Total No. of Questions : 10]

SEAT No. :

P3548

[Total No. of Pages : 3

[5560]-201
T.E. (Chemical)
CHEMICAL ENGINEERING MATHEMATICS
(2012 Course) (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) In a chemical Process water vapour is heated to a sufficient high temperature that is sufficient portion of water dissociates to form O_2 and H_2 as

$$H_2O \rightleftharpoons H_2 + \frac{1}{2} O_2 .$$

It is assumed that this is the only reaction involved, the mole fraction of $H_2O(x)$ that dissociates can be represented by

$$K_P = \frac{x}{1-x}\sqrt{\frac{2P_t}{2+x}}$$

Where KP = reaction constant = 0.04568

Pt = total pressure = 2 atm.

Determine the value of x that satisfy the above equation using newton raphson method (Take initial guess as 0.02). **[10]**

OR

Q2) a) Explain the graphical interpretation of False Position method. **[5]**

b) The velocity v (Km/hr) of a vehicle which starts from rest is given at fixed intervals of time t (minutes) is as follows

t (minutes)	2	4	6	8	10	12	14	16	18	20
V m/min	10	18	25	29	32	20	11	05	02	00

Estimate approximately the distance covered in 20 minutes. **[5]**

P.T.O.

Q3) A set of values of x and $f(x)$ are given below. Use Langrages interpolation formula to find $f(9)$. **[10]**

x	5	7	11	13	17
F(x)	150	392	1452	2366	5202

OR

Q4) Show that the sum of the squares of the residuals is minimum in case of least square method. **[10]**

Q5) a) Solve the following differential equation using Modified Eulers method for the given boundry condition $\frac{dy}{dx} = \log(x + y)$ $y(1) = 2$, find value of y at $x = 1.4$ upto accuracy = 0.001. **[8]**

b) State the graphical interpretation of Eulers method. **[8]**

OR

Q6) The rate of emission of a radioactive substance is proportional to the amount N of the substance remaining at any instant t, governed by the equation $\frac{d\,\mathrm{N}}{dt} = -k\,\mathrm{N}$ where the negative sign indicates that the radioactivity decreases with time. Taking $k = 0.01$ and at $t = 0$, N = 100 gm, find how much material remains when t = 100 sec. Use Runge Kutta second order method with $h = 50$. **[16]**

Q7) State various methods to solve partial differential equations and discuss Finite Difference Approximation in detail. **[16]**

OR

Q8) Solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$

At $t = 0$, $u = \sin 2x$, $0 < x < 0.5$

At $x = 0$ and $x = 0.5$, $u = 1$ for all values of t

Take $h = 1$ and $k = 0.2$, find the values of u at $t = 0.05$ and $x = 0$ to 0.5. **[16]**

Q9) a) Discuss steps involved in linear programing. **[9]**

b) Explain scanning and bracketing procedure for optimization of unconstrained functions of one dimensional search. **[9]**

Q10) A company is manufacturing two types of products A and B. Production is limited to 80 units of product A and 60 units of product B due to limited supply of raw material. Production of each of these products requires 5 units and 6 units of electronics components respectively. The electronic components are supplied by another manufacturer and the supply is limited to 600 units per day. The company has 160 employees i.e. the labour supply amounts to 160 man-days. The production of one unit of product A required 1 man-day of labour and one unit of product B requires 2 man-days of labour. Each unit of these products is sold in the market at a profit of Rs. 50/- and Rs. 80/- respectively. Determine how many units of each product the company should produce to maximize profit. **[18]**

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