M.E. CHEMICAL ENGINEERING EXAMINATION, 2018

(First Year, First Semester)

NUMERICAL METHODS FOR CHEMICAL ENGINEERING

Time: Three hours   Full Marks: 100

All question carry equal marks

1. The heat transfer coefficient (h) is related to the velocity (u) of a fluid flowing through a pipe by $h = au^b$. Determine the values of a and b from the following data.

u, m/s	0.305	0.914	1.524	2.134	2.743
h, W/m^2 K	852	2100	3208	4258	5224

2. a) Find the root of the equation: $f(x) = 3x + \sin(x) - \exp(x) = 0$ within the range [1.5,2.0] using Bisection method.

b) What are the advantages and disadvantages of Newton-Raphson method in solution of nonlinear equation?

c) Find a root of the equation: $\exp(-x) - 3\log(x) = 0$ which lies between 1.0 and 2.0 using Secant method.

3. Use Runge-Kutta formula of fourth order to find the numerical solution at $x = 0.4$ for

$$\frac{dy}{dx} = \sqrt{x + y}, y(0) = 0$$

Assume step length $h = 0.2$. Compare the results with analytical solution.

4. Consider the following data table to find dy/dx at $x = 0.5$ and $x = 5.5$.

x	0	1	2	4	5	6
$y = f(x)$	1	14	15	5	6	19

5. Find Lagrange's interpolation polynomial through the following set of data and find dy/dx at $x = 5$

x	1	2	7	8	12
$y = f(x)$	4	5	5	4	2