

<b>GANPAT UNIVERSITY</b>									
<b>FACULTY OF ENGINEERING &amp; TECHNOLOGY</b>									
Programme		Bachelor of Technology			Branch/Spec.		Petrochemical Engineering I		
Semester		IV			Version		1.0.0.0		
Effective from Academic Year			2020-21		Effective for the batch Admitted in			July 2019	
Subject code		2PCE4101	Subject Name		<b>Heat Transfer Operations</b>				
Teaching scheme					Examination scheme (Marks)				
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	1	1	0	5	Theory	40	60	100
Hours	3	1	2	0	6	Practical	30	20	50
Pre-requisites:									
-									
Course Objective									
<ul style="list-style-type: none"> <li>• To Know the basic concept of heat conduction.</li> <li>• Understand heat transfer by convection and radiations.</li> <li>• To design different types of heat exchangers by using LMTD method.</li> <li>• Understand Heat transfer in extended surfaces such as fins, conduction convection heat transfer.</li> </ul>									
Theory syllabus									
Unit	Content								Hrs
<b>1</b>	<b>Conduction:</b> Conduction through a single homogeneous solid, thermal conductivity of solids, liquids and gases. Conduction through several bodies in series. Contact resistances. Unsteady state heat conduction, lumped heat capacity system, transient heat flow in a semi-infinite solid.								<b>7</b>
<b>2</b>	<b>Heat Transfer by Convection:</b> Forced convection, Laminar heat transfer on a flat plate Laminar and turbulent flow heat transfer inside and outside tubes. Film and overall heat transfer coefficients. Resistance concept, Coefficients for scale deposits, L.M.T.D. in heat exchangers with co and counter current flow. Heat exchanger design, Effectiveness – NTU method in finned tube heat exchangers. Natural convection: Heat transfer from plates and cylinders in verticals and horizontal configuration, natural convection to spheres. Heat transfer with phase change, i. e. heat transfer in Boiling and condensation, Single and multiple effect evaporators.								<b>10</b>
<b>3</b>	<b>Heat Transfer by Radiation:</b> Black and grey body radiations, view factor, luminous and non-luminous gases. Combined heat transfer, i.e. conduction, convection and radiation together, Concept of critical insulation thickness..								<b>6</b>
<b>4</b>	<b>Combined natural and forced convection:</b> Fluid flow and heat transfer across cylinders and spheres. Combined natural and forced convection heat transfer in horizontal circular conduits. Heat transfer in extended surfaces such as fins, conduction convection heat transfer ,forced convection heat transfer in circular conduits with longitudinal fins. Heat transfer in non-Newtonian fluids								<b>9</b>

5	<b>Heat exchanger design:</b> Design of single and multi-pass shell and tube type exchangers using LMTD and effectiveness – NTU methods. Spiral coil and plate type heat exchangers. Single and multi-phase condenser. Design of Reboilers, vaporisers. Kettle type and Thermo siphon reboilers ,forced circulation vaporizers.	7
6	<b>Heat transfer in packed and fluidized beds.</b> Heat transfer in agitated vessels both, jacketed and with coil, Determination of overall heat transfer coefficient, transient heating or cooling	6
<b>Assignments and tutorials are based on the above syllabus.</b>		
Practical Content		
Practical list shall be based on the above content of subject		
Text Books		
1.	J. M. Coulson and J. F. Richardson, “Chemical Engineering”, Vol. 1 ELBS, Pergamon press, 1970	
2.	Geoffrey Hewitt, G.L.Shires and T.Reg Bott , “Process Heat Transfer” CRC press,1994.	
3	J.P.Holman, “Heat Transfer” 10th Editon,Tata McgrawHill publishing ltd.2011	
Reference Books		
1.	J. M. Coulson and J. F. Richardson, “Chemical Engineering” Vol. 2 ELBS, Pergamon press, 1970	
2.	W. L. McCabe J. C. Smith and P. Harriot, “Unit Operations of Chemical Engineering”, 4th ed. McGraw Hill 1985.	
<b>ICT/MOOCs</b>		
1.	<a href="https://nptel.ac.in/courses/103103032/">https://nptel.ac.in/courses/103103032/</a>	
2.	<a href="https://nptel.ac.in/courses/103101137/">https://nptel.ac.in/courses/103101137/</a>	
3.	<a href="https://nptel.ac.in/courses/103105140/">https://nptel.ac.in/courses/103105140/</a>	
Course Outcomes		
<p>Know the basic concept of heat conduction.</p> <p>Understand heat transfer by convection and radiations.</p> <p>Student will able to design different types of heat exchangers by using LMTD method.</p> <p>Able to know Heat transfer in extended surfaces such as fins, conduction convection heat transfer</p>		