QP Code: R264A018 | Reg. No | | | | | | | | | | | AY 23

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Fourth Semester – Regular/Supplementary) Examinations, April 2026

23BBTPC24003 - Upstream Process Engineering

(Biotechnology)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

	Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a.	What is critical thickness of insulation?	CO2	K1
b.	Define LMTD and explain its physical significance in heat transfer operations.	CO3	K2
c.	Difference between laminar and turbulent flow	CO4	K2
d.	Define Flux. Mention the Flux in terms of molar unit and mass Unit.	CO5	K2
e.	Differentiate among Molecular diffusion and eddy diffusion.	CO6	K1

PART – B **(10 x 5 = 50 Marks)**

	Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a.	Derive the energy consumption for size reduction by considering crushing efficiency and mechanical efficiency.	5	CO1	K1
b.	Give the classification and stages of size reduction machines. Name four common ways of breaking solids in size reduction machines	5	CO1	K2
	(OR)			
c.	Write in brief about the construction and operation of a Ball Mill. Discuss the factors which affect the Grinding efficiency.	5	CO1	K1
d.	Write in brief about the construction and operation of a Roll Crusher. Discuss the angle of nip and its relation with Roll diameter, Feed size and Product Size.	5	CO1	K2
3.a.	Derive an expression for One-dimensional steady state Heat conduction through a composite wall.	5	CO2	K3
b.	A wall consists of two layers:	5	CO2	K2

Layer	Thickness (m)	Thermal Conductivity (W/m·K)
Layer 1	0.10	0.8
Layer 2	0.15	0.4

Area = 5 m²
Temperature of inner surface = 200°C
Temperature of outer surface = 50°C
Find the Total heat transfer rate

(OR)

c.	Derive an expression for One-dimensional steady state Heat conduction through a composite cylinder.	5	CO2	K1
d.	A pipe is insulated with two layers Given Data, Length = 1 m, Inner surface temperature = 300°C Outer surface temperature = 50°C	5	CO3	K3

Find heat transfer rate.

Layer	Inner Radius (m)	Outer Radius (m)	k (W/m·K)
Layer 1	0.05	0.08	15
Layer 2	0.08	0.12	0.5

4.a.	Apply the continuity equation to determine velocity at different sections of a pipe with varying diameter.	5	CO3	K1
b.	Explain the working principle of a Venturimeter with a neat sketch and derive the expression for discharge	5	CO3	K1
	(OR)			
c.	Apply Bernoulli's equation to calculate pressure, velocity, or height in a flowing fluid system.	5	CO3	K2
d.	Describe the construction and working of a Pitot tube and derive the velocity measurement equation.	5	CO4	K1
5.a.	Derive the Flux Equation in case of a Equimolecular counter diffusion in case of Gaseous Mixture.	5	CO4	K1
b.	Compare mass, heat, and momentum transfer and discuss the analogy between them	5	CO5	K2
	(OR)			
c.	Derive the Flux Equation in case of a stagnant diffusion in case of Gaseous Mixture	5	CO5	K2
d.	State Fick's Law of diffusion. Mention the importance of Diffusivity.	5	CO4	K2
6.a.	Define distillation and explain its principle based on relative volatility.	5	CO5	K2
b.	Explain the T–x–y diagram and interpret the significance of bubble point and dew point curves.	5	CO6	K2
	(OR)			
c.	Discuss the concept of vapour-liquid equilibrium (VLE) in distillation with suitable explanation.	5	CO5	K2
d.	Explain differential distillation and derive the basic governing equation.	5	CO6	K1

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