Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023
FOOD TECHNOLOGY
(2020 SCHEME)

Course Code : 20FTT201

Course Name: Principles of Chemical Engineering

Max. Marks : 100 **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. The flowrate of water through a pipe is reported as 15 cubic feet per minute. Taking density of water as 1g/cm^3, calculate the mass flowrate in kg/s.
2. How many molecules are present in 691 g K_2CO_3?
3. Differentiate excess reactant and limiting reactant.
4. Determine the heat capacity of $Na_2SO_4.10H_2O$ at room temperature using Kopp's rule. The atomic heat capacities of elements (J/molK) are 26.04 for Na, 22.6 for S, 16.8 for O and 9.6 for H
5. Differentiate absolute viscosity and kinematic viscosity.
6. State Pascal's law for fluid statics.
7. What is friction factor?
8. Define about hydraulic radius and equivalent diameter.
9. With the help of block diagram write the classification of pumps.
10. Write about open channel meters.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) A drier is fed with wet solid to reduce the moisture content from 80% to 15%. The product leaving the drier is admitted to an oven which further brings down the moisture to 2%. If the drier can handle 1000kg of wet solid per day, calculate (10)
    i) Weight of the products leaving the drier and oven per day.
    ii) The percentage of the original water that is removed in the drier and the oven.
    b) Define molarity, molality and normality. (4)

OR

12. a) An aqueous solution of sodium carbonate containing 15% carbonate by weight.80 % of the carbonate is removed as $Na_2CO_3.10\ H_2O$ by evaporation of water and subsequent cooling at 278 K. The solubility of $Na_2CO_3.10\ H_2O$ is 9 % by weight. On (9)

the basis of 100 kg of solution, determine the quantity of crystals formed and amount of water evaporated.

b) Write the steps in solving material balance problems. (5)

MODULE II

13. a) Differentiate yield, conversion and selectivity with example. (6)

b) Propane is burnt with excess of air to ensure complete combustion. If 50kg of CO_2 and 20 kg CO are obtained when propane is completely burnt with 550kg air. Determine i) Mass of propane burnt in kg ii) % excess air iii) Composition of flue gas. Molecular weight of air = 29. (8)

OR

14. a) The heat capacity of CO_2 is given;

$Cp=26.540+42.954*10-3T-14.298*10-6T^2$. Cp is given in kJ/kmolK. How much heat is required to heat I kg of CO_2 from 300K to 1000K. (9)

b) What are the five methods to find latent heat of vaporization? (5)

MODULE III

15. a) State Newton's law of viscosity. With neat diagram explain Newtonian and non-Newtonian fluids. (8)

b) Explain manometer working and derive the expression for pressure drop. (6)

OR

16. a) With neat diagram explain Reynolds experiment. (7)

b) Explain the classification of flow. (7)

MODULE IV

17. a) Derive Bernoulli's equation stating the assumptions. (6)

b) Discuss the frictional loss from sudden expansion and sudden contraction. (8)

OR

18. Derive Hagen Poisellius equation for laminar flow of incompressible Newtonian fluid through a circular pipe. (14)

MODULE V

19. a) With neat diagram explain any three reciprocating pumps. (9)

b) Explain the characteristic curves of a centrifugal pump. (5)

OR

20. a) Explain the following: (8)

i. Cavitation

ii. NPSH
iii. Priming
iv. Water hammer

b) Derive the flowrate equation for a venturi meter. (6)

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