SC - 33

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Seat No.	

S.E. (Civil Engineering) (Semester - III) Examination, November - 2019
ENGINEERING MATHEMATICS - III
Sub. Code: 63338

Day and Date : Saturday, 23 - 11 - 2019 **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 non programmable calculator is allowed.

SECTION - I

Q1) Attempt any three of the following. **[18]**

a) Solve $(D^4 - 1)\, y = \cos x \cosh x$

b) Solve $(D^2 + 5D + 4)\, y = x^2 + 7x + 9$

c) Solve $(D^2 + 1)\, y = \operatorname{cosec} x$

d) The deflection of a strut of length 1 with one end ($x = 0$) built in and the other supported and subjected to end thrust P, satisfies the differential equation $\frac{d^2y}{dx^2} + a^2 y = \frac{a^2 R(l-x)}{P}$, where $a^2 = \frac{P}{EI}$. Find the equation of the deflection curve.

Q2) Attempt any two: **[16]**

a) Find the constants a and b if the directional derivative of $\phi = ay^2 + 2bxy + xz$ at P(1,2,–1) is maximum in the direction of the tangent to the curve $\bar{r} = (t^3 - 1)i + (3t - 1)j + (t^2 - 1)k$ at point (0, 2, 0).

b) Show that the vector field represented by $\bar{F} = (y^2 - z^2 + 3yz - 2x)\, i + (3xz + 2xy)\, j + (3xy - 2xz + 2z)\, k$ is both irrotational and solenoidal. Also obtain its scalar potential.

c) Find the magnitude of tangential component of acceleration at any time t of a particle whose position at any time t is given by $x = \cos t + t \sin t$, $y = \sin t - t \cos t$.

P.T.O.

Q3) Attempt any two: **[16]**

a) Fit a second degree parabola $y = ax^2 + bx + c$ to the following data:

x	10	12	15	23	20
y	14	17	23	25	21

b) Fit the curve $y = ab^x$ to the following data:

x	1	2	3	4	5	6	7	8
y	1	1.2	1.8	2.5	3.6	4.7	6.6	9.1

c) Find the two lines of regression for the following data:

x	19	22	24	27	29	33	37
y	10	12	13	16	17	20	25

SECTION - II

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

a) 10% of the tools produced in a certain manufacturing process turn out to be defective. Find the probability that :

i) In a sample of 10 tools chosen at random exactly two will be defective.

ii) Out of 20 tools selected at random there are exactly two defectives and at least two defectives.

b) In a certain factory producing cycle tyres there is a small chance of 1 in 500 for any tyre to be defective. The tyres are supplied in lots of 20. Using Poisson distribution calculate the approximate number of lots containing no defective, one defective & two defective tyres respectively in a consignment of 20000 tyres.

c) The life time of certain type of battery has mean life of 400 hours & a standard deviation of 50 hours. Assuming the distribution of life time to be normal, find:

i) The percentage of batteries which have life time more than 350 hours.

ii) The percentage of batteries which have life time between 300 & 500 hours. (Given : For S.N.V. z area between z = 0 & z = 1 is 0.3413 and z = 0 & z = 2 is 0.4772).

Q5) Attempt any three of the following. **[18]**

a) Using Laplace transformation evaluate $\int_0^\infty e^{-2t} t \sin^2 t \, dt$.

b) Find the Laplace transform of $\frac{2 \sin t \sin 2t}{t}$.

c) Obtain the inverse Laplace transform of $s^2 / \left(s^2 + 4\right)^2$ using convolution theorem.

d) Use Laplace transform to solve $(D^2 + 4D + 8)\, y = 1$ where $y(0) = 0$, $y'(0) = 1$.

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

a) Evaluate $\int_0^{1+i} z^2 dz$ along the path

i) $y = x$

ii) $x = y^2$

b) Show that $u = y^3 - 3x^2 y$ is a harmonic function and find its harmonic conjugate and corresponding analytic function.

c) If $f(z) = u + iv$ is an analytic function of $z = x + iy$ & $u - v = e^x (\cos y - \sin y)$, find $f(z)$ in terms of z.

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