Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEMESTER B.TECH (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, DEC 2015

SUBJECT: PROCESS DESIGN OF CHEMICAL EQUIPMENTS [CHE 301]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY ONE FULL** question.
- Missing data may be suitable assumed.

1A. Estimate the size of hydrocyclone needed to separate 95% of particles with a diameter greater than 0.02 mm, from a dilute slurry with a flow rate of 1300 m^3/day. The density of liquid is 1100 kg/m^3 and that of the solid is 3000 kg/m^3, viscosity 1.5 mNs/m^2 **20**

1B. Design a Shell and Tube heat exchanger to handle 20,000 kg/hr of kerosene that is to be cooled from 200 ^oC to 95 ^oC. Crude oil is available at 40 ^oC and the output is preferred at 80 ^oC. **80**

DATA:

	Kerosene	Crude
Specific heat (BTU/lb ^oF)	0.605	0.49
Sp. gravity	0.8	0.83
Viscosity (lb/ft. hr)	0.97	8.7
Thermal Conductivity (BTU/hr. ft. ^oF)	0.0765	0.077

- Use $Q_h = Q_c$ without any extra allowance

2A. A gas mixture contains 2.5% acetone and the rest dry air by volume. It is required to remove 95% of the acetone by scrubbing with fresh water in a packed tower. The gas is available at 2500 kg/hr, 25^oC and 1 atm. Design the tower using following data : **100**

Gas phase viscosity = 0.018 cP

Diffusivity of acetone in air = 11.23 x 10^{-6} m^2/s

Diffusivity of acetone in water = 12.8 x 10^{-10} m^2/s

The equilibrium may be obtained using the relation : $y^* = 1.75$ x

- Where y^* and x are mole fraction of acetone in gas and liquid phases respectively.