LOK JAGRUTI UNIVERSITY (LJU)

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Chemical Engineering (708)

Bachelor of Engineering (B.E.) - Semester – V

Course Code:	**017083501**
Course Name:	**Transport Phenomena**
Category of Course:	Professional Core Course (PCC)
Prerequisite Course:	Fluid Mechanics, Heat Transfer, Mass Transfer, Mathematics

Teaching Scheme				
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**Total Hours**
3	**0**	**0**	**3**	**30**

Syllabus

Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**Introduction to Transport Phenomena**			**2 (7%)**
	1.1 Concept and Industrial Relevance	---	---	
	1.2 Classification of Transport Processes	---		
	1.3 Conservation Laws	---		
02	**Introduction to Momentum Transport**			**3 (10%)**
	2.1 Molecular Momentum Transport	Introduction to Fluid Mechanics (017083302-Unit-1.3)	---	
	2.2 Temperature and Pressure Dependence of Viscosity	Fluid Flow Phenomena (017083302-Unit-2.1)		
	2.3 Viscosity Prediction for Gases and Liquids			
	2.4 Newton’s Law of Viscosity	Fluid Flow Phenomena (017083302-Unit-2.3)		
	2.5 Convective Momentum Transport			
03	**Shell Momentum Balance and Velocity Distribution in Laminar Flow**			**3 (10%)**
	3.1 Shell Momentum Balance and Boundary Conditions	---	---	
	3.2 Flow of Falling Film	---		
	3.3 Flow Through Circular Pipe	---		
	3.4 Flow Through Annulus	---		
	3.5 Flow Over Moving Plate	---		
04	**Equation of Changes**			**3 (10%)**
	4.1 Equation of Continuity	Baisc Equation of Fluid Flow (017083302-Unit-3.2)	---	
	4.2 Equation of Motion	---		
	4.3 Navier Stokes Equation	---		
05	**Introduction to Energy Transport**			**3 (10%)**
	5.1 Molecular Energy Transport	Introduction to Three modes of Heat Transport (017083403-Unit-1.1)	---	
	5.2 Temperature and Pressure Dependence of Thermal Conductivity	Conduction (017083403-Unit-2.2)		
	5.3 Fourier’s Law	---		
06	**Shell Energy Balance and Temperature Distribution in Solids**			**2 (7%)**
	6.1 Shell Energy Balance & Boundary Conditions		---	
	6.2 Heat Conduction with Electrical Heat Source	Conduction (017083403-Unit-2.3)		
	6.3 Heat Conduction with Chemical Heat Source	Conduction (017083403-Unit-2.3)		
	6.4 Temperature Distribution in Two Concentric Cylinders	---		
	6.5 Heat Conduction Through Composite Wall	Conduction (017083403-Unit-2.3)		
07	**Convective Heat Transfer**			**4 (13%)**
	7.1 Free and Forced Convection	Forced Convection (017083403-Unit-5.1)	---	
	7.2 Natural Convection Heat Transfer Governing Equation	---		
	7.3 Flow Over Flat Plate	---		
08	**Introduction to Mass Transport**			**3 (10%)**
	8.1 Molecular Mass Transport	Introduction to Mass Transfer (017083402-Unit-1.1)	---	
	8.2 Equation of Molecular Mass Transport	Molecular Diffusion in Fluids (017083402-Unit-2.2)		

	8.3 Temperature and Pressure Dependence of Diffusivity	Molecular Diffusion in Fluids (017083402-Unit-2.5)		
09	**Shell Mass Balance and Concentration Distribution in Solids**			
	9.1 Shell Mass Balance and Boundary Conditions	---	---	**4 (13%)**
	9.2 Diffusion Through Stagnant Gas Film			
	9.3 Equimolar Counter Diffusion			
	9.4 Diffusion of A Through Non-Diffusing B			
10	**Mass and Molar Transport by Convection**			
	10.1 Mass and Molar Concentration	---	---	**3 (10%)**
	10.2 Mass Average and Molar Average Velocity			
	10.3 Molecular Mass and Molar Fluxes			
	10.4 Convective Mass and Molar Fluxes			

Proposed Theory + Practical Evaluation Scheme by Academicians
(% Weightage Category Wise and it's Marks Distribution)

L:	3	T:	0	P:	0

Note: In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.
Each Test will be of 25 Marks.
Each Test Syllabus Weightage: Range should be 20% - 30%

Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory	**3**	**3**	MCQ	40%	40
Theory			Theory Descriptive	10%	10
Theory			Formulas and Derivation	50%	50
Theory			Numerical	00%	00
Expected Theory %	**100%**		**Calculated Theory %**	**100%**	**100**
Practical	**0**		Individual Project	0%	0
Practical			Group Project	0%	0
Practical			Internal Practical Evaluation (IPE)	0%	0
Practical			Viva	0%	0
Practical			Seminar	0%	0
Expected Practical %	**0%**		**Calculated Practical %**	**0%**	**100**
Overall %	**100%**			**100%**	**100**

Course Outcome	
1	To understand the fundamentals of transport phenomena, including momentum transport and laminar flow analysis, to comprehend industrial processes and their implications accurately.
2	To achieve proficiency in fundamental transport phenomena, encompassing equations of continuity, motion, and energy transport principles, for comprehensive analysis of temperature distributions and heat conduction scenarios in solids
3	To achieve proficiency in convective heat transfer and mass transport principles to analyze heat and mass transfer phenomena in various scenarios effectively.
4	To analyze and solve complex problems related to mass transfer in solids and fluids, contributing to advancements in various engineering fields.
Suggested Reference Books	
1	"Transprt Phenomena", R. Byron Bird, John Wiley & Sons (Asia) pvt. Ltd. 2nd Edition.
2	"Transport Processes and Separation Process Principles", Christie John Geankoplis, PHI Learning Private Limited., New Delhi, 4th Edition,
3	"Fundamentals of Heat and Mass Transfer", Incropera, John Wiley & Sons (Asia) pvt. Ltd. 6th Edition.
4	"Introduction to Transport Phenomena", W.J.Thomson, Pearson Education Asia, New Delhi, 2001.

List of Open Source Software/Learning Website	
1	https://nptel.ac.in/courses/103/105/103105128/
2	https://nptel.ac.in/courses/103/103/103103146/