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VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 90026

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – JAN. 2026
Fourth Semester
Biotechnology
U23BT411 - UNIT OPERATIONS
(Regulation 2023)

Time: Three Hours

Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Write the expression of Daltons Law.	2	K1	CO1
2.	Find the molecular weight of H ₂ SO ₄ and Na ₂ CO ₃ .	2	K1	CO1
3.	Write the difference between the recycle and bypass stream.	2	K2	CO2
4.	For the reaction CH ₄ + 2O ₂ → CO ₂ + 2H ₂ O. What is theoretical requirement of O ₂ per k.mol of methane?	2	K2	CO2
5.	Define continuity equation and its application.	2	K3	CO3
6.	Define Newtonian law of Viscosity.	2	K3	CO3
7.	Define kicks law.	2	K2	CO4
8.	What will be the power required to crush 150 tonnes per hour of limestone if 80 percent of the feed passes 50 mm screen and 80 percent of the product a 3.125 mm screen? Work index of limestone = 12.74.	2	K1	CO4
9.	List the different types of fluidizations.	2	K1	CO5
10.	State Ergun equation.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.	Questions	Marks	KL	CO
11. a)	Nitrogen gas is confined in a cylinder and the pressure of the gas is maintained by a weight placed on the piston. The mass of the piston and the weight together is 100Lb. The gravity is 9.81m/s ² . Determine a. Force exerted by the atmosphere and piston the weight of gas piston diameter 4inch. b. The pressure of the gas in bar and psi c. If the gas is allowed to expand pushing up piston and weight by 400mm. What is work done?	13	K4	CO1
(OR)				
b)	Natural Gas is piped from the well at 300K and 400Kpa. The gas is found to contain 93.0% methane, 4.5% ethane and the rest nitrogen. Calculate the following a. Partial Pressure of nitrogen. b. Pure component volume of ethane in 10 m ³ of the gas. c. Density of standard condition in kg/m ³ d. Density of gas piped in kg/m ³ e. Average molecular weight of gas. f. Composition in weight percentage.	13	K4	CO1
12. a)	i. Derive the material balance equation for distillation operation. ii. 10000 Kg/hr of solution containing 20% methanal is continuously feed to distillation column. Distillate is found to contain 98% methanol and waste solution from the column 1% methanol. All percentage are by weight. a. Calculate the mass flowrate of distillate and bottom product. b. Percentage loss of Methyl alcohol.	5 8	K4	CO2
(OR)				
b)	Write short notes on: i. limiting and excess reactant ii. Recycle, bypass and purging	7 6	K2	CO2
13. a)	With neat sketch explain the Rheological diagram and discuss the behavior of Newtonian and non-Newtonian fluids.	13	K2	CO3

(OR)

- b) i. Acetic acid is to be pumped at a rate of 0.02 m³/s through a 75 mm i.d. pipe line. What is the pressure drop in the pipe line over a length of 70 m?
Data: Density of acetic acid = 1060 kg/m³
Viscosity of acetic acid = 0.0025 (N.s)/m² 7 K3 CO3
- ii. Explain the working principle of rotameter with neat diagram. 6
14. a) Compare and contrast different types of crushers. Also explain the advantages and disadvantages. 13 K3 CO4
- (OR)
- b) i. Calculate the operating speed of the ball mill from the following data: 6 K4 CO4
- a. Diameter of ball mill = 500 mm
- b. Diameter of ball = 40 mm
- c. Operating speed is 50% of the critical speed of the mill.
- ii. Explain the jaw crusher with neat diagram and name its parts. 7 K2
15. a) Explain the working principle of fluidization, and its types with neat diagram. 13 K3 CO5
- (OR)
- b) Discuss in detail the fluid flow concepts through packed beds and fluidized beds. 13 K4 CO5

PART C

(1 x 15 = 15 Marks)

- | Q. No | Questions | Marks | KL | CO |
|--------|---|-------|----|-----|
| 16. a) | A feed to continuous fractionating column analysis 28% benzene and 72 % toluene by weight. The analysis of distillate shows 52 wt percentage of benzene and 5 weight % of benzene found in bottom product. Calculate amount of distillate and bottom product per 1000kg of feed per hour. | 15 | K4 | CO3 |
| | (OR) | | | |
| b) | Draw a neat sketch of venturi meter and explain its construction and working principle. | 15 | K3 | CO5 |