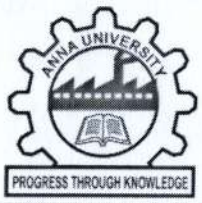

DEPARTMENT OF PRODUCTION TECHNOLOGY

MIT CAMPUS

ANNA UNIVERSITY : : CHENNAI – 600 044.

COURSE PLAN

COURSE DETAILS:

Degree	B.E		
Programme Name	ROBOTICS AND AUTOMATION (4/8)		
Course Code &Title	PR 5301 THERMODYNAMICS AND FLUID MECHANICS		
Credits	3	**Session**	Jan - Jun 2024
Course Type	CORE	**Section**	1
Name of the Faculty	Mr.A.Visagan, Teaching Fellow, Department of Production Technology, MIT Campus, Anna University, Chennai -44		

COURSE CONTENT:

Syllabus: (Approved Syllabus as per Regulation 2019)

UNIT I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS **9**

Thermodynamic system and surroundings – properties of system – STATE AND EQUILIBRIUM – Forms of energy – Quasi static process – Zeroth law of thermodynamics – Work and heat transfer – Path and point functions – First law of thermodynamics applied to open systems – SFEE equation and its applications. Second law of thermodynamics applied to Heat engines, Refrigerators& Heat pumps. Carnot's theorem and clausius inequality – Concept of entropy applied to reversible and irreversible processes – Third law of thermodynamics.

UNIT II INTRODUCTION TO APPLICATIONS OF THERMODYNAMICS **9**

Air standard cycles – Thermodynamics assumption – Otto cycle, diesel cycle and Brayton cycle (air standard efficiency, mean effective pressure and power. Air compressors: classification, single and multistage compressors, inter-cooler in compression process. Refrigerators: classification, vapour compression and absorptions systems, Eco-friendly refrigerants. Heat Transfer: introduction to modes of heat transfer with examples.

UNIT III BASIC CONCEPT OF FLUID MECHANICS & FLOW OF FLUIDS **9**

Fluid: Properties and types. Pressure: laws of pressure, types of pressure, pressure measurement using manometers and mechanical gauges. Viscosity: Kinematic and dynamic viscosity. Fluid kinematics and dynamics – Types of fluid flow – velocity – rate equation of continuity – energy of a liquid in motion – head of a liquid – Bernoulli's theorem

UNIT IV DIMENSIONAL AND MODEL ANALYSIS 9

Dimension – need for dimensional analysis, Rayleigh's and Buckingham's method applied to flow problems, limitation of dimensional analysis. Model analysis – similitude, dimensionless numbers and their significance, similarity laws, model studies, limitation of scale models.

UNIT V HYDRAULIC MACHINES 9

Introduction and classification of hydraulic machines. Reciprocating pump: constructional details, working principle, co-efficient of discharge, slip, power required. Centrifugal pump: classification and working principle, specific speed. Turbines: classification, working principle of a Pelton wheel turbine.

TOTAL =45 PERIODS

TEXT BOOKS:

1. Nag, P.K., "Engineering Thermodynamics", Tata McGraw-Hill Co. Ltd., 2007.
2. Chattopadhyay, P.," Engineering Thermodynamics", Oxford University Press, New Delhi, 2010.
3. Rathakrishnan, E., "Fundamentals of Engineering Thermodynamics" Prentice-Hall India, 2005.
4. Bansal. R.K., "Fluid Mechanics and Hydraulics Machines", Lakshmi Publications Pvt. Ltd., New Delhi, 9th Edition, 2015.

REFERENCES:

1. Reynold, "Thermodynamics", Int. Student Edition, McGraw-Hill Co. Ltd., 1990.
2. Ramalingam, K.K., "Thermodynamics", Sci-Tech Publications, 2006
3. Holman, J.P," Heat Transfer", 3rd Edition, McGraw-Hill, 2007.
4. Shames, I.H., "Mechanics of Fluids", Kogakusha, Tokyo, 1998 5. Kumar, K.L., "Fluid Mechanics", Eurasia Publishers, 1990.

COURSE LEARNING OBJECTIVES

The main learning objective of this course is to prepare the students for:

1. To make students understand the basic laws of thermodynamics.
2. To make the students to familiarize with the concepts, laws and methodologies for the analysis of gas turbines and compressors
3. To introduce the basic concepts of fluid mechanics.
4. To make students understand the working principle of different types of pumps and Hydraulic turbines.

COURSE OUTCOME (CO)

Upon completion of this course, the students will be able to:

1. Understand and apply the basic laws of thermodynamics and fluid mechanics for different
   applications
2. Use the basic concepts and methodologies for the analysis of gas turbine and compressors.
3. Recognize the concepts in fluid mechanics and also know about the flow of fluids
4. Understand the need of dimensional and model analysis.
5. Understand the working principle of different types of pumps and hydraulic turbines.

COURSE ARTICULATION MATRIX

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	1	2	1							1	1		1
2	3	1	2	2	1							1	1		1
3	3	1	2	2	1							1	1		1
4	3	1	1	2	2							1	1		1
5	3	1	1	2	2							1	1		1

The correlation levels:1: Low;2: Medium;3: High.

COURSE ALIGNED PROGRAMME OUTCOMES (PO) & PROGRAMME SPECIFIC OUTCOMES (PSO)

PO	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply knowledge of mathematics, basic science and engineering science.
2	Problem analysis	Identify, formulate and solve engineering problems.
3	Design/development of solutions	Design a system or process to improve its performance, satisfying its constraints.
4	Conduct investigations of complex problems	Conduct experiments & collect, analyze and interpret the data.
5	Modern tool usage	Apply various tools and techniques to improve the efficiency of the system.
6	The Engineer and society	Conduct selves to uphold the professional and social obligations.
7	Environment and sustainability	Design the system with environment consciousness and sustainable development.
8	Ethics	Interacting industry, business and society in a professional and ethical manner.
9	Individual and team work	Function in a multidisciplinary team.
10	Communication	Proficiency in oral and written Communication.
11	Project management and finance	Implement cost effective and improved system.
12	Life-long learning	Continue professional development and learning as a life-long activity.

PSO	Graduates demonstrate
1	The program aims to produce proficient engineers in Robotics and Automation field to serve the various technological needs of Industry and Society.
2	To impart graduates with multidisciplinary engineering knowledge in Robotics and Automation system
3	The program shall create graduates to continuously uplift the knowledge, skill, attitude, self-learning, and teamwork, constantly able to practice the ethical values and protect the environmental eco systems.

COURSE TENTATIVE SCHEDULE / PLAN

Week	Day	Date	Hrs	Unit	Topics	Text / Ref.
1	MO	05/02/2024	2	III	Fluid: Properties and types. Pressure: laws of pressure, types of pressure, pressure	T4

					measurement using manometers and mechanical gauges.	
2	TH	08/02/2024	1		Viscosity: Kinematic and dynamic viscosity. Fluid kinematics and dynamics	T4
3	MO	12/02/2024	2		Types of fluid flow – velocity – rate equation of continuity	T4
4	MO	15/02/2024	1		Energy of a liquid in motion – head of a liquid – Bernoulli's theorem	T4
5	MO	19/02/2024	2	IV	Dimension – need for dimensional analysis, Rayleigh's and Buckingham's method applied to flow problems, limitation of dimensional analysis.	T4
6	MO	22/02/2024	1		Rayliegh method- Problems	T4
7	MO	26/02/2024	2		Buckingham's theorem - Problems	T4
8	MO	29/02/2024	1		Model analysis – similitude, dimensionless numbers and their significance, similarity laws, model studies, limitation of scale models.	T4
9	MO	04/03/2024	2	V	Introduction and classification of hydraulic machines.	T4
10	MO	07/03/2024	1		Construction and working of reciprocating and centrifugal pumps	T4
11	MO	11/03/2024	2		Reciprocating pump: constructional details, working principle, co-efficient of discharge, slip, power required	T4
12	MO	14/03/2024	1		Reciprocating pump-problems and derivation	T4
13	MO	18/03/2024	2		Centrifugal pump: classification and working principle, specific speed.	T4
14	MO	21/03/2024	1		Centrifugal pump – velocity triangle and nomenclature	T4
15	MO	25/03/2024	2		Centrifugal pumps - pumps	T4
16	MO	28/03/2024	1		Turbines – Introduction- Construction and working principle	T4
17	MO	01/04/2024	2		Pelton turbine – velocity triangle and nomenclature and problems	T4
18	MO	04/04/2024	1		Pelton turbine problems	T4
19	MO	08/04/2024	2		Performance curves of pumps and turbines	T4
20	MO	11/04/2024	1	I	Introduction to thermodynamics	T1, R3
21	MO	15/04/2024	2		Thermodynamic system and surroundings – properties of system	T1, R3
22	MO	18/04/2024	1		State and Equilibrium – Forms of energy – Quasi static process	T1, R3
23	MO	22/04/2024	2		Zeroth law of thermodynamics – Work and heat transfer – Path and point functions	T1, R3
24	MO	25/04/2024	1		First law of thermodynamics applied to open systems – SFEE equation and its applications	T1, R3
25	MO	29/04/2024	2		Second law of thermodynamics applied to Heat engines	T1, R3
26	MO	02/05/2024	1		Second law of thermodynamics applied to	T1,

					Refrigerators& Heat pumps. Carnot's theorem and clausius inequality	R3
27	MO	06/05/2024	2	II	Concept of entropy applied to reversible and irreversible processes – Third law of thermodynamics.	T1, R3
28	MO	09/05/2024	1		Air standard cycles – Thermodynamics assumption – Otto cycle, diesel cycle	T1, R3
29	MO	13/05/2024	2		Brayton cycle (air standard efficiency, mean effective pressure and power.	T1, R3
30	MO	16/05/2024	1		Air compressors: classification, single and multistage compressors, inter-cooler in compression process.	T1, R3
31	MO	20/05/2024	2		Refrigerators: classification, vapour compression and absorptions systems, Eco-friendly refrigerants.	T1, R3
32	MO	23/05/2024	1		Heat Transfer: introduction to modes of heat transfer with examples.	T1, R3

COURSE DELIVERY/INSTRUCTIONAL METHODOLOGIES:

✓Chalk & Talk	✓ Stud. Assignments	✓Web Resources
✓ LCD/~~Smartboards~~	✓ Stud. Seminars	☐ Add-On Courses

COURSE ASSESSMENT METHODOLOGIES-DIRECT

✓ University (End Semester) Examination		✓Internal Assessment Tests	
✓ Assignments	☐ Laboratory Practices	☐ Mini/Major Projects	✓Stud. Seminars
☐ Viva Voce	☐ Certifications	☐ Add-On Courses	☐ Others

COURSE ASSESSMENT METHODS

S.N.	Mode of Assessment	Date	Duration	% Weight
1	Internal Assessment Tests1		1½ hr	25 %
2	Internal Assessment Tests2		1½ hr	25 %
3.	University Examination		3 hr	50 %
	Additional marks may be given for Assignments / Group/ Team Seminar Presentation)			

COURSE ASSESSMENT METHODOLOGIES-INDIRECT

✓ Assessment of CO (By Feedback, Once)	✓ Student Feedback On Faculty (Once)
☐ Assessment of Mini/Major projects by Ext. Experts	☐ Others

COURSE (EXTRA) ESSENTIAL READINGS:

1. All tutorials have been given as video sources to the students.

COURSE EXIT SURVEY (will be collected at end of the course)

The purpose of this survey is to find out from students about their learning experiences and their thoughts about the course.

Rating:	1: Slight (Low)	2: Moderate (Medium)	3: Substantial (High)
CO1:			
CO2:			
CO3:			
CO4:			
CO5:			

COURSE POLICY (Compensation Assessment)

1. Attending all the assessment is mandatory for every student
2. Course policy will be followed as per the academic course regulation

COURSE ACADEMIC DISHONESTY AND PLAGIARISM

1. All rules and regulation prescribed by the ACOE, University Departments, are applicable in the Internal Assessment Tests and University (End Semester) Examinations.
   (https://acoe.annauniv.edu/download_forms/student_forms/Guidelines.pdf)
2. In general, possessing a mobile phone, carrying bits of paper with materials, talking to other students, copying from other students during Internal Assessment Tests and University (End Semester) Examinations will be treated as Malpractice and punishable as per the rules and regulations. The misuse of Assignment / Project / Seminar works from others is considered as academic dishonesty and will be treated with the rules and regulations of the University.

COURSE ADDITIONAL INFORMATION

Queries / clarifications / discussion (if required) may be e-mailed to / contact the course instructors during their Office Hours.

For Approval

AVs

Course Faculty

Course Coordinator

6/2/24

Professor in charge

HOD (PT/MIT)