Total No. of Questions : 6] SEAT No. :

P612

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BE/Insem/APR - 235
B.E. (Chemical Engg.)
PROCESS MODELLING AND SIMULATION
(2015 Pattern) (Semester - II) (Paper - I)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates :

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6.***
2) ***Assume suitable data, if necessary.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of electronic pocket calculator is allowed.***

Q1) a) Derive the individual component balance equations based on chemical kinetics for the following elementary reversible reaction occurring in a batch reactor of volume 'V' : **[6]**

$$A \Leftrightarrow B + C$$

Assume k_1 and k_2 as the forward and backward rate constants respectively.

b) State the applications of mathematical modelling in process industries. **[4]**

OR

Q2) Derive the complete model of a non-isothermal CSTR, starting from the fundamental laws of conservation. Assume a first order exothermic reaction: $A \rightarrow B$ occurring in the CSTR. **[10]**

Q3) Derive the model equations of a laminar flow in a narrow slit. **[10]**

OR

Q4) Explain the momentum fluxes for creeping flow of a fluid in a slot. **[10]**

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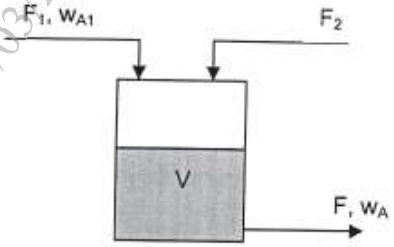
Q5) Derive the model equations of a single effect evaporator. Enlist all the assumptions. **[10]**

OR

Q6) a) A concentrated salt (component 'A') solution is diluted with pure water (component 'B') in a continuous mixer as shown below. Derive the model equations of the mixer. **[6]**



where,

F_1 = volumetric flowrate of aqueous stream '1' containing salt concentration W_{A1} (in weight fraction),

F_2 = volumetric flowrate of pure water stream '2',

F = volumetric flowrate of outlet stream containing salt concentration W_A (in weight fraction)

Assume, ρ_1, ρ_2, ρ are the densities of the respective streams and V is the volume of the salt solution in the mixer. Neglect heat effects.

b) Explain the thermal effects occurring in cooling towers in terms of simple model equations. **[4]**

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