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**S.E. (Mech.) (Part-II) (Semester-IV) (Revised)****Examination, Dec. - 2013****NUMERICAL METHODS****Sub. Code : 43593****Day and Date : Wednesday, 11 - 12 - 2013****Total Marks : 100****Time : 2.30 p.m. to 5.30 p.m.**

- Instructions :
- 1) Attempt any three questions from each section.
  - 2) Figures to the right indicate full marks.
  - 3) Use of non-programmable calculator is allowed.
  - 4) Make suitable assumptions if required and state them clearly.

**SECTION-I**

**Q1) a)** What do you understand by algebraic and transcendental equations?  
Find positive root of  $x \cdot e^x = 2$  by the method of False Position, correct to three decimal places. [8]

**b)** Solve: [8]

$$x^2 + xy = 10$$

$$y + 3xy^2 = 57$$

by Newton Raphson method with the initial values  $x_0 = 1.5$  and  $y_0 = 3.5$ .

**Q2) a)** Solve the following system by Gauss Elimination method. [9]

$$10x - 7y + 3z + 5u = 6$$

$$-6x + 8y - z - 4u = 5$$

$$3x + y + 4z + 11u = 2$$

$$5x - 9y - 2z + 4u = 7$$

**b)** Solve the following equation using Jacobi's iteration method, correct to three decimal places. [7]

$$3x + 4y + 15z = 54.8$$

$$x + 12y + 3z = 39.66$$

$$10x + y - 2z = 7.74$$

- Q3) a) The pressure and volume of gas are related by the equation  $pv^\lambda = k$  ( $\lambda$  and  $k$  are the constants). Fit this equation for the following data using principle of least squares. [9]

p	0.5	1	1.5	2.0	2.5	3.0
v	1.62	1.00	0.75	0.62	0.52	0.46

- b) The following table gives relation between steam pressure and temperature. Find the pressure at temperature 372.1 °C by using Newton's Divided Difference formula. [7]

T	361	367	378	387	399
P	154.9	167.9	191	212.5	244.2

- Q4) a) State Addition law of probability and Multiplication law of probability. [4]

- b) Find the mean and median to the following data. [6]

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of Students	12	18	27	20	17	6

- c) A firm produces articles of which 0.1 percent are defective. It packs them in cases each containing 500 articles. If merchant purchases 100 such cases, how many cases can be expected to be free from defectives, how many can be expected to have one defective? [8]

## SECTION-II

- Q5) a) A rod is rotating in a plane. The following table given the angle  $\theta$  (in rad) through which the rod has turned for various values of time  $t$  (sec). Calculate the angular velocity & ang. acc<sup>n</sup> of the rod at  $t = 0.6$  sec. [8]

$$t = \quad 0 \quad \quad 0.2 \quad \quad 0.4 \quad \quad 0.6 \quad \quad 0.8 \quad \quad 1.0$$

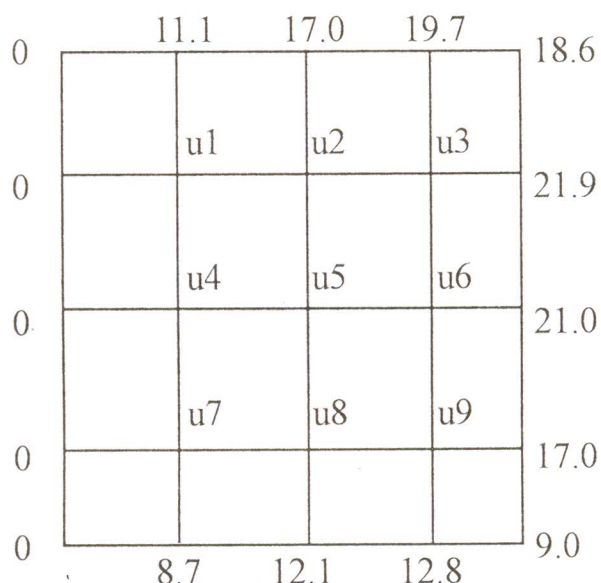
$$\theta = \quad 0 \quad \quad 0.12 \quad \quad 0.49 \quad \quad 1.12 \quad \quad 2.02 \quad \quad 3.20$$

- b) Evaluate  $\int_0^{\pi/2} \sin x \, dx$  by Simpson's  $\frac{1}{3}$  rule dividing the range into six equal parts. [8]

Q6) a) Find the value of  $y(0.1)$  by Picard's method given  $\frac{dy}{dx} = \frac{y-x}{y+x}$ ;  $y(0) = 1$ . [8]

b) Given  $y' = x^2 - y$ ;  $y(0) = 1$ . Find  $y(0.1)$  using Runge Kutta method fourth order. [8]

Q7) Find by Liebmann's method, the values at the internal lattice points of a square region of the harmonic function  $u$  whose boundary values are as shown in fig. [16]



Q8) a) Discuss the applications of finite element method in engg. [5]

b) Explain the steps involved in finite element method. [5]

c) Explain the behaviour of linear element by using shape function & hence derive the expression

$$\phi = N_i \phi_i + N_j \phi_j. \quad [8]$$

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