CHN-323 Computer Applications in Chemical Engineering   **Max Marks: 60, Time: 90 mins**

INSTRUCTIONS:
1. Attempt all questions. Answer all parts of a question at single place.
2. Please check all pages of question paper and report the discrepancy, if any.
3. Return the MCQ sheet within first 30 min of the exam.
4. Make suitable assumptions wherever necessary.

Question 1:

Determine the value of λ that satisfies the equation below:

$$\frac{1}{\sqrt{\lambda}} = -4\log_e\left(\beta + \frac{5}{\xi\sqrt{\lambda}}\right) + 2$$

The parameters β varies in the range of 0.1-1.1 and the parameter ξ varies in the range of 3000-4000.

   (i) Write a MATLAB code for solving the above equation for λ.
   (ii) Plot λ vs β for five different values of ξ.
   (iii) Plot λ vs ξ for five different values of β.

Plotting should be done in MATLAB itself with proper labeling of axes and legends.

Question 2:

A mixture of xylene, styrene, toluene, and benzene (15%, 25%, 40%, 20% molar basis) is fed to a distillation column (C1) at a flow rate of 70 mol/min. Both the top and bottom products of this column are fed separately to another two distillation columns (C2 and C3).

C2 receives the top product of C1 as the feed and delivers two product streams. The molar composition of top product of C2 is 7% xylene, 4% styrene, 54% toluene, and the remaining benzene. The molar composition of bottom product of C2 is 18% xylene, 24% styrene, 42% toluene and the remaining benzene.
C3 receives the bottom product of C1 as the feed and delivers two product streams. The molar composition of top product of C3 is 15% xylene, 10% styrene, 54% toluene, and the remaining benzene. The molar composition of bottom product of C3 is 24% xylene, 65% styrene, 10% toluene and the remaining benzene.

The following needs to be estimated: (i) flow rates of the top and bottom products of all the columns (ii) molar composition of top and bottom products of C1.
   (i) Based on the chemical engineering principles and a proper schematic, write the set of equations to be solved.
   (ii) Write a MATLAB program (with own/inbuilt functions) to solve the resulting set of equations.