



National Institute of Technology Meghalaya
An Institute of National Importance

CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2018
Department	Mechanical Engineering	Semester	V

Course Code	Course Name	Credit Structure				Marks Distribution	
		L	T	P	C	Continuous Evaluation	Total
ME 353	Thermal Engineering Lab	0	1	2	2	100	100
Course Objectives	To provide student with the knowledge of different types of heat transfer, heat exchangers and refrigeration systems.	Course Outcomes	CO1	Demonstrate necessary skills to apply Fourier's law of heat conduction in order to obtain thermal conductivity of different samples of solid, liquid and gas using heat conduction unit. Illustrate temperature profiles in these experiments.			
	To develop the student's ability to measure thermal conductivities, heat transfer coefficients and COP of refrigeration system.		CO2	Demonstrate necessary skills to classify, compare and explain free and forced convection phenomena through flat plate, pipe bundles and fins. Calculate and compare heat transfer coefficients, efficiencies, Nusselt number and Reynolds number for free and forced convection.			
			CO3	Demonstrate necessary skills to explain different types of heat exchangers, while classifying different types of flow arrangements. Evaluate and analyze mean heat transfer coefficients, LMTD and illustrate temperature profiles in these experiments.			
	To develop students ability to analyze thermal performance parameters for application towards real life thermal engineering applications		CO4	Demonstrate necessary skills to verify Lambert's cosine law and Kirchoff's Law on absorptivity, reflectivity and emissivity with thermal radiation unit.			
			CO5	Demonstrate necessary skills to illustrate different components in a refrigeration unit and compare and analyze performance of vapour compression and vapour absorption refrigeration units.			

No.	COs	Mapping with Program Outcomes (POs)											Mapping with PSOs			
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	CO ₁	3	2	2	2	0	0	0	2	2	3	0	2	3	2	0
2	CO ₂	3	2	2	2	0	0	0	2	2	3	0	2	3	2	0
3	CO ₃	3	2	2	2	0	0	0	2	2	3	0	2	3	2	0
4	CO ₄	3	2	2	2	0	0	0	2	2	3	0	2	3	2	0
5	CO ₅	3	2	2	2	0	0	0	2	2	3	0	2	3	2	0

SYLLABUS

No.	Content	Hours	COs
I	Introduction Introducing student with fundamental concepts of types of heat transfer by conduction, convection and radiation, heat exchangers and fundamental methods of refrigeration systems. Introducing students with tubular and shell-and-tube heat exchanger units and vapour compression and absorption refrigeration units.	03	All COs
II	Heat conduction in solids Determination of thermal conductivity and temperature profile during linear and radial heat conduction	03	CO1
III	Heat conduction in gases and liquids Determination of thermal conductivities of various fluids at different temperatures during steady-state heat conduction in gases and liquids.	03	CO1
IV	Study of heat convection Test Unit for Free and Forced Convection: Measuring the heat transfer rates, coefficients, efficiencies, Reynolds and Nusselt numbers for free and forced convection through flat plate, pipe bundle and fins.	03	CO2
V	Heat exchangers Tubular Heat Exchanger: Measuring and plotting the temperature curves in parallel-counter flow, cross parallel-cross counter flow operation, calculation of mean heat transfer coefficient. Shell and Tube Heat Exchanger: Measuring and plotting the temperature curves in parallel-counter flow, crossparallel-cross counter flow operation, calculation of mean heat transfer coefficient.	03	CO3
VI	Radiation unit Thermal Radiation Unit: Verifying the Lambert's cosine law; Kirchoff's laws on absorptivity, reflectivity and emissivity.	03	CO4
VII	Vapour compression refrigeration unit Understanding the operation of key components of a vapour compression refrigeration system (compressor, evaporator, condenser, and expansion element) and the cycle. Performing the energy balance.	03	CO5
VIII	Vapour absorption refrigeration unit Studying the basic principle of an absorption refrigeration system under various loads.	03	CO5
Total Hours		24	

Essential Readings

- F. P. Incropera, Incropera's Principles of Heat and Mass Transfer, Wiley.
- Y. A. Cengel, A. J. Ghajar, Heat and Mass Transfer: Fundamentals and applications., McGraw Hill education

Supplementary Readings
1. A. Bejan, "Convective Heat Transfer", John Wiley and Sons.
2. C. P. Arora, "Refrigeration and Air Conditioning", Tata McGraw Hill.
3. R. J. Dossat, "Principles of refrigeration", John Wiley and Sons.