Total No. of Questions : 12]

SEAT No. :

P2493

[Total No. of Pages : 4

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T.E (Mechanical Sandwich) (Semester - I)

NUMERICAL METHODS AND OPTIMIZATION

(2015 Pattern)

Time :2½ hours] ***[Max. Marks :70***

Instructions to the candidates:

1) *Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7or Q8, Q9 or Q10, Q11 or Q12.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of calculator is allowed.*
5) *Assume suitable data, if necessary.*

Q1) The vander waals equation for real gases is given by, **[6]**

$\{p+(a/v^2)\}\ (v - b) = RT$

Where p = pressure = 1 kN/m^2, R = Gas constant = 0.082kJ/kg k, a = constant = 3.82, b = constant = 0.06, V = volume at pressure p and T = temperature. Find the volume at 300 K. Assume initial volume = 20 m^3 / kg. Solve the numerical upto 2 iteration.

OR

Q2) Determine using Half interval method, a root of equation cos (x) – 1.3 (x) = 0. **[6]**

Not more than 4 iterations are expected.

Q3) Solve the system of equation using Gauss elimination method. **[8]**

$x - y + 4z = 16$

$3x + 2y + z = 18$

$x + 4y – 2z = 12$

Use partial pivoting.

P.T.O.

OR

Q4) Solve the system of equation using Gauss Seidel iterative method. **[8]**

10 x + y + z = 12

2 x + 10 y + z = 13

2 x + 2y + 10 z = 14

Find the solution after 4 iterations.

Q5) Maximise, Z = 3x + 2y subject to condition, **[6]**

-2 x + y < = 1

x < = 2

x + y < = 3

x, y > = 3

Use graphical method.

OR

Q6) Write a short note on the any three following: **[6]**

a) Constrained optimization

b) Slack variable

c) Artificial variable

d) Genetic Algorithm

Q7) a) A steel plate of 750 mm* 750 mm has its two adjacent sides mainteined at 100 °C. While the two other sides are maintained at 0 °C. What will be the steady state temperature at interior points assuming a grid size of 250 mm. **[10]**

	T_4	T_3
	T_1	T_2

b) Give $\frac{dy}{dx} = \frac{y-x}{y+x}$ with inital condition y(0) = 1; Find y for x = 0.1 by Euler's method. Take n = 5. **[6]**

OR

Q8) a) Draw a flowchart for Runge - kutta fourth order method. **[8]**

b) Initial temperature within an isulated cylindrical metal rod of 4 cm length is given by, T = 50 (4-x), 0 < x < 4, where x is distance from one end in cm. Both the end are maintained at 0 °C. Find the temperature as a function of x and t (0 ≤ t ≤ 1.5) if the heat flow is governed by $\frac{\partial T}{\partial t} = \alpha \frac{\partial^{2T}}{\partial x^2}, \Delta x = 1, \Delta t = 0.25, \alpha = 2.$ **[8]**

Q9) a) An experiment gave the following values:

v(ft/min)	350	400	500	600
t (min)	61	26	7	2.6

It is known that v and t are connected by the relation $v = at^b$. Find the best possible values of a and b. **[8]**

b) Kinematic viscosity of water (v) is related to temperature (T) in the following manner: **[8]**

T (°C)	0	4	8	12	16	20	24
$v*10^{-2}$, (cm^2/s)	1.7923	1.5676	1.3874	1.2396	1.1168	1.0105	0.9186

Use method of least square to fit the parabolic equation of the form $v = a + bT + cT^2$ for the data.

OR

Q10) a) Draw flow chart for lagrange's interpolation. **[6]**

b) From the following table of yearly premium for policies maturing at coming ages, estimate the premiums for policies maturing at the age of 46 years by Newton's Difference method: **[10]**

Age	45	50	55	60	65
Premium	2871	2404	2083	1862	1712

Q11) a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using. **[10]**

i) Trapezoidal rule

ii) Simpson's 1/3rd rule

iii) Simpson's 3/8th rule

and compare the results with its actual value.

b) Evaluate $\int_0^2 \frac{x^2+2x+1}{1+(x+1)^4}$ dx by Gaussian 3 - point formula. **[8]**

OR

Q12) a) Evaluate $\int_6^{14}\int_1^5 (x-y+1)\, dx.dy$ by using simpson's 1/3rd rule with number of strips for x and y equal to 4. **[10]**

b) Draw a flow chart by trapezoidal rule to find $\int_0^1 \sqrt{\sin(x)+\cos(x)}$ **[8]**

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