BE (chem) sem - VIII CBSGS.
May- 2017

Q.P.Code:18093

Duration 03 Hr   Total Marks 80

N.B. 1) Question No.1 is compulsory
2) Answer any three out of five question
3) Assume suitable data wherever necessary and state them clearly
4) Figure to the right indicate full marks

Q.1

a)   Explain in details Equation of state (EOS) model   05

b)   Explain overall strategy for developing unit model   05

c)   List out the various methods of optimization and explain in brief.   05

d)   Model non ideal flash column.   05

Q2   Calculate the bubble point temperature in flash column for the mixture with components,   20
flowrates, boiling points & Antoine coefficients given in the following table:- Total
Pressure is 1 bar, For Antoine equation P is in mm Hg, T is in ^0K where 99% of Benzene
is recovered in the overhead and 99.5% of xylene to be recovered in bottom.

Component	f (mole/hr)	Boiling Point	A	B	C
Benzene	30	353	15.9008	2788.51	-52.34
Toluene	50	383	16.0137	3096.52	-53.67
O-xylene	40	418	16.1156	3395.57	-59.44

Q.3   A proposed new method for desalting brackish water is as follows: 20

Turn Over

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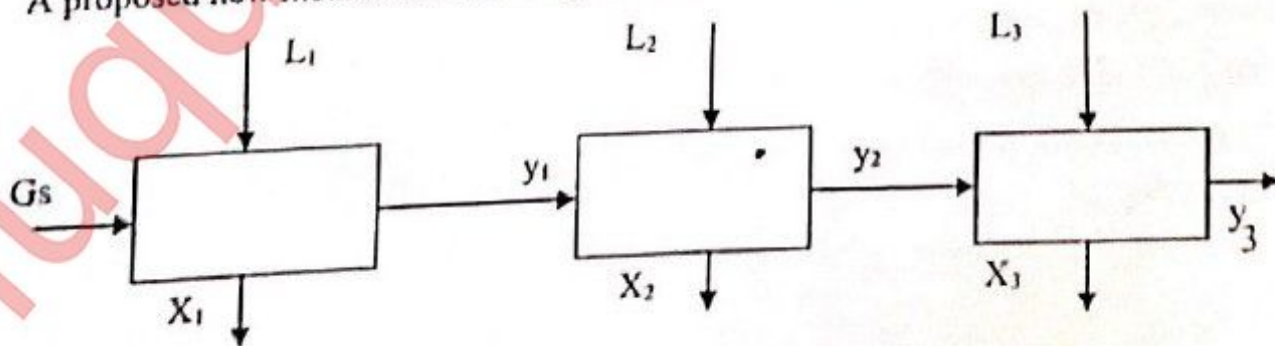
The salt is to be absorbed on to a patented solid adsorbent in a three stage process as shown above. Determine the distribution of pure adsorbent so as to minimize the total flow rate required. The equilibrium relation is given by $y = x^2/100$

Gs= 1000 kg/hr of water

X= Kg of salt per kg of adsorbent

y= Kg of salt per Kg of water

$y_0 = 0.03$ and $y_3 = 0.0001$

Use Newtons method and show at least two iterations.

Q.4(a) In a absorption column vapour consist of 10 mol/s air and 01 mol/sec acetone . Acetone is to be absorbed in water(solvent) Solvent temperature is of 300K and pressure of 10 bar .Recovery of acetone r=0.95. Absorption factor 1.4.Calculate required water flow rate, No.of stages and flow rates of existing stream   **10**

Antonie Constant **Water** A= 8.07131 B= 1730.63 C= 233.426

Acetone A=4.42448 B=1312.253 C= -32.445

Q.4(b) Find the tear stream for the given flowsheet   **10**
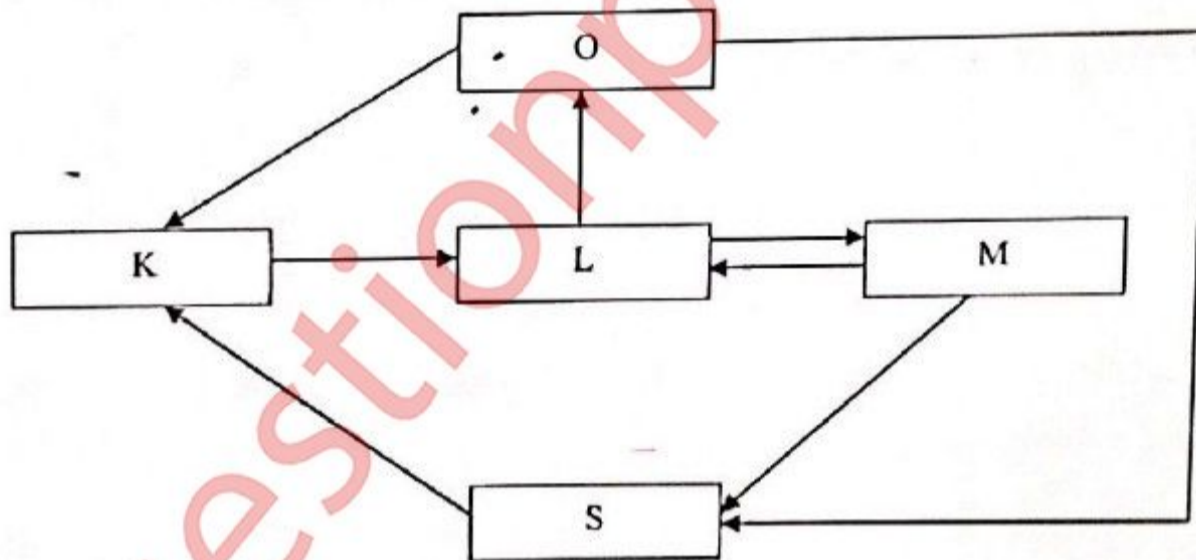
Q.5a) Solve by Lagrangian Method   **10**

$S = 2X_1X_2 + 2X_2X_3 + X_1X_3$

$X_1X_2X_3 = 32$, & $X_1, X_2, X_3 > 0$

b) Using Newton's method along with Armijo line search method to solve following equation   **10**
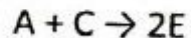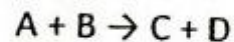
$f_1 = 2x_1^2 + x_2^2 - 6 = 0$

$f_2 = x_1 + 2x_2 - 3.5 = 0$

Turn Over

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Q6   Feed streams with pure species A and B are mixed with a recycle stream in a CSTR,   20

where the following reactions take place:

A + B → C + D

A + C → 2E

B + E → F

F is a gaseous product, D is a solid waste, C is a by-product while E is the main product.

The plant consists of a reactor, a filter and two distillation columns. 98% of high boiling E

is recovered from the first column, while volatile C is separated in the second column. Due

to formation of an azeotrope, some of component C (equivalent to 10 wt% of component

E) is retained in the column bottoms. 90% of this bottom product is recycled, while the

rest is purged. Construct a Williams-Otto flow sheet and develop the process equations.