

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
 TEST 2 EXAMINATION- OCT. 2018
 B.Tech (BT) IIIrd Semester

COURSE CODE: 10B11BT311

MAX. MARKS : 25

COURSE NAME: Thermodynamics and Chemical processes

COURSE CREDITS: 4

MAX. TIME: One and half Hours

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

- Q1(a). Why gases have two types of specific heat? 2
- (b). Why metabolism is called as the set of life-sustaining chemical transformations? 3
- Q2(a). A mixture (A) (125 kg) contains 2.5% invert sugars and 50% water; rest can be considered as solids. Another mixture (B) (45 kg) containing 50% sucrose, 1% invert sugars, 18% water and the remainder solids. Both mixtures A and B mixed together in mixing tank. Water is also added as separate component. Final product containing 2% invert sugars as one component is obtained.
- (i) How much water is required?
- (i) What is the concentration of sucrose in final product? 7
- (b) The chemical reaction equation for respiration of glucose is:
- $$C_6H_{12}O_6 + 6 O_2 \rightarrow 6 CO_2 + 6 H_2O.$$
- Candida utilis cells convert glucose to CO_2 and H_2O during growth. The cell composition is $CH_{1.84}O_{0.55}N_{0.2}$ plus 5% ash. Yield of biomass from substrate is 0.5 g g^{-1} . Ammonia is used as nitrogen source.
- (i) What is the oxygen demand with growth compared to that without?
- (ii) C. utilis is also able to grow with ethanol as substrate, producing cells of the same composition as above. On a mass basis, how does the maximum possible biomass yield from ethanol compare with the maximum possible yield from glucose? 7
- Q3. Water at 25°C enters an open heating tank at a rate of 10 kg h^{-1} . Liquid water leaves the tank at 88°C at a rate of 9 kg h^{-1} ; 1 kg h^{-1} water vapour is lost from the system through evaporation. At steady state, what is the rate of heat input to the system? If h (liquid water at 88°C - 368.5 kJ kg^{-1} ; h (saturated steam at 88°C - $2656.9 \text{ kJ kg}^{-1}$; h (liquid water at 25°C - 104.8 kJ kg^{-1}) 6