Total No. of Questions :10]

SEAT No. :

P2898

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[4958] - 1091

T.E. (Chemical)

CHEMICAL ENGINEERING MATHEMATICS

(2012 Course) (End Semester) (Semester - I) (309341)

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) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data, if necessary.***

Q1) a) The bacteria concentration (C) in a reservoir varies as $C = 4e^{-2t} + e^{-0.1t}$. Calculate the time required for bacteria concentration to be 0.5 accurate upto 4 decimal places, use Newton Raphson method. **[5]**

b) Explain convergence and divergence in case of Newton - Raphson method using graphical representation. **[5]**

OR

Q2) a) Solve the following system of equations using relaxation method. Perform 3 iterations.

$$10x_1 + x_2 + x_3 = 12$$

$$2x_1 + 10x_2 + x_3 = 13$$

$$2x_1 + 2x_2 + 10x_3 = 14$$ **[5]**

b) What are the drawbacks of elimination method. **[5]**

P.T.O.

Q3) a) Use least square regression to fit a straight line to the data given below

x	1	2	3	4	5	6	7
y	0.5	2.5	2.0	4.0	3.5	6.0	5.5

[5]

b) The value of Nusselt number (Nu) and Reynold number (Re) found experimently are given below. If the relation between Nu and Re is of type Nu = a. Re^b, find the values of a and b for the given values of Nu and Re **[5]**

Re	3000	4000	5000	6000	7000
Nu	14.3575	16.6517	16.7353	17.6762	18.5128

OR

Q4) a) What is linear extrapolation and polynomial extrapolation. **[5]**

b) A function $f(x)$ is described by following data

x	1	1.1	1.2	1.4	1.6	1.9	2.2
$f(x)$	3.123	4.247	5.635	9.299	14.303	24.759	39.319

Find the numerical integration of function in limit from 1 to 2.2 using Trapezoidal rule. **[5]**

Q5) a) Solve the following equation.

$2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 9y = 9$ with $y(0) = 1$, $y'(0) = -2$. Estimate y at $x = 0.1$ using Taylor series method. Take step size = 0.1. **[8]**

b) Explain error induced by Eulers method. **[8]**

OR

Q6) a) Using Runge - Kutta 2nd order method solve the following differential equation $\frac{dy}{dx} = x + y,\ y(0) = 1,\ h = 0.1,$ find y(0.2). **[8]**

b) Explain graphical interpretation of modified eulers method. **[8]**

Q7) Solve $\frac{d^2y}{dx^2} + y = 0$ with boundry conditions

$y = 0$ when $x = 0$

$y = 0$ when $x = 1$

Find y at $x = 0.5$ **[16]**

OR

Q8) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ for the following conditions using Crank - Nicolson method.

At $x = 0$ and $x = 3$, $u = 0$ for all values of t

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

Take increment in x as 1 and increment in t as 0.1. Find all values of u for $t =$ 0 to $t = 0.3$ **[16]**

Q9) a) Explain salient features of Golden search method. **[9]**

b) Explain numerical methods for optimizing a function of one variable. **[9]**

OR

Q10) A confectioner manufactures two types of biscuits A and B. A sells at profit of Rs. 40 per box, where B brings a profit of Rs. 50 per box. The biscuits are processed in three main operations blending, cooking and packaging. The average time taken in minutes for each box, for each of the processing operations is tabulated. The blending equipment is available for a maximum 12 machine hrs, cooking facilities for almost 30 hrs, and packing equipment for more than 15 hrs. Determine how many boxes of each type of confectioner should manufacture in order to maximize profit. How much is this profit. **[18]**

	Blending	Cooking	Packaging
A	1 (min)	5	3
B	2 (min)	4	1