Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER II– EXAMINATION – WINTER - 2016

Subject Code: 2723001 **Date: 19/11/ 2016**

Subject Name: Advanced Mass Transfer

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the method of selection of operating pressure in distillation column. **07**

(b) State and explain various types of Membrane Modules used in Membrane Separation Processes. **07**

Q.2 **(a)** Write a short note on diffusion through solids. **07**

(b) Explain advantages and industrial applications of membrane separation processes. **07**

OR

(b) State various membrane separation processes and explain any one in detail. **07**

Q.3 Determine minimum reflux ratio, minimum number of theoretical stages required, optimum reflux ratio and theoretical stages required for desired separation for following system by FUG method. Feed flow rate is 70 kmol/hr and feed is saturated liquid. Composition (on mol basis) of distillation column streams and average relative volatilities of all components of feed are as follows. **14**

Component	α_{avg}	Feed %	Distillate %	Residue %
Benzene	8.96	2.2	22.8	0
Toluene	2.8407	7.4	72.2	0.5
Ethyl Benzene	1	43.4	5	47.5
Styrene	0.6506	47	0	52

Toluene is light key and ethyl benzene is heavy key component.

OR

Q.3 **(a)** Discuss advantages and disadvantages of vacuum distillation in detail. **07**

(b) Explain the concept of energy conservation in distillation. **07**

Q.4 **(a)** Explain the concept of super-heated drying and discuss its working principle. **07**

(b) Derive the rate equations for fast and slow reactions for heterogeneous reaction systems in case of mass transfer with chemical reaction. **07**

OR

Q.4 **(a)** Discuss advantages and applications of Super-heated Steam drying in brief. **07**

(b) Derive rate expression for fast fluid-fluid reactions. **07**

Q.5 **(a)** Write a short note on Falling film absorber, its advantages and process design features. **07**

(b) Discuss the criteria for selection of Spray tower, Venturi scrubber and Tray tower as absorber. **07**

OR

Q.5 Determine the degree of freedom and specify a typical set of design variables using total number of variables and design equations for **any two** of following: **14**

i) Stream mixer ii) Partial condenser iii) Adiabatic equilibrium stage

iv) N connected equilibrium stages with heat transfer

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