

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: IMSc
BRANCH: FOOD TECHNOLOGY.

SEMESTER : III
SESSION : MO/2022

SUBJECT: FT202 INTRODUCTION TO FOOD ENGINEERING

TIME: 3:00 Hours

FULL MARKS: 50

INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) The Coefficient of viscosity of water is 1CP at 20°C. Calculate its value both in English and SI unit [2]
Q.1(b) Write Short note on: [3]
a) Limiting reactant, b) Excess reactant
c) stoichiometry d) Yield of reaction.
- Q.1(c) The pressure difference ΔP in a pipe of diameter D and length l due to turbulent flow depends on the velocity V, viscosity μ , density ρ , roughness k, Using Buckingham's Pi-theorem, find an expression for ΔP . [5]
- Q.2(a) Write Short note on: [2]
Raoult Law and Gibbs' Phase Rule
- Q.2(b) Example of common non-dimensional parameters and their physical significance: Reynolds number, Froude number and Mach number [3]
- Q.2(c) Soyabean seed are extracted with hexane in batch Extracter. The flaked seed contain 18.6% oil, 69.0% solid and 12.4 % moisture. At the end of the process, cake of milk is separated from the hexane oil mixture. The cake analysis yield 0.8% oil, 87.7% solid and 11% moisture. Find the % recovery of oil. All % are by wt only [5]
- Q.3(a) An evaporator is fed with 15000 Kg/hr of a solution containing 10% sodium chloride, 15% NaOH. In operation water is evaporated and NaCl is precipitated as crystal. The thick liquor leaving the evaporator containing 45% NaOH, 2% NaCl and rest is H₂O . [5]
Calculate:
(i)Kg/hr water evaporated.
(ii)Kg/hr salt precipitated.
(iii)Kg/hr thick liquid
- Q.3(b) The vapour-phase hydration of ethylene to ethanol is represented by: [5]
$$C_2H_4(g) + H_2O(g) \rightarrow C_2H_5OH(g)$$

Calculate the standard heat of reaction if the following data are available:
$$2CO_2(g) + 3H_2O(l) \rightarrow C_2H_5OH(l) + 3O_2(g) \quad \Delta H_{298}^0 = 1366.91 \text{ kJ}$$

The standard heat of combustion of ethylene at 298 K is -1410.99 kJ/mol and heats of vaporization of water and ethanol are, respectively, 44.04 kJ/mol and 42.37 kJ/mol.
- Q.4(a) What do you mean by zero order reaction ? How the value of rate constant is determined ? What is the relation between rate constant and half-life period ? [3]
- Q.4(b) Give two examples of first order reaction. [3]
What are the factors on which the rate of reaction depends? Discuss each factor in brief.
- Q.4(c) A second order reaction, where initial concentration of both reactants is equal to 25 % completed in 400 Second. How long will it take for reaction to go to 75% completion. [4]
- Q.5(a) Discuss the property types of industrial thermocouples with range of operation and advantages. [3]
Q.5(b) Discuss briefly the instruments used in measuring pressure in food process industry [3]
Q.5(c) Sketch and explain the block diagram for automatic close loop control system [4]