Total No of Questions: [8] SEAT NO. :

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S.E. CIVIL ENGINEERING

Engineering Mathematics - III

(COURSE - 2012)

Time: 2 Hours Max. Marks : 50

Instructions to the candidates:

1) *Answers Q1 or Q2, Q3 or Q4, Q5 or Q6 and Q7 or Q8.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right side indicate full marks.*
4) *Use of Non programmable calculator is allowed.*
5) *Assume Suitable data if necessary.*

Q1) a) Solve **any two** : [08]

i) $(D^3 - 3D^2 + 4D - 2)\, y = e^x + \cos x$

ii) $(D^2 - 4D + 4)\, y = 8x^2 e^{2x} \sin 2x$

iii) $[(x+1)^2 D^2 + (X+1) D]\, y = (2x+3)(2X+4)$ $\quad D = \frac{d}{dx}$

b) Solve [04]

$28x + 4y - z = 32$

$2x + 17y + 4z = 35$

$x + 3y + 10z = 24$ by **Gauss Seidel method**

OR

Q2) a) A light horizontal strut AB of length L is freely pinned at A & B is under the action of equal and opposite compressive forces P at each of its ends and carries a load W at its centre. Find the deflection. [04]

[Hint : $EI\frac{d^2y}{dx^2} = -\frac{W}{2}x - Py, \quad x = 0, \quad y = 0, \quad x = \frac{L}{2}, \frac{dy}{dx} = 0, \quad \frac{P}{EI} = n^2$]

b) Apply fourth order Runge - Kutta method to $\frac{dy}{dx} = 3x + \frac{y}{2}$, $y(0) = 1$ to determine y (0.1) taking h = 0.1 [04]

c) Solve [04]

$4X_1 + 2X_2 + 14X_3 = 14$

$2X_1 + 17X_2 - 5X_3 = -101$

$14X_1 - 5X_2 + 83X_3 = 155$ by Cholesky's method

Q3) a) Find the coefficient of correlation of the following table [04]

x	5	7	9	11
y	8	4	16	12

b) If the probability that an individual suffers a bad reaction from a certain injection is 0.002, determine the probability that out of 1000 individuals, more than two individuals will suffer a bad reaction. [04]

c) Find the directional derivative of $\Phi = xy^2 + yz^3$ at (2, 1, 1) in the direction normal to the surface $x^2y + y^2x + yz^2 = 3$ at (1, 1, 1). [04]

OR

Q4) a) Calculate first three moments about mean for the following data [04]

x	61	64	67	70	73
f	5	18	42	27	8

b) Show that (**any one**) [04]

i) $\nabla.\left(r\,\nabla\frac{1}{r^3}\right) = \frac{3}{r^4}$

ii) $\overline{F} = (x + 3y)i + (y - 2z)j + (az + x)k$ is solenoidal. Find value of **a**.

c) $\overline{F} = (y\,e^x + e^z)i + (z\,e^y + e^x)j + (x\,e^z + e^y)k$ [04]

is irrotational and find their scalar potential

Q5) a) Find the work done by the force $\overline{F} = 3x^2\hat{\imath} + (2xz - y)\hat{\jmath} + 2\hat{k}$ along the curve $x^2 = 4y$, $3x^3 = 8z$ from x=0 to x=z. [04]

b) Apply stokes theorem to calculate $\int_c 4y\,dx + 2z\,dy + 6y\,dz$, where c is the curve at intersection of $x^2 + y^2 + z^2 = 6z$ & $z = (x+3)$ [05]

c) Use divergence theorem to evaluate $\iint_s (x\,dy\,dz + y\,dz\,dx + z\,dx\,dy)$ over the surface of a sphere of radius a. [04]

OR

Q6) a) Use Green's theorem to evaluate [04]

$\int_c \overline{F}.d\bar{r}$ where $\overline{F} = y^3\hat{\imath} - x^3\hat{\jmath}$ and 'c' is the circle $x^2 + y^2 = a^2$, z=0

b) Use Divergence theorem to evaluate $\iint_s \overline{F}.d\bar{s}$ where $\overline{F} = 4x\hat{\imath} - 2y^2\hat{\jmath} + z^2\hat{k}$ and s is surface bounding the region $x^2+y^2 = 4$, z = 0 and z = 3. [05]

c) Evaluate $\iint_s \left(\nabla * \overline{F}\right).\hat{n}\,ds$ where s is the curved surface of the parabolaid $x^2+y^2 = 2z$, bounded by the plane z = 2, where $\overline{F} = 3(x - y)\hat{\imath} + 2xz\hat{\jmath} + xy\hat{k}$ [04]

Q7) a) A string of length L is stretched and fastened to two ends. Motion is started by displacing the string in the form u(x) = a sin $(\frac{\pi x}{l})$ from which it is released at t=0. Find the displacement 'u' at any time 't', if it satisfies the equation $\frac{\partial^2 y}{\partial t^2} = e^2\frac{\partial^2 y}{\partial x^2}$ [07]

b) Solve $\frac{\partial u}{\partial t} = a^2\frac{\partial^2 u}{\partial x^2}$ if [06]

i) $u(x, \infty)$ is finite

ii) $u(0, t) = 0$

iii) $u(l, t) = 0$

iv) u(x, 0) = x, $0<x<l$

OR

Q8) a) An infinitely long plane uniform plate is bounded by two parallel edges in the y direction and an end at right angles to them. The breadth of the plate is π. The end is maintained at temperature u_0 at all points and other edges at zero temperature. Find steady state temperature u(x, y). if it satisfies $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ [07]

b) Solve $\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2}$ if [06]

i) u(x, t) is bounded

ii) u(0, t) = 0

iii) $u(l, t) = 0$

iv) $u(x, 0) = \frac{u_0 x}{l}$, $0 < x < l$