

**SL-308**

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**S.E. (Mechanical Engineering) (Semester-IV)**

**Examination, April - 2017**

**APPLIED NUMERICAL METHODS**

**Sub. Code : 63360**

**Day and Date : Tuesday, 25-04-2017**

**Total Marks : 100**

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

- Instructions :**
- 1) All questions are compulsory.
  - 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 calculator is allowed.

**Q1) a) Solve any two [2×5=10]**

- i) Solve for a positive root of  $x - \cos x = 0$  by Regula Falsi method.
- ii) Using Newton Raphson method find the root between 0 and 1 of  $x^3 = 6x - 4$ .
- iii) Explain approximate error with an example.

**b) Perform two iterations of the Newton Raphson method to solve the system of equations**

$$x^2 + xy = 10; y + 3xy^2 = 57$$

Take initial approximations as  $x_0 = 1.8, y_0 = 3.1$ .

**[10]**

**Q2) Solve any three**

**3×5=15]**

**a) The currents  $i_1, i_2, i_3$ , and  $i_4$  in an electric network satisfy the system of linear equation**

$$3i_1 + 2i_3 - i_4 = 60$$

$$2i_1 - i_2 + 4i_3 = 160$$

$$4i_2 + i_3 - 2i_4 = 20$$

$$5i_1 - i_2 - 2i_3 + i_4 = 0$$

Using Gauss Jordan method, find  $i_1, i_2, i_3$ , and  $i_4$ .

**P.T.O.**

- b) Solve the following equations by Gauss-Seidal method.

$$83x + 11y - 4z = 95$$

$$3x + 8y + 29z = 71$$

$$7x + 52y + 13z = 104$$

- c) Solve the system of equations using LU Decomposition.

$$5x - 2y + z = 4$$

$$7x + y - 5z = 8$$

$$3x + 7y + 4z = 10$$

- d) Solve the system of equations using Gauss Elimination method

$$x + 2y + z = 3$$

$$2x + 3y + 3z = 10$$

$$3x - y + 2z = 13$$

Q3) Solve any three.

[3×5=15]

- a) From the table given below, find the best values of 'a' and 'b' for curve  $y = ae^{bx}$  by the method of least squares.

x:	1	2	3	4
y:	1.65	2.7	4.5	7.35

- b) Using Lagrange's formula of interpolation find  $y(9.5)$ .

x:	7	8	9	10
y:	3	1	1	9

- c) Find  $f(x)$  as a polynomial in  $x$  and hence  $f(0)$  for the following data by Newton's divided difference formula.

x:	-1	1	2	3
f(x):	-21	15	12	3

- d) Define Independent, repeated, Bernoulli trials and hence explain binomial distribution with an example.

**SL-308****[3×5=15]****Q4) Solve any three.**

- a) Given the data below, find the isothermal work done on the gas as it is compressed from 23 litres to 3 litres.  $W = \int_{v_1}^{v_2} p dv$  using Simpsons 1/3<sup>rd</sup> Rule.

V (lit):	3	8	13	18	23
P (atm):	12.5	3.5	1.8	1.4	1.2

- b) Use Romberg's method to evaluate  $\int_0^2 (dx/(x^2+4))$  take  $h=1.0, 0.5$ , and  $0.25$ .
- c) Evaluate  $\int_0^{\pi/2} (\sin x) dx$  by two point Gaussian Quadrature formula.
- d) The table given below reveals the velocity 'v' of a body during the time 't'. Find its acceleration at  $t=1.1$ .

t	1.0	1.1	1.2	1.3	1.4
v	43.1	47.7	52.1	56.4	60.8

**Q5) Solve any three.****[3×5=15]**

- a) Using modified Eulers method find y at  $x=1.5$  if  $y' = 2y/x$  Given  $y(1)=2$  take  $h=0.25$
- b) Find the eigen values and corresponding eigen vectors of

$$\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix} \text{ by both power method}$$

- c) Given the boundary value problem  $\frac{d^2 y}{dx^2} = ex^2$ ;  $y(0)=2$ ,  $y(1)=5$  obtain its solution in the range  $0 \leq x \leq 1$  with  $h=0.25$  using finite difference method.
- d) Solve  $\frac{dy}{dx} = y - x^2$ ; given  $y(0)=1$  by picard;s method. Obtain the values of  $y(0.1)$ ,  $y(0.2)$ .

Q6) a) Classify the following partial differential equations:

[5]

i)  $U_{xx} + 4U_{xy} + 4U_{yy} = 0$

ii)  $x^2 U_{xx} + (1-y^2) U_{yy} = 0; x > 0, y > 0$

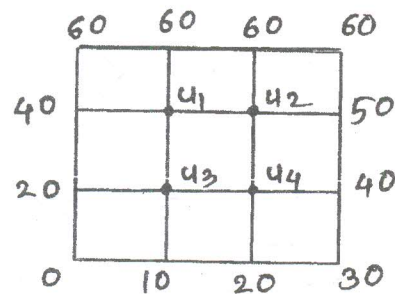
iii)  $y^2 U_{xx} + U_{yy} = 0$

b) Explain implicit method with a neat sketch.

[5]

c) Solve  $U_{xx} + U_{yy} = 0$  in the square region as shown in fig.1 by Liebmann's method. Take  $\Delta x = \Delta y$ . Perform three iterations of Gauss Seidel method.

[10]



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