R - 1082

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Seat No.	

S.E. (Civil Engg.) (Semester - III) Examination, December - 2014
ENGINEERING MATHEMATICS - III (Revised)
Sub. Code : 63338

Day and Date : Friday, 05 - 12 - 2014 **Total Marks : 100**

Time : 10.00 a.m. to 1.00 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) $(D^2+4)y = x\sin 3x$

b) $(D^4+8D^2+16)y = \cos 2x$

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

d) The differential equation of cantilever beam of length l and weighing W kg/unit length, subjected to horizontal compressive force P applied at the free and is given by $EI\dfrac{d^2y}{dx^2}+Py = \dfrac{-1}{2}Wx^2$. If $y=\delta$ and $\dfrac{dy}{dx}=0$ at $x=l$ and $\dfrac{d^2y}{dx^2}=0$ at $x=0$. Find the maximum deflection δ of the beam where $\dfrac{P}{EI}=n^2$

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

a) Prove that $\nabla\left[\dfrac{\overline{a}\cdot\overline{r}}{r^n}\right] = \dfrac{\overline{a}}{r^n}-\dfrac{n(\overline{a}\cdot\overline{r})\overline{r}}{r^{n+2}}$ and $\nabla\left[\dfrac{1}{r}\right]=\dfrac{-\overline{r}}{r^3}$.

b) Find the directional derivative of $\phi = 2x^3y - 3y^2z$ at P(1, 2, −1) in the direction of Q(3, −1, 5). Also Find $\mathrm{Div}(\overline{F})$ and $\mathrm{Curl}(\overline{F})$ at (1, −1, 1) if $\overline{F} = x^2zi - 2y^3z^3j + xy^2z^2k$.

P.T.O.

c) Find a, b, c if $\overline{F} = (axy + bz^3)i + (3x^2 - cz)j + (3xz^2 - y)k$ is irrotational and find its scalar potential ϕ such that $\overline{F} = \nabla \phi$ and also find value of a if $\overline{G} = (x+3y)i + (y-2z)j + (az+x)k$ is Solenoidal.

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

a) Find the best values of a and b in the law $y = ae^{bx}$ by the method of least squares from

x	=	0	5	8	12	20
y	=	3	1.5	1	0.55	0.18

b) Find the line of regression and hence coefficient of correlation from the following data

x	=	10	14	18	22	26	30
y	=	18	12	24	6	30	36

c) Fit a second degree curve to the following data and estimate the production in 1975

Year	=	1921	1931	1941	1951	1961	1971	1981
Production (m tons)	=	3	5	9	10	12	14	15

SECTION - II

Q4) Attempt any Two of the following **[16]**

a) If the probability that an individual suffers a bad reaction from a certain injection is 0.001, determine the probability that out of 2000 individuals

i) exactly 3

ii) more than 2 Individuals

iii) none

iv) more than one individual will suffer a bad reaction

b) In a sample of 1000 cases, the mean of a certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal, find

i) how many students score between 12 and 15?

ii) how many score above 18?

iii) how many score below 8?

iv) how many score 16?

[Given : For S.N.V.Z, area from z = 0 to z = 0.4 is 0.1554,

area from z = 0 to z = 0.6 is 0.2257,
area from z = 0 to z = 0.8 is 0.2881,
area from z = 0 to z = 1 is 0.3413,
area from z = 0 to z = 1.6 is 0.4452,
area from z = 0 to z = 2.4 is 0.4918]

c) i) Find the probability of getting 4 heads in 6 tosses of a fair coin.

ii) If the probability density function is given by

$$f(x) = kx^2(1-x^3), 0 \le x \le 1$$

Find k.

Q5) Attempt any Three from the following **[18]**

a) Find the Laplace transform of

$$\frac{e^{-4t}.\sin 3t}{t}$$

b) Find the Laplace transform of $t^2 \cos at$.

c) Using convolution theorem, find inverse Laplace transform of

$$\frac{1}{s(s^2+a^2)}$$

d) Solve using Laplace transform

$$y'' + y = \sin 3t, y(0) = 0, y'(0) = 0$$

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

a) Evaluate $\int_C \frac{e^z}{(z^2+\pi^2)^2} dz$ where c is |z| = 4.

b) Find the value of the integral

$$\int_0^{1+i} (x - y + ix^2) dz$$

i) along the straight line from z = 0 to z = 1 + i

ii) along the real axis from z = 0 to z = 1 and then along a line parallel to the imaginary axis from z = 1 to z = 1 + i.

c) Show that the function $u = 3x - 2xy$ is harmonic and find corresponding analytic function.

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