

Seat No.	
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## S.E. (Civil Engg.) (Semester - III) Examination, 2013

## ENGINEERING MATHEMATICS - III

Sub.Code : 42654

Day and Date : Thursday, 30-05-2013

Total Marks : 100

Time : 2.30 p.m. to 5.30 p.m.

- Instructions: 1) Attempt any three questions from each section.  
 2) Figures to the right indicate full marks.  
 3) Use of Calculator is allowed.

## SECTION - I

Q1) a) Solve  $(D^4 - 16)y = \cos 3x$  [5]

b) Solve  $\frac{d^2 y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \sin x$  [6]

c) Solve  $\frac{d^2 y}{dx^2} + 3\frac{dy}{dx} + 2y = e^x$  [6]

Q2) A horizontal strut under the action of equal and opposite forces P at its ends

satisfies  $\frac{d^2 y}{dx^2} + n^2 y = \frac{W}{2EI}(x^2 - lx)$  where  $n^2 = \frac{P}{EI}$  and W is weight per unit

length. Find y if  $y = 0$  when  $x = 0$  &  $x = l$ . [16]

Q3) a) Solve  $y^2 p^2 - x^2 q^2 = x^2 y^2 z$  [5]

b) Solve  $p(z + p) + q = 0$  [5]

c) Solve  $x(y + z)\frac{\partial z}{\partial x} + y(z + x)\frac{\partial z}{\partial y} = z(y - x)$  [6]

- Q4) a) Express  $e^{-x}$  in a Fourier series over  $-\pi < x < \pi$  [9]  
 b) Express  $x^2$  in a Fourier Cosine series over  $0 < x < 1$  [8]

## SECTION - II

- Q5) a) The two regression equations of the variables  $x$  and  $y$  are [6]  
 $x = 19.13 - 0.87y$  and  $y = 11.64 - 0.50x$

Find  $\bar{x}$ ,  $\bar{y}$  and the correlation coefficients between  $x$  and  $y$ .

- b) Calculate the coefficient of correlation from the following data [5]

x:	34	27	31	38	38	36	39	40
y:	3.75	4.62	4.25	4.12	4.28	4.32	4.21	4.05

- c) Fit a second degree parabolic curve to the following data [6]

x:	1974	1975	1976	1977	1978	1979	1980	1981
y:	12	14	26	42	40	50	52	53

- Q6) a) Weights of 4000 students are found to be normally distributed with mean 50 kgs and standard deviation 5 kgs. Find the number of students with weights. [6]

1. Less than 45 kgs                      2. Between 45 and 60 kgs.

(For a standard normal variate  $z$  area under the curve between  $z = 0$  and  $z = 1$  is 0.3413 and that between  $z = 0$  and  $z = 0.4772$ ).

- b) An insurance company found that only 0.01% of the population is involved in a certain type of accidents each year. If its 1000 policy holders were randomly selected from the population. What is the probability that not more than two of its clients are involved in such an accident next year (Given  $e^{-0.1} = 0.9048$ ) [5]
- c) Find the value of  $k$  if the following function is a probability density function

$$f(x) = \begin{cases} kx^2(1-x^3), & 0 \leq x \leq 1 \\ 0, & \text{Otherwise} \end{cases} \quad [5]$$

- Q7) a) A vector field  $\vec{F} = (y \sin z - \sin x) i + (x \sin z + 2yz) j + (xy \cos z + y^2) k$

Prove that it is irrotational and hence find its scalar potential. [6]

b) Find the angle between the surfaces  $x^2 + y^2 + z^2 = 9$  and  $z = x^2 + y^2 - 3$  at the point  $(2, -1, 2)$ . [6]

c) Find the directional derivative of  $\phi = xy^2 + yz^2$  at  $(2, -1, 1)$  in the direction  $2i + j + 3k$ . [5]

Q8) a) Verify the Green's theorem for the field  $\vec{F} = x^2\vec{i} + xy\vec{j}$  over the region R enclosed by  $y = x^2$  and the line  $y = x$ . [8]

b) Verify Divergence theorem for  $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$  and S be the surface of the cube bounded by the planes  $x = 0, x = 2, y = 0, y = 2, z = 0, z = 2$ . [8]

