 3D - 1)y = t^2 e^t$$

Given that  $y(0) = 1, y'(0) = 0, y''(0) = -2$

OR

a) By convolution theorem, evaluate

$$L^{-1} \left\{ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right\}$$

b) Evaluate

$$\text{i)} \quad L \left\{ \int_a^t e^{-t} \cos t dt \right\}$$

$$\text{ii)} \quad L \left\{ t^3 \cos 3t \right\}$$

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- Q.6. a) Expand the function  $f(x) = 2x - x^2$  in (0, 3) and hence deduce that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$$

- b) Expand  $f(x) = \pi x - x^2$ ,  $0 < x < \pi$  in half-range cosine series.

OR

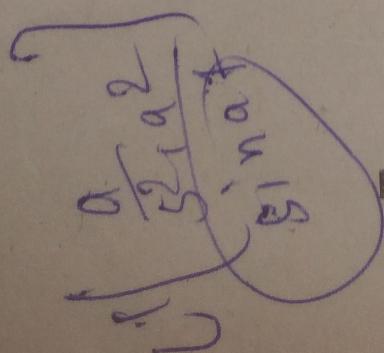
- a) Obtain Fourier series for the function  $f(x)$  defined by

$$f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi \leq x \leq 0 \\ 1 - \frac{2x}{\pi}, & 0 \leq x \leq \pi \end{cases}$$

- b) Develop  $\sin \frac{\pi x}{l}$  in a half-range cosine series in the range  $0 < x < l$

$$f(x) = \frac{1}{2} + \sum_{n=1}^{\infty} (-1)^{n+1} \frac{2(-1)^n}{n} \cos nx$$

$$= \frac{1}{2} - \sum_{n=1}^{\infty} \frac{2}{n} \cos nx$$



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