Reg.No.:												

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

Question Paper Code: 10001

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025
Third semester
Biotechnology
U19GE304 - UNIT OPERATIONS
(Regulation 2019)

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.	Define molarity and molality.	2	K1	CO1
2.	Convert 499 g of CuSO4.5H2O into moles	2	K1	CO1
3.	Write the difference between the recycle and bypass stream	2	K2	CO2
4.	What is ment by purging process?	2	K2	CO2
5.	Define continuity equation and its application.	2	K3	CO3
6.	Define Newtonian law of Viscosity.	2	K3	CO3
7	Differentiate orifice and venturi meter.	2	K2	CO4
8.	A pitot tube is installed in the center of a pipe 80mm diameter. Find the velocity of water in the center of the pipe if the water rises 300 mm in tube.	2	K1	CO4
9.	Why are diaphragm pumps widely used as 'metering pumps?	2	K1	CO5
10.	What is ment by cavitation?	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	Assume air to behave as an ideal gas, Calculate the molar volume of air at 350 K and 1 bar.	7	K4	CO1
		ii.	Evaluate $\int_0^1 e^x dx$ by Simpson 1/3 rule the integral [0,1] is divided n to six equal parts.	6	K4	

(OR)

	b)	Write short notes on i. Ideal gas law, ii. Amagat's Law, iii. Daltons La	13	K3	CO1
12.	a)	i. Derive the material balance equation of Evaporation.	5	K3	CO2
		ii. A feed to a continuous fractionating column analysis 28% benzene and 72% toluene by weight. The analysis of distillate shows 52 weight percentage benzene and 5 weight percentage benzene was found in bottom product. Calculate the amount of distillate and bottom product per 1000 kg of feed per hour. Also calculate the percentage of recovery of benzene.	8	K3	
		(OR)			
	b)	A wet solids is to be dried from 80% to 5% moisture on wet basis. Calculate the amount of moisture to be e.	13	K3	CO2
13.	a)	i. With neat Sketch explain the Rheological diagram and explain the behavior of Newtonian and non-Newtonian fluids.	8	K3	CO3
		ii. Calculate dynamic viscosity of oil which is used for lubrication between a square plate of size 0.8 m x 0.8 m and an inclined angle of inclination 30 degree. The weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of the oil film is 1.5 mm.	5	K3	
		(OR)			
	b)	i. Derive continuity equation for three-dimensional flow of incompressible fluids using cartesian coordinates.	7	K4	CO3
		ii. The right limb of a simple U- tube mano meter containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The center of the pipe is 12cm below the level of mercury in right limb. Find the pressure of fluid in the two limbs is 20cm.	6	K4	
14.	a)	i. A Sharp-edged orifice having a diameter of 0.0566m is installed in a 0.1541m pipe through which oil having a density of 878 kg/m^3 and a viscosity of 4.1 cp is flowing. The measured pressure difference across the orifice is 93.2kN/m^2. Calculate the volumetric flow rate in m^3/s. Assume that C_o = 0.61.	7	K4	CO4
		ii. Explain the fluid flow (concepts) though packed beds and fluidized beds.	6	K4	

(OR)

b)	i.	Water trickles by gravity over bed of particles each 1mm diameter in a bed of diameter 6 cm and height 2m. The water is fed from a reservoir whose diameter is much larger than that of the packed bed, with water maintained at a height of 0.1m above the top of the bed. The bed has a porosity of 0.31. Calculate the volumetric flow rate of water if its viscosity is 1.0 cP.	6	K4	CO4
	ii.	With neat sketch explain the working principle of Butter fly valve.	7	K4	
15. a)		Explain the working principle of axial flow pumps. And its advantages:	13	K3	CO5

(OR)

b)	Water is to be pumped from a tank, located on the ground, to a cooling tower. The tank is open to the atmosphere. The difference between the level of water in the tank and discharge point is 15meters. The velocity of water through a 40mm internal diameter discharge pipe is 3m/s. In the pipe line there is a valve which is equivalent to 200 pipe diameters and a fitting equivalent to 150 pipe diameters. The length of the entire piping is 30 meters. Calculate the power requirement of the pump.	13	K4	CO5

PART C

(1 x 15 = 15 Marks)

Q. No		Questions	Marks	KL	CO
16.	a)	Describe the method of Dimensional analysis using Buckingham Pi theorem.	15	K4	CO3

(OR)

b)	Crude oil having specific gravity of 0.91 and a viscosity of 0.124 Pa. s is pumped at a rate of 7 L/S through a pipe line 75mm diameter having a length of 62m and whose outlet is 3m higher than its inlet. Calculate the power required for the pump if its efficiency is 60%.	15	K4	CO5