

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
B.Tech.Sem - IV CHEMICAL :SUMMER- 2022
SUBJECT : NUMERICAL METHODS FOR CHEMICAL ENGINEERING

Day : Tuesday
Date : 14-06-2022

S-24440-2022

Time : 10:00 AM-01:00 PM
Max. Marks : 60

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data **WHEREVER** necessary.

Q.1 (a) Suppose that you have the task of measuring the lengths of a bridge and a rivet and come up with 9999 and g cm respectively. If the true values are 10,000 and 10 cm respectively. Compute: **i)** The true error **ii)** The true % relative error for each case. **(04)**

- (b)** Elaborate the following: **(06)**
- i)** Accuracy and Precision
 - ii)** Transaction error and round off error
 - iii)** Root mean square error

OR

Q.1 What is ANOVA? Elaborate the mathematical steps of short cut method for one-way ANOVA **(10)**

Q.2 Use Newton -Raphson method to find the root of the equation $x^3 - 3x - 5 = 0$ with initial value $x_0 = 2$ (three iterations). **(10)**

OR

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

Q.3 Specific volume of super-heated steam is listed in steam table at various temperatures. **(10)**

T ($^{\circ}$C)	700	720	740	760	780
V (liter)	0.1058	0.128	0.1462	0.1603	0.1703

Determine V at $T = 750^{\circ}$ C.

OR

Q.3 a) Elaborate the following: **(04)**

- i)** Regression vs classification
- ii)** Nonlinear regression

b) Experiments are conducted to study the variation in thermal conductivity (k) of certain fluid with temperature and following data is generated. **(06)**

If $\bar{k} = a_0 + a_1 \bar{T}$. Find the best values for a_0 and a_1 .

T ($^{\circ}$C)	0	2	5	7
k (W/m$^{\circ}$C)	-1	5	12	20

P.TO

Q.4 Given $\frac{dy}{dx} = x^2 + y$ and $y(0) = 1$. Use second-order Runge-Kutta formula to determine an approximate value of y when $x = 0.02$. **(10)**

OR

Q.4 Solve by Picard's method of successive approximation (upto third iteration) **(10)**
 $\frac{dy}{dx} = x + y^2$, $y(0) = 1$. Find $y(0.1)$?

Q.5 Estimate the integral of $f(x) = 0.2 + 25x - 200x^2 + 675x^3 - 900x^4 + 400x^5$. **(10)**
Evaluate the integral with the help of multiple application of Simpson's 1/3rd rule and estimate the error with number of segments 4; $a = 0$, $b = 0.8$.

OR

Q.5 Use trapezoidal rule to evaluate $\int_1^2 \frac{dx}{x^2}$ corresponding to five intervals. **(10)**

Q.6 (a) Elaborate how control volume approach is applied for heat conduction equation. **(04)**

(b) Elaborate design and analysis of experiments and its generalization and interpretation on engineering data **(06)**

OR

Q.6 (a) Elaborate the applications of finite difference method to chemical engineering process-based problems. **(04)**

(b) Elaborate the mathematical steps of two-way ANOVA **(06)**

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