JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -3 EXAMINATION- Dec 2017
B.Tech (BT) IIIrd Semester

MAX. MARKS:35

COURSE CODE: 10B11BT311
COURSE NAME: Thermodynamics and Chemical processes
COURSE CREDITS: 4

MAX. TIME: Two Hours

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

Q1(a). How the lineweaver-burk plot and Langmuir plot are useful for the calculations of Michaelis-Menten constants?   3

(b). 1 mole of an ideal gas, (Cv =12.471 JK^{-1} mol^{-1}) is heated from 300 k to 600K. Calculate entropy change when (i) volume is kept constant and (ii) pressure is kept constant.   (R= 8.314JK^{-1})   3

Q2. Consider the following interconversion, which occurs in glycolysis :

Fructose-6-phosphate 1 $\leftrightarrow$ glucose-6-phosphate   (K'eq = 1.97)

(a) What is $\Delta G^{o\prime}$ for the reaction (assuming that the temperature is 25°C) ?

(b) If the concentration of fructose-6-phosphate is adjusted to 1.5 M and that of glucose6-phosphate is adjusted to 0.5 M, what is ΔG ?   3   3

Q3(a). Elucidate the flow system for energy balance equations.   4

(b). Classification of non newtonian fluids depends upon the relationship between shear stress and shear strain. Justify this statement by giving equations and graphs.   2

Q4(a). Discuss how viscosity is calculated in an impeller viscometer.

(b). Draw the proper flow sheet and mass balance table for the following material balances: *Acetobacter aceti* bacteria convert ethanol to acetic acid under aerobic conditions as shown below. A continuous fermentation process for vinegar production is proposed using non-viable A. aceti cells immobilised on the surface of gelatin beads. The production target is 2 Kg h^{-1} acetic acid, however the maximum acetic acid concentration tolerated by the cells is 12 %. Air is pumped into the fermenter at a rate of 200 gmol h^{-1}.   4

$$C_2H_5OH + O_2 \rightarrow CH_3COOH + H_2O$$

Q5. From the following data:

Shear stress (dyn cm^{-2})	Shear rate (s^{-1})
44.1	10.2
235.3	170
357.1	340
457.1	510
636.8	1020

(a) Plot the rheogram for this fluid.

(b) Determine the appropriate non-Newtonian parameters.   5

(c) What is the apparent viscosity at shear rates of 15 s^{-1}

Q6(a). In double-tube pass heat exchanger, flow of tube and shell fluids is mainly countercurrent for one tube pass and mainly cocurrent for the other. Justify this statement.   4

(b). How the overall heat-transfer coefficient can be expressed in terms of individual resistances to heat transfer? 4