Seat
No.

## S.E. (Mechanical) (Semester - IV) Examination, November - 2014
## NUMERICAL METHODS
### Sub. Code : 43593

Day and Date : Thursday, 27 - 11 - 2014      **Total Marks : 100**

Time : 10.00 a.m. to 1.00 p.m.

Instructions :
1) Attempt any THREE questions from each section.
2) Make suitable assumptions / data if required and state clearly.
3) Draw neat sketches wherever necessary.
4) Figures to the RIGHT indicate FULL marks.
5) Use of calculators is allowed.

## SECTION - I

**Q1)** a) Use false position method for finding the roots of equation.    **[8]**

$$x - e^{-x} = 0$$

b) Use NR method to solve :    **[8]**

$$x = x^2 + y^2$$
$$y = x^2 - y^2$$
$$(x_0, y_0) = (0.8, 0.4)$$

**Q2)** a) Solve the system of equations by LU Decomposition    **[8]**

$$4x_1 + x_2 + x_3 = 4$$
$$x_1 + 4x_2 - 2x_3 = 4$$
$$3x_1 + 2x_2 - 4x_3 = 6$$

*P.T.O.*

b) Use Gauss Sidel Iteration method to solve [8]

$$100x_1 - 7x_2 + 3x_3 + 5x_4 = 6$$

$$-6x_1 - 80x_2 - x_3 - 4x_4 = 5$$

$$3x_1 + x_2 + 4x_3 + 110x_4 = 2$$

$$5x_1 - 9x_2 - 20x_3 + 4x_4 = 7$$

**Q3)** a) For the following data, find the polynomial $f(x)$ which passes through all the points using Newton's Divided Difference Interpolation. [9]

| $x$ | −1 | 0 | 3 | 6 | 7 |
|------|----|----|----|-----|------|
| $f(x)$ | 3 | −6 | 39 | 822 | 1611 |

b) Fit the saturation growth rate model $y = \dfrac{ax}{b+x}$ to the data [9]

| $x$ | 2 | 4 | 6 | 8 |
|------|-----|-----|-----|-----|
| $y$ | 1.4 | 2.0 | 2.4 | 2.6 |

**Q4)** a) Of 10 girls in class, 3 have blue eyes. If 2 of girls are chosen at random, what is the probability that [6]

    i) Both have blue eyes

    ii) Neither has blue eyes

    iii) At least one has blue eyes

b) Fit a binomial distribution to the following data : [10]

| $x$ | 0 | 1 | 2 | 3 | 4 |
|------|----|----|----|----|----|
| $f$ | 30 | 62 | 46 | 10 | 2 |

## SECTION - II

**Q5)** a) Evaluate $\int_1^3 \frac{1}{x} dx$. by simpson's $\frac{1}{3}$ rule with 4 strips and 8 strips. comment on the result. **[8]**

b) A train is moving at the speed of 30 m/sec. Suddenly brakes are applied speed of train per seconds is given. **[8]**

| Time t | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
|--------|----|----|----|----|----|----|----|----|----|----|
| Speed v | 30 | 24 | 19 | 16 | 13 | 11 | 10 | 8 | 7 | 5 |

Apply Simpson's $\frac{1}{3}$ rule to determine distance moved by train in 45 secs.

**Q6)** a) Find the largest eigen value and the corresponding eigen vector of

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$ by power method. **[8]**

b) Using predictor corrector method find approximate value of $y$ when $x = 0.6$ given $\frac{dy}{dx} = 1 - 2xy$ and $y(0) = 0$ take h = 0.2. **[8]**

**Q7)** a) What is differential equation? Give two real life examples of application of differential equations. **[6]**

b) Solve $u_{xx} + u_{yy} = 0$ over the square mesh of side 4 units satisfying the following boundary conditions : **[10]**

     i)    $u(0, y) = 0$        for   $0 \leq y \leq 4$

     ii)   $u(4, 0) = 12 + y$  for   $0 \leq y \leq 4$

     iii)  $u(x, 0) = 3x$       for   $0 \leq x \leq 4$

     iv)  $u(x, 4) = x^2$        for   $0 \leq x \leq 4$

**Q8)** Write short notes on any THREE :                                       **[18]**

     a)   Explicit and Implicit method

     b)   Procedure in FEM.

     c)   Shape function.

     d)   Galerkin method.

     e)   Boundary value problems.

     f)   Crank Nicolson method.

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