P - 311

Seat No.	

Total No. of Pages : 4

S.E. (Civil Engg.) (Part - II) (Semester - III)
Examination, April - 2016
ENGINEERING MATHEMATICS - III (Revised)
Sub. Code : 63338

Day and Date : Friday, 29 - 04 - 2016 **Total Marks : 100**

Time : 03.00 p.m. to 06.00 p.m.

Instructions : 1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Use of Calculator is allowed.**

SECTION - I

Q1) Solve any three of the following : **[18]**

a) $(D^2 - 6D + 13)\, y = e^{3x} \operatorname{Sin} 4x + 3^x$

b) $(D^2 + 4)\, y = x \operatorname{Sin} 3x$

c) $x^2 \frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + 2y = e^x$

d) The differential equation of strut of length l freely hinged at each end is $EI\frac{d^2y}{dx^2} + Py = \frac{-Wl^2}{8} Sin\left(\frac{\pi x}{l}\right)$. Find the bending of a strut at x where $\frac{P}{EI} = n^2$.

Q2) Attempt any two of the following : **[16]**

a) A vector field is given by $\bar{F} = (x^2 + xy^2)i + (y^2 + x^2y)\, j$. Show that $\bar{F}$ is irrotational and find its scalar potential. Also find Grad (Div $\bar{F}$).

P.T.O.

b) If $\overline{a}$ is a constant vector and $\overline{r}$ = xi+yj+zk then prove that

i) $\nabla(\overline{a} \bullet \overline{r}) = \overline{a}$

ii) $\text{Div}(\overline{a} \times \overline{r}) = 0$

iii) $\text{Div}\ (\overline{a} \bullet \overline{r})\overline{a} = a^2$

iv) $\text{Curl}\ (\overline{a} \times \overline{r}) = 2\overline{a}$

c) If $\overline{F} = (x + y + 1)i + j - (x + y)k$ then prove that $\overline{F} \bullet \text{Curl}\ \overline{F} = 0$ and if $\phi = x^3 + y^3 + z^3 - 3xyz$, find $\overline{r} \bullet \nabla\phi$ where $\overline{r}$ = xi+yj+zk.

Q3) Attempt any two of the following : **[16]**

a) From the following data find the line of regression of x on y and estimate x when y = 105

x	=	44	58	49	46	58	56	48	46	48	47
y	=	88	114	102	113	91	89	102	93	114	94

b) Fit a curve of the form $y = ab^x$ from the following data

x	=	2	3	4	5	6
y	=	144	172.8	207.4	248.8	298.5

c) Estimate y when x = 12 by fitting a straight line to the following data

x	=	1	2	4	5	6	8	9	10
y	=	52.5	58.7	70.2	75.4	81.1	95.5	102.2	108.2

SECTION - II

Q4) Attempt any two of the following : **[16]**

a) If ten percent of bolts produced by a machine are defective then determine the probability that out of 10 bolts, chosen at random

i) one

ii) none

iii) at most 2

iv) at least 2 bolts will be defective

b) A skilled typist, on routine work, kept a record of mistakes made per day during 300 working days.

Mistakes per day	0	1	2	3	4	5	6
No. of days	143	90	42	12	9	3	1

Fit a poisson distribution to the above data & hence calculate theoretical frequencies.

c) i) The diameter of an electric cable is assumed to be continuous random variate with function $f(x) = 6x(1-x)$, $0 \leq x \leq 1$ verify that $f(x)$ is a probability density function.

ii) Weights of 4000 students are found to be normally distributed with mean 50 kgs & standard deviation 5 kgs. Find the number of students with weights less than 45 kgs.

[Given : For S.N.V. Z area from Z = 0 to Z = 1 is 0.3413]

Q5) Attempt any three from the following : **[18]**

a) Find laplace transform of t cos 2t. cosht.

b) Find laplace transform of $\frac{d}{dt}\left(\frac{\sin t}{t}\right)$.

c) Find inverse laplace transform of $\frac{s(s^2+2)}{(s+1)^2(s^2+1)}$.

d) Use laplace transform to solve

$y'' - 4y' + 4y = 64\sin 2t \quad y(0)=0, \quad y'(0)=1.$

Q6) Attempt any two of the following : **[16]**

a) Show that the function $U=x^3-3xy^2$ is harmonic and find the corresponding analytic function.

b) Evaluate using Cauchy's integral formula

i) $\int_c \frac{e^{2z}}{(z-1)(z-2)}\,dz$, where c is the circle, $|z|=3$

ii) $\int_c \frac{\cos \pi z}{z^2-1}\,dz$ around a rectangle with vertices $2 \pm i, \quad -2 \pm i$

c) Evaluate $\int_c \frac{z^2-z+1}{z-1}\,dz$ where c is the circle

i) $|z|=1$

ii) $|z|=0.5$