Total No. of Questions : 10]

SEAT No. :

P2517

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[5253]-547

T.E. (Chemical)

CHEMICAL ENGINEERING MATHEMATICS

(2015 Pattern)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer any Five questions.***
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) Explain Convergence and Divergence in case of Newton- Raphson method. **[10]**

OR

Q2) During a certain process the specific heat capacity of system is given by C = (0.4 + 0.004 T)kJ/kg°C. Find heat transferred when temperature changes from 25°C to 125°C, the mass of the gas is 3kg. Use the Trapezoidal rule with number of strips equal to 3. **[10]**

Q3) The velocity distribution of a fluid near a flat surface is given below :

x	0.1	0.3	0.6	0.8
y	0.72	1.81	2.73	3.47

x is the distance from the surface (mm) and v is the velocity (mm/ses). Use Langrage interpolation polynomial to obtain the velocity at x = 0.4. **[10]**

OR

P.T.O.

Q4) The Table below gives the temperature T (°C) and length *l* (mm) of heated rod. If $l = a_0T + a_1$, find the best values of a_0 and a_1. **[10]**

T	20	30	40	50	60	70
l	800.3	800.4	800.6	800.7	800.9	801.0

Q5) State the graphical interpretation of Eulers method. **[16]**

OR

Q6) The temperature of the slab at one end is 1000 °C. The ambient temperature is 45 °C. Heat flow from one end to other end of the slab is 20.4 kW for area of 1 m^2. The thermal conductivity of a slab is given by $K = 0.8 (1 + 0.025 T)$ where T is the temperature at the other end. If the thickness of slab is 40mm, find the temperature at the other end using Eulers method, take h = 0.01 mm. **[16]**

Q7) A non insulated metallic bar 1 m long is held in air which ia at temperature 20 °C. One end of the bar is maintained at 100°C while other is at 40°C. The temperature distribution along the length at steady state may be assumed to be $\frac{d^2T}{dX^2} + h(T_a - T) = 0$, where T is temperature in degree Celsius, X is the distance measured from hot end, Tais atmospheric temperature in °C and h = 0.01. Calculate the rod temperature at a distance 250, 500, 700mm from hot end.**[16]**

OR

Q8) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ for the following condition using explicit finite difference method at $x = 1$ and $x = 4$, $u = 0$ for all values of t at $t = 0$ $u = e^x + \cos x$ for $1 < x < 4$. Take dh = 1, dk = 0.1. Find all values of u for $t = 0$ to $t = 0.5$. **[16]**

Q9) a) What are the six steps of optimization. **[9]**

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

OR

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]**