M. Tech. –I (Chemical Engineering) (CBCS – 2015 Course) :
SUMMER - 2019
SUBJECT: APPLIED MATHEMATICS FOR CHEMICAL ENGINEERING

Day: Thursday | Time: 11.00 AM TO 02.00 PM
Date: 16/05/2019 | **S-2019-3393** | Max Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Answers to both the sections should be written in SAME answer books.

SECTION -I

Q.1 Write note on :

a) Data uncertainty **(04)**
b) Truncation error **(03)**
c) Round off errors **(03)**

OR

Q.1 Explain stepwise short cut method for one way ANOVA **(10)**

Q.2 Determine the real root of $x^{3.3}= 79$ with the False-position method to within $\varepsilon_s= 0.1\%$. Use initial guesses of 3.0 and 4.0 **(10)**

OR

Q.2 The velocity v of a falling parachutist is given by **(10)**

$$v = \frac{gm}{c}[1- e^{-\left(\frac{c}{m}\right)t}]$$

where, g = 9.8 for a parachutist with a drag coefficient c = 14 kg/s, compute the mass m so that the velocity v is 35 m/s at t = 7 sec. Use the False position method to determine m to level of $\varepsilon_s= 0.1\%$.

Q.3 Given the data **(10)**

x	5	10	15	20	25	30	35	40	45	50
y	16	25	32	33	38	36	39	40	42	42

Use least square regression to fit a straight line.

OR

Q.3 Employ inverse interpolation using a cubic interpolating polynomial and bisection to determine the value of x that corresponds to $f(x)$ =0.3 for the following tabulated data **(10)**

x	1	2	3	4	5	6	7
$f(x)$	1	0.5	0.3333	0.25	0.2	0.1667	0.1429

P.T.O.

SECTION – II

Q.4 **a)** Apply trapezoidal rule to evaluate **(07)**

$$I = \int_{-2}^{2} \frac{t}{5+2t}\, dt$$

b) Quantitatively discuss Newton-Cots integration method **(03)**

OR

Q.4 Prove that **(10)**

$$I = \frac{4}{3} I(h_2) - \frac{1}{3} I(h_1)$$ with the help of Romberg integration

Q.5 A mass balance for chemicals in a completely mixed reactor can be written as **(10)**

$$V\frac{dc}{dt} = F - QC - kVC^2$$

where V is volume (10 m^3), C is concentration, F is Feed rate (200g/min), Q is flow rate (1 m^3/min) and k is reaction rate (0.1 m^3/g.min). If at t=0, C_o=0. Find the concentration at t= 2min, taking h=1. Use 4^{th} order Runge-Kutta method

OR

Q.5 Solve the boundary value problem **(10)**
y" – 64y +10 = 0; y(0) = y(1) = 0 by finite difference method. Compute the value of y(0.5) and compare with analytical value.

Q.6 Describe the importance of design of experiments **(10)**

OR

Q.6 Why is it necessary to develop mathematical model for the experimental data? **(10)**
Explain with one example

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