AL-Qadisiya University *College of Engineering* *Chemical Engineering Dept.* *Second Examination 2014-2015* *Examiner :K.K.Hameed*	*Subject: Computer Application* *Class: Fourth* *Time : 1.5 hours* *Max. Marks :100* *Date: 28/ 4 / 2015*

Answer All Question

Q1: Consider the following two reaction taking place in a bach reactor:

$$A+B \xrightarrow{K1} C$$

$$B+C \xrightarrow{K2} D$$

For component A $\frac{dCA}{dt} = -k1CACB$

For component B $\frac{dCB}{dt} = -k1CACB - k2CBCc$

For component C $\frac{dCc}{dt} = k1CACB - k2CBCc$

For component D $\frac{dCD}{dt} = k2CBCc$

The initial condition is: at t=0, CA=1 mol/m3, CB=1, CC=0, and CD=0. The rate constant are: k1=1 s-1 and k2=0.1 s-1. Using the Runge-Kutta fourth order method (matlab), determine the concentration of A, B,C, and D at 10 s.

(25 MARK)

Q2: Using Matlab to Calculate the composition of the liquid and vapour phases for the acetone , acetonitrile, and nitromethane. The feed composition is Z1=0.25, Z2=0.5, and Z3=0.25. At the given temperature: P1sat =195.75 kpa, P2sat=97.84 kpa, and P3sat=50.32 kpa. The pressure of the system is 100 kpa. Assume the system to follow Raoult, s law.

Given:

$P_i^{sat}=kiP$, $yi = \frac{KiZi}{1-V+VKi}$, $xi = \frac{zi}{1-V+VKi}$

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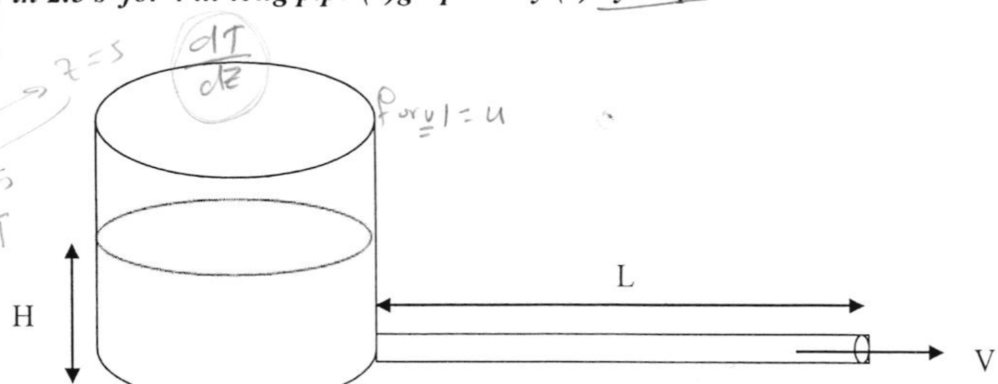
(25 MARK)

Q3: As depicted in fig as show below , the velocity of water, v(m/s), discharged from a cylindrical tank through a long pipe can be computed as

$$v = \sqrt[2]{2gH}\tanh\left(\frac{\sqrt[2]{2gH}}{2L}t\right)$$

Where g=9.8 m/s2, H =initial head (m), L=pipe length (m), and t=time(s). Determine the head needed to achieve v=5 m/s in 2.5 s for 4 m-long pipe (a)graphically (b) by loop-condition.



(25 MARK)

Q4: ***Consider a binary vapour-liquid equilibrium system . The Antoine equations of the components are given by:***

$$lnP1 = 16.678 - \frac{3640.2}{T+219.61}$$ ***where P1 is saturation pressure.***

$$lnP2 = 16.2887 - \frac{3816.44}{T+227.02}$$ ***where P2 is saturation pressure.***

Where the temperature is in C° and the vapour pressure in kpa. The parameters in the Wilson equation are: a1=437.98 and a2=1238. The molar volume of the component is V1=76.92 cm3/mol and V2=18.07 cm3/mol. Assume the system to follow the modified Raoult's. Calculate the bubble point pressure at 100 C° and x1=0.5.

The constants are given by:

$$A1 = V2/V1exp(-\frac{a1}{RT}) \quad , \quad A2 = V1/V2exp(\frac{a2}{RT})$$

The activity coefficients are given by:

$$ln\beta1 = -ln(x1 + x2A1) + x2[\frac{A1}{x1 + x2A1} - \frac{A2}{x2 + x1A2}]$$

$$ln\beta2 = -ln(x2 + x1A2) - x1[\frac{A1}{x1 + x2A1} - \frac{A2}{x2 + x1A2}]$$

The pressure is given by:

$$P = x1\beta1P1 + x2\beta2P2$$

(25 MARK)

Good Luck