



**C. U. SHAH UNIVERSITY**  
**Wadhwan City**

**FACULTY OF:** - Technology & Engineering  
**DEPARTMENT OF:** - MECHANICAL ENGINEERING  
**SEMESTER:** - VI  
**CODE:** - 4TE06HMT1  
**NAME:** – Heat and Mass Transfer (HMT)

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**TEACHING & EVALUATION SCHEME:-**

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
		Th	Tu	Pr	Total		Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
							Marks	Hours	Marks	Hours	Pr/Viva	TW	Pr	
4TE06HMT1	Heat and Mass Transfer (HMT)	3	0	2	5	4	30	1.5	70	3	---	20	30	150

**Objectives:-**

- It gives fundamental difference between thermodynamics and heat transfer and different modes of heat transfer.
- Clear understanding about different laws governing the heat transfer modes, their physical significance and list their applications.

**Prerequisites:-**

Basic knowledge of thermodynamics and mathematics for the related practices.

**Course outline:-**

Sr. No.	Course Content	No. of Hours
1	<b>Introduction:</b> Typical heat transfer situations, Modes of heat transfer, Heat transfer parameters, Different thermo physical properties, Effect of temperature on thermal conductivity of various kinds of materials	02
2	<b>Heat Conduction:</b> Fourier's law, General three-dimensional heat conduction equation in Cartesian, Cylindrical and spherical co-ordinates, One dimensional steady conduction through plane wall, composite plane, cylinder and sphere, Critical thickness of insulation, Heat transfer from extended surface (fins), Types of fins, Heat transfer through rectangular fins, infinite long fins, fins insulated at tip and fin losing heat at tip, Efficiency and effectiveness of fins, Biot number.	10
3	<b>Heat Convection:</b> Newton-Rikhman law, Dimensional analysis applied to forced and free convection, Dimensional numbers and their physical significance, Empirical corrections for free and forced convection, Thermal and hydrodynamics of boundary layers, Continuity momentum and energy equations, Blasius solution for laminar boundary layer, Von-Karman	10



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	integral solution.	
4	<b>Heat Radiation:</b> Absorptivity, reflectivity and transmissivity, Black white and grey body, Emissive power and emissivity, Laws of radiation, Planck, Stefan-Boltzmann, Wein's displacement law, Kirchoff's law, Intensity of radiation and solid angle, Lambert's cosine law, Radiation heat exchange between black bodies, Shape factor, Heat exchange between non-black bodies, Infinite parallel planes and infinite long concentric cylinders, Radiation shield, Heat exchange between two grey surfaces, Electrical analogy.	<b>10</b>
5	<b>Heat exchangers:</b> Types of heat exchangers, Overall heat transfer coefficient, Analysis of heat exchangers, LMTD method, Effectiveness-NTU method, Correlation factor and effectiveness of heat exchangers	<b>5</b>
6	<b>Boiling and Condensation:</b> Boiling heat transfer Pool boiling, Condensation heat transfer, Film condensation, Dropwise condensation.	<b>3</b>
7	<b>Mass Transfer:</b> Modes of mass transfer, Concentration, velocities and fluxes, Fick's law, General mass diffusion equation in stationary media, Steady state diffusion through a plain membrane, Mass transfer coefficient, Convective mass transfer.	<b>5</b>

**Learning Outcomes: -**

- The learners may able to get balanced treatment of the heat exchange in simple, lucid and easily understandable way without sacrificing emphasis on the fundamental aspects.
- Help to appreciate the importance of heat transfer in various fields of engineering.

**Books Recommended:-**

1. Heat & Mass Transfer by **Dr. D. S. Kumar**, S. K. Kataria & Sons, New Delhi.
2. Heat & Mass Transfer by **Er. R. K. Rajput**, S. Chand & Company Ltd., New Delhi.
3. Heat & Mass Transfer by **Arrora & Domkundwar**, Dhanpat Rai and Co., New Delhi.

**Research reference:-**

1. Heat Transfer by **J. P. Holman**, Tata McGRAW Hill.
2. Introduction to Thermodynamics and Heat Transfer by **Yunus and A. Cengel**, McGRAW Hill, International.
3. Heat and Mass Transfer by **P.K. Nag**, Tata McGRAW Hill, New Delhi.
4. Heat Transfer by **S. P. Sukhatme**, University Press.
5. Fundamental of Heat and Mass Transfer by **C. P. Kothandraman**, New Age International.