INSTITUTE	**FACULTY OF ENGINEERING AND TECHNOLOGY**
PROGRAM	**BACHELOR OF TECHNOLOGY (MECHANICAL ENGINEERING - ROBOTICS & AUTOMATION)**
SEMESTER	**3**
COURSE TITLE	**THERMOFLUIDS ENGINEERING**
COURSE CODE	**01MR0301**
COURSE CREDITS	**4**

Objective:

1 The objective of this course is to provide fundamental knowledge of thermodynamics, heat transfer, and fluid mechanics, and to enable students to understand and apply these principles to analyze the working and performance of compressors and hydraulic systems used in robotic and automated engineering applications

Course Outcomes: After completion of this course, student will be able to:

1 Apply the laws of thermodynamics and steady flow energy equations for various systems

2 Analyze the working principles, performance, and heat transfer characteristics of different types of compressors

3 Apply the basic equations of fluid mechanics (continuity, energy, and momentum) to compute flow parameters in fluid systems

4 Analyze fluid flow through pipes and boundary layers by evaluating losses, friction factors, flow regimes, and measurement techniques in fluid transport systems

5 Evaluate the performance, efficiency, and suitability of different pump and hydraulic systems for fluid power transmission

Pre-requisite of course: Elements of Mechanical Engineering

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**BASIC THERMODYNAMICS** Systems: Closed, Open and Isolated, Property, State, Path and Process, Quasi-Static Process, Zeroth Low,, First Law, Steady Flow Energy Equation., Engineering Applications of Steady Flow Energy Equation., Second Law, Kelvin-Planck Statement – Clausius Statement – Concept of Entropy	8

Contents : Unit	Topics	Contact Hours
2	**COMPRESSORS** Classifications of Compressors, Single Stage and Multi Stage, Effect of Intercooler in Multi Stage Compressor, Perfect and Imperfect Intercooler, Work Done by the Compressor, Reciprocating, Rotary, Axial, Vane Compressors, Study of Heat Transfer, Modes of Heat Transfer.	10
3	**BASIC EQUATIONS** Properties of Fluids, Fluid Statics, Pressure Measurements, Buoyancy and Floatation, Flow Characteristics, Concept of Control Volume and System, Reynold's Transportation Theorem, Continuity Equation, Energy Equation and Momentum Equation - Applications	8
4	**FLOW THROUGH PIPES AND BOUNDARY LAYER** Flow Measurement, Orifice meter, Venturi meter and Pitot Tube, Reynold's Experiment, Laminar Flow Through Circular Conduits, Darcy Weisbach Equation, Friction Factor, Moody Diagram, Major and Minor Losses, Hydraulic and Energy Gradient Lines, Pipes in Series and Parallel	8
5	**PUMPS** Classification of pumps, Centrifugal pumps, Working principle, Heads and Efficiencies, Velocity triangles, Work Done by The Impeller, Performance Curves, Reciprocating Pump Working Principle, Indicator Diagram and its Variations, Work Saved by Fitting Air Vessels, Rotary Pumps.	8
Total Hours		**42**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment - 1** To determine the different types of flow Patterns by Reynolds's experiment	2
2	**Experiment - 2** To determine the equivalent length of the different fitting arrangements in pipe flow	2
3	**Experiment - 3** To determine the frictional losses encountered in a hydraulically smooth pipe under laminar and turbulent flow situations	2
4	**Experiment - 4** To determine the coefficient of discharge through an orifice meter	2
5	**Experiment - 5** To determine the coefficient of discharge through venturi meter	2
6	**Experiment - 6** To perform an experiment on a double stage reciprocating air compressor	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
7	**Experiment - 7** To perform an experiment on a centrifugal air compressor/blower	2
8	**Experiment - 8** To conduct the performance test for Centrifugal pump	2
9	**Experiment - 9** To conduct the performance test for the Reciprocating pump	2
10	**Experiment - 10** To determine effective thermal conductivity of the composite wall	2
11	**Experiment - 11** To determine heat transfer co-efficient by natural convection	2
12	**Experiment - 12** To determine the metacentric height of a floating body	2
Total Hours		**24**

Textbook :

1 Engineering Thermodynamics, Nag. P.K., Tata McGraw-Hill, 2017

2 Hydraulics and Fluid Mechanics, Modi P.N. and Seth S.M, Standard Book House, 2019

References:

1 Thermodynamics, Thermodynamics, Arora C.P, Tata McGraw-Hill, 2017

2 Thermodynamics, Thermodynamics, Ramalingam K.K., Sci-Tech Publications, 2009

3 Fluid Mechanics: A Concise Introduction, Fluid Mechanics: A Concise Introduction, Pani B S, Prentice Hall of India Private Ltd, 2016

4 Hydraulics, Fluid Mechanics and Fluid Machines, Hydraulics, Fluid Mechanics and Fluid Machines, Ramamurtham S., Dhanpat Rai Publishing Co Pvt., 2014

5 Fluid Mechanics and Hydraulic Machines, Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publications, 2019

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
0.00	0.00	50.00	30.00	20.00	0.00

Instructional Method:

1 Power Point Presentation

Supplementary Resources:

1. https://uorepc-nitk.vlabs.ac.in/exp/flow-through-pipes/index.html
2. https://uorepc-nitk.vlabs.ac.in/exp/flow-through-fittings/index.html