

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2023)

CLASS: BTECH
BRANCH: CHEMICAL

SEMESTER : VII
SESSION : MO/2023

SUBJECT: CL406 PROCESS MODELLING SIMULATION AND OPTIMIZATION

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 4 questions total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates
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- Q.1(a) A mixture of 40% benzene and 60% mol% toluene is being flash distilled at a rate of 10 Kmole/h at 1 atm total pressure. The liquid product should not contain more than 30% benzene. Calculate the amounts and the composition of the top and the bottom products. The relative volatility of benzene in the mixture is 2.5. Solve analytically (numerically if you find any difficulty in solving analytically). [3] CO 406.1
- Q.1(b) Why we would need the Reynolds transport theorem for derivation of conservative equations [2] CO 406.1
- Q.2 Solve [10] CO 406.4
- $$F_1(y) = 4 - 8y_2 + 4y_3 - 2y_2^3 = 0$$
- $$F_2(y) = 1 - 4y_2 + 3y_3 + y_3^2 = 0$$
- Using the Newton-Raphson technique, starting with $y^1 = [y_2^1 \ y_3^1]^T = [0.5 \ 0.5]^T$. Show up to four iterations.
- Q.3 Derive the basic form of Reynolds transport theorem by the delta shift method [5] CO 406.1
- Q.4 Discuss in brief [5] CO 406.3
- (a) Bisection method and
 - (b) Regula-falsi methods
- With neat functional diagrams and discuss the convergence criteria and order of error in these techniques.

:::21/09/2023 M:::