SWARNANDHRA COLLEGE OF ENGINEERING AND TECHNOLOGY
(Autonomous)
Narsapur, West Godavari District, A.P. 534280
DEPARTMENT OF MECHANICAL ENGINEERING

TEACHING PLAN

Course Code	Course Title	Semester	Branches	Contact Periods /Week	Academic Year	Date of commencement of Semester
23ME6T01	HEAT TRANSFER	VI	ME	6	2025-26	10-12-25

COURSE OUTCOMES

CO1	Describe the fundamental modes and laws of heat transfer.[K3]
CO 2	Solve one-dimensional conduction problems in various geometries.[K3]
CO 3	Apply convective heat transfer principles to external and internal flows.[K3]
CO 4	Examine the rate of heat transfer with phase change.[K3]
CO 5	Analyze performance of heat exchangers.[K4]
CO 6	Determine radiation heat transfer between surfaces and apply shape factor concepts.[K3]

UNIT	Out Comes / Bloom's Level	Topics No.	Topics/Activity	Text Book / Reference	Contact Hour	Delivery Method
I	CO1: Describe the fundamental modes and laws of heat transfer. [K3]	**Introduction, Conduction Heat Transfer, One Dimensional Steady State Conduction Heat Transfer**				
		1.1	General discussion about applications of heat transfer, Basic modes of heat transfer,	T1,T2	1	Chalk & Talk, PPT Videos and Active learning (Role play)
		1.2	Laws of heat transfer	T1,T2	1	
		1.3	General conduction equation in Cartesian coordinates	T1,T2	1	
		1.4	General conduction equation in cylindrical coordinates	T1,T2	1	
		1.5	General conduction equation in spherical coordinates	T1,T2	1	
		1.6	Steady, unsteady and periodic heat transfer, Initial and boundary conditions.	T1,T3	1	
		1.7	One dimensional conduction heat transfer without heat generation in plane, composite planes, cylinder and composite cylinders.	T1,T3	1	
		1.8	Overall heat transfer coefficient, Electrical analogy – Critical radius of insulation. Variable Thermal conductivity	T1,T3	1	
		1.9	One dimensional conduction heat transfer with heat generation in plane and cylinder.	T3,R3	1	
		1.10	Extended surface (fins) Heat Transfer –types, General fin heat transfer equation for long Fin	T1,T3,R2	1	
		1.11.	General fin heat transfer equation for fin with insulated tip, General fin heat transfer equation Short Fin,	T1,T3	1	
		1.12	Fin effectiveness, Fin efficiency	T1,T3,R2	1	
		1.13	Problems		3	
					15	

II	Solve one-dimensional conduction problems in various geometries.[K3]					
		2.1	Systems with negligible internal resistance , Lumped heat analysis	T1,T2	1	Chalk & Talk, PPT Videos and Active learning (Think-pair-share)
		2.2	Significance of Biot and Fourier Numbers,	T1,T3	1	
		2.3	Chart solutions of transient conduction systems.	T1,T2	1	
		2.4	Concept of Semi-infinite body.	T1,T3,R2	1	
		2.5	Problems	T1,T2	3	
		2.6	Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow	T1,T2	1	
		2.7	Dimensional analysis as a tool for experimental investigation – Buckingham π Theorem and method	T1,T2	1	
		2.8	application for developing semi – empirical non- dimensional correlation for convection heat transfer	T1,T3	1	
		2.9	Significance of non-dimensional numbers – Concepts of Continuity	T1,T3	1	
		2.10	Concepts of Momentum and Energy Equations	T1,T3	1	
		2.11	**(Beyond syllabus)** Semi – infinite body and finite bodies of cylinders and cubes.		1	
				Total	13	
III	Apply convective heat transfer principles to external and internal flows.[K3]	**Forced convection: External Flows:**				
		3.1	Concepts about hydrodynamic boundary layer and thermal boundary layer	T1,T2,T4	1	Chalk & Talk, PPT Videos and Active learning (Think-pair-share)
		3.2	Use of empirical correlations for convective heat transfer -Flat plates	T1,T2,T4	1	
		3.3	Use of empirical correlations for convective heat transfer - Cylinders.	T1,T2,T4	1	
		3.4	Problems on external flows	T1,T2,T4	2	
		3.5	Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths	T1,T2	1	
		3.6	Division of internal flow based on this – Use of empirical relations for Horizontal Pipe Flow and annulus flow.	T1,T2,T4	1	
		3.7	Problems on internal flow	T1,T2,T4	2	
		3.8	Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate -	T1,T2,T4	1	
		3.9	Use of empirical relations for Vertical plates and pipes.	T1,T2,T4	1	
		3.10	Problems	T1,T2,R1	2	
					13	

IV	Examine the rate of heat transfer with phase change.[K3] Analyze performance of heat exchangers.[K4]	**Heat Transfer with Phase Change Boiling:& Condensation and Heat Exchangers**				
		4.1	**Boiling:** Pool boiling Regimes Calculations on Nucleate boiling,	T1,T2	1	Chalk & Talk, PPT Videos and Active learning (Think-pair-share)
		4.2	Critical Heat flux and Film boiling	T1,T2	1	
		4.3	**Condensation:** Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate	T1,T2	1	
		4.4	Film condensation on vertical and horizontal cylinders using empirical correlations.	T1,T2	1	
		4.5	Problems on boiling	T1,T2,R1	1	
		4.6	Problems on condensation.	T1,T2,R1	1	
		Heat Exchangers				
		4.7	Applications, Classification of of heat exchanger, overall heat transfer Coefficient and fouling factor	T1,T2	1	
		4.8	Heat exchanger analysis - LMTD method	T1,T2	1	
		4.9	Effectiveness- NTU method	T1,T2	2	
		4.10	Cross flow heat exchanger, Shell and tube heat exchanger.	T1,T2	1	
		4.11	Problems	T1,T2,R1	2	
				Total	13	
V	Determine radiation heat transfer between surfaces and apply shape factor concepts.[K3]	**5 Radiation Heat Transfer**				
		5.1	Emission characteristics and laws of black-body radiation	T1,T4,R3	1	Chalk & Talk, PPT Videos and Active learning (Flipped class room)
		5.2	Emissivity, Absorptivity, Reflectivity and transmissivity, Concept of Black body, Irradiation – total and monochromatic quantities	T1,T4,R3	1	
		5.3	Planck's law and Wein's displacement law and Kirchhoff law	T1,T4,R3	1	
		5.4	Stefan – Boltzmann's law of radiation and Lambert cosine law	T1,T4,R3	1	
		5.5	Intensity of radiation	T1,T4,R3	1	
		5.6	Radiation heat transfer between black bodies	T1,T4,R3	1	
			Concept of Shape factor	T1,T4,R3	1	
		5.7	Emissivity, Radiation heat transfer between gray bodies	T1,T4,R3	1	
		5.8	Radiation shields, electrical analogy for radiation networks	T1,T4,R3	1	
		5.9	Problems	T1,T2,R1	3	
				Total	12	
				CUMULATIVE PROPOSED PERIODS	66	

Text Books:

S.No	AUTHORS, BOOK TITLE, EDITION, PUBLISHER, YEAR OF PUBLICATION
T1	R.C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, 6th edition,New Age Internationals, 2022
T2	R K Rajput, Heat and Mass Transfer, Revised 7th Edition, S Chand- 2018
T3	D.S. Kumar, Heat Transfer, 8thEdition, S. K. Kataria, & Sons, 2015.

T4	J. P. Holman, Heat Transfer, 10th Edition, Tata McGraw-Hill publishing Company Limited, 2017.
Reference Books:	
R1	Yunus A. Cengel Heat and Mass Transfer - Fundamentals and Applications, 6th Edition, McGraw Hill Education, 5 August 2020
R2	P. K. Nag, Heat and Mass Transfer,3rd Edition, Tata McGraw-Hill Education, 2011.
R3	S. C Arora,S. Domkundwar and Anand V. Domkundwar, Heat and Mass Transfer, 2nd Edition, , Dhanpat Rai & co, 2007.
Web Details	
1	https://nptel.ac.in/courses/112101097
2	https://www.youtube.com/watch?v=qa-PQOjS3zA
3	https://www.youtube.com/watch?v=jc_hL_tSFzo
4	https://www.youtube.com/watch?v=6OGnB9tywtI
5	https://www.youtube.com/watch?v=CDncSyDvpdQ

		Name	Signature with date
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