GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Branch: Automobile Engineering

Course / Subject Code : DI01002011

Course / Subject Name : Basics of Automotive Science

w. e. f. Academic Year:	2024-25
Semester:	1st
Category of the Course:	PCC-01

Prerequisite:	NA
Rationale:	This course provides an introduction to the principles of automotive science, focusing on essential concepts in thermodynamics and fluid mechanics. It is designed to diploma students with a foundational understanding of energy systems, fluid behavior, and their applications in the automotive industry. Through the study of energy conservation, fluid properties, system dynamics, and practical applications of hydraulic and pneumatic systems, students will gain the knowledge necessary to comprehend and tackle engineering challenges. Additionally, the course emphasizes energy conservation and sustainable engineering practices, preparing students to appreciate efficient and effective engineering systems.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Recognize basic terminology and laws of thermodynamics.	**R & U**
02	Recognize basic properties & principles of Fluid Mechanics.	**R & U**
03	Apply principles of thermodynamics and fluid mechanics in automotive system and equipment.	**A**

**Revised Bloom's Taxonomy (RBT)*

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	1	0	4	70	30	00	00	100

Course Content:

Unit	Unit Outcomes (UOs)	Topics and Sub-topics
Unit – I **Fundamentals of Thermodynamics**	**1a** Explain importance and application of thermodynamics in engineering. **1b** Explain key terms and properties of thermodynamics. **1c** Explain first law of thermodynamics and concepts of work, heat, enthalpy and specific heats. **1d** Explain second law of thermodynamics and concepts of entropy, reversible and irreversible process, heat engine, refrigerator and heat pump. **1e** Explain various processes on P-V and T-S diagram. **1f** Describe the characteristics of ideal gases and apply the ideal gas laws. **1g** Identify different types of modes of heat transfer and different types of work.	**1.1 Introduction to Thermodynamics** • Definition and scope of thermodynamics • Importance and applications in engineering. **1.2 Basic Concepts and Definitions** • System, surroundings and universe • Types of systems (closed, open, isolated) • Properties of a system (extensive and intensive) • State, state functions, and process • Equilibrium, types of equilibrium **1.3 Energy and the First Law of Thermodynamics** • Work and heat • The first law of thermodynamics (energy conservation) • Internal energy, enthalpy, and specific heats **1.4 Second Law of Thermodynamics** • Introduction to entropy • Reversible and irreversible processes • The second law of thermodynamics • Heat engines, refrigerators, and heat pumps. **1.5** Represent constant pressure, constant volume, constant temperature, adiabatic and polytrophic process on P-V and T-S diagram. **1.6** Ideal gas and their basic laws. **1.7** Introduction to modes of heat transfer and types of work.

Unit –II **Fundamentals of Fluid Mechanics**	**2a.** Recognize importance of fluid mechanics and define various properties of fluid. **2b.** Comprehend concept of pressure and its measurement. **2c.** Describe Pascal's law. **2d.** Explain the types of fluid flow. **2e.** Explain continuity equation and Bernoulli's theorem. **2f.** Explain flow rate measurement with orifice, venture and Pitot tube. **2g.** Explain importance and application of Pneumatics.	**2.1 Introduction to Fluid Mechanics** • Definition and scope of fluid mechanics • Importance and applications in engineering. • Properties of fluids (density, viscosity, surface tension, specific volume, thermal conductivity, specific heat capacity, compressibility.) **2.2 Fluid statics** • Pressure and its measurement (Concept of atmospheric pressure, gauge pressure, vacuum, absolute pressure and pressure measuring devices.) • Pascal's law **2.3 Fluid kinematics and Dynamics** • Types of fluid flow- Steady, unsteady, laminar, turbulent-, one-, two- and three-dimensional flow, uniform and non-uniform flow. • Continuity equation. • Bernoulli's theorem • Flow rate measurement (orifice, Venturi, and Pitot tube) **2.4 Introduction to Pneumatics** • Definition and scope of Pneumatics. • Importance and application of Pneumatics.
Unit –III **Thermodynamics and Fluid Mechanics in Automobile.**	**3a** Represent P-V and T-S diagram of Carnot cycle, Otto cycle, Diesel cycle and Dual cycle. **3b** Describe functional details of IC-engine. **3c** Describe functional details of hydraulic devices.	**3.1** Air cycle: P-V and T-S diagram and equation for air standard efficiency of Carnot cycle, Otto cycle, Diesel cycle, Dual cycle. **3.2** Basic of IC-Engine. (Petrol and diesel engine working.) **3.3** Concept and functional details of Hydraulic lift, hydraulic brakes, hydraulic steering, hydraulic jack,

	3d Describe functional details of various valves. **3e** Describe functional details of air compressor.	hydraulic shock absorber. **3.4** Valve- function, types and requirement, pressure control valve, pressure relief valve, pressure reducing valve, flow control valve, non-return/check valve. **3.5** Pneumatic Components - Air compressors its necessity. **3.6** Energy conservation: Definition, importance of energy conservation, impact on environment and economy. **3.7** Thermodynamics principles of waste heat recovery.

Unit No.	Content	No. of Hours	% of Weightage
1.	Fundamentals of Thermodynamics.	14	35
2.	Fundamentals of Fluid Mechanics.	14	35
3.	Thermodynamics and Fluid Mechanics in Automobile.	17	30
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
50	**25**	**25**	**0**	**0**	**0**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:
(a) Books:

Sr. No.	Title of Book	Author	Publication with place, year and ISBN
1	Thermodynamics	Dr D. S. Kumar	Publisher .S.K : Kataria & Sons; Reprint 2013 edition (1 January 2013) ISBN-10 9380027664 : ISBN-13 9380027661-978 :
2	Fluid Mechanics and Hydraulic machines	Dr. R. K. Bansal	Laxmi Publications; Tenth edition (1 January 2018) ISBN-10 8131808157 : ISBN-13 8131808153-978 :
3	Engineering Thermodynamics	R. K. Rajput	LAXMI PUBLICATIONS (P) LTD (1 January 2009) ASIN B08LTKWKMY :
4	Thermal Science & Engineering	Dr D. S. Kumar	S.K. Kataria & Sons(Year 2020) ISBN: 978-93-5014-428-2
5	A Text book of thermal engineering	R S Khurmi, JK Gupta	S. Chand Publishing ISBN: 9788121925730
6	Energy management: conservation and audit	Anil kumar, Om Prakash, Prashant singh Chauhan and Samsher	CRC Press; 1st edition (28 July 2020) ISBN-13: **978-0367343835**

(b) Open source software and website:

1. https://www.howacarworks.com
2. https://swayam.gov.in
3. https://auto.howstuffworks.com
4. https://en.wikipedia.org
5. https://nptel.ac.in/courses/112/105/112105221

Suggested Activities for Students: If any

Other than the classroom and laboratory learning, following are the suggested student-related **co-curricular** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of each activity. They should also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Charts can be prepared.
b) Small report on any topic given by concern faculty.
c) Small groups of students can be formed for assigned work. Assigned work should be such that it covers market survey, team work, presentation, time management, quality development.

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