

Total No. of Questions : 10]

SEAT No. :

P2847

[4958]-1022

[Total No. of Pages : 3

T.E.(Mechanical - SW)

NUMERICAL METHODS & COMPUTATIONAL TECHNIQUES

(2012Course) (Semester-I) (302061)(End Sem)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume suitable data if necessary and mention it clearly.*

Q1) a) Find the root of the equation $3x + \sin x - e^x = 0$ by the False Position Method correct to 2 decimal places. **[6]**

b) Explain Cubic Spline interpolation method. **[4]**

OR

Q2) a) Use Simpson's 3/8 rule to evaluate. **[6]**

$$I = \int_{0.5}^{0.7} \sqrt{x} e^x dx$$

b) Prepare Newton's Backward Difference interpolation table for the following data. **[4]**

x	100	150	200	250	300
y	10.63	13.03	15.04	16.81	18.42

Q3) a) Explain Inverse Interpolation and Extrapolation. **[2]**

b) Solve following set of equations using Gauss Elimination Method. **[8]**

$$3X + 6Y + Z = 16$$

$$2X + 4Y + 3Z = 13$$

$$X + 3Y + 2Z = 9$$

OR

P.T.O.

Q4) a) Explain Hermit Interpolation. [2]

b) Solve following set of equations using Gauss Siedel Method [8]

$$27X + 6Y - Z = 85$$

$$X + Y + 54Z = 110$$

$$6X + 15Y + 2Z = 72$$

Q5) a) Explain: [8]

Round of error, Truncation error, and error propagation with example.

b) Fit an exponential model $y = ae^{bx}$ to the given tabulated data [8]

x	1.2	2.8	4.3	5.4	6.8	7.9
y	7.5	16.1	38.9	67.0	146.6	266.2

OR

Q6) a) An object is suspended in a wind tunnel and the force measured for various levels of wind velocity. The results are tabulated below. Use least square regression to fit the straight to this data. [8]

v,m/s	10	20	30	40	50	60	70	80
F, N	25	70	380	550	610	830	1220	1450

b) Draw the flowchart to fit straight line for given data (x_i, y_i) . [8]

Q7) a) Use Runge Kutta second order and fourth order method to find the value of y when x=1 given that y=1 when x = 0 and that [12]

$$\frac{dy}{dx} = \frac{y-x}{y+x}$$

Use h= 0.5. Comment on the answer.

b) Explain predictor corrector method to solve ODEs. [4]

OR

- Q8) a)** population growth of any species is frequently modeled by an ODE of the form [8]

$$\frac{dN}{dt} = aN - bN^2 \quad N(0) = N_0$$

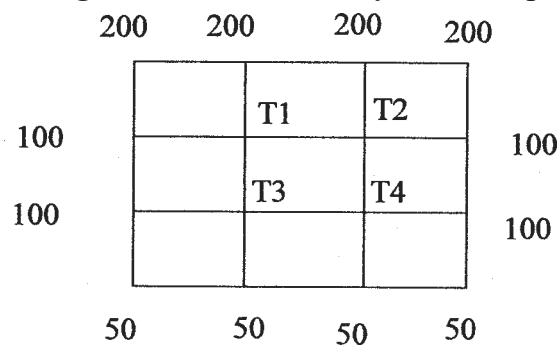
where N is the population, aN represents the birthrate, and bN^2 represents the death rate due to all causes, such as disease, competition for food supplies and so on.

If $N_0 = 100000$, $a = 0.1$, and $b = 0.0000008$, calculate $N(t)$ after every 4.0 years from $t = 0.0$ to 20.0 years.

Use Euler's method.

- b) Draw the flowchart for modified Euler method. [8]

- Q9) a)** The edges of a steel plate of $1\text{m} \times 1\text{m}$ has maintained at temperatures as shown in fig. What will be steady state temperatures at the interior points? [10]



- b) Explain the numerical technique to solve parabolic equation. [8]

OR

- Q10)a)** Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial^2 t}$ for the following conditions by using Crank-Nicolson method.

At $x = 0$ and $x = 3$, $u = 0$ for all t 's.

At $t = 0$, $u = x^2$ for $0 < x < 3$.

Assume $h = 1$, $k = 0.01$. Find u at $t = 0.03$. [10]

- b) Draw the flowchart for solving Laplace equation. [8]

