



GUJARAT TECHNOLOGICAL UNIVERSITY

Programme Name: Engineering

Level: Diploma

Branch: Mechanical Engineering / Mechanical Engineering (CAD/CAM)

Course /Subject Code: DI01000191

Course /Subject Name: Elements of Mechanical Engineering

w.e.f. Academic Year:	2024-2025
Semester:	1 st
Category of the Course:	PCC-01

Prerequisite:	Zeal to learn the subject
Rationale:	Understanding of basic principles of Mechanical Engineering is required in various field of engineering. Advancement of technology knowledge is must require for the engineering diploma holders. An engineering diploma holder expected to look after many activities at work place. This course mainly encompasses the major areas of mechanical engineering which are required to perform tasks such as selection of hand tools, power tools, hydro-pneumatic devices/equipment, I.C. Engines, pumps, air compressors, boilers and material handling equipment used for various purposes. This course is designed in such a way that practical performed in this course will develop basic skills to perform well in industry as well as in field work.

Course Outcome:

After Completion of the Course, Student will able to:

NO	Course Outcomes	RBT Level
01	Use relevant mechanical power and hand tools in real life applications.	A
02	Recognize the various properties of gases, steams and their applications in an engineering industry.	R
03	Explore the working principles of different prime movers like IC Engine, Boilers, refrigerator, air conditioner etc.	U
04	Select relevant power transmission mode in simple engineering situation.	A
05	Identify and comprehend various hydro-pneumatic devices/equipment, brakes, clutch and couplings.	A



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Teaching and Examination Scheme:

			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				ESE (E)	PA/ CA (M)	PA/CA(I)	ESE(V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction & Basic Mechanical Tools – Application: Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Prime movers and its types. Basic Mechanical Components and its applications like bolts, nuts, washers, bearings, valves, bushes, springs, levers, rivets, keys, o' rings, oil seals, shafts, axles. Different Pipe fittings and its applications. Hand tools and its application like different types of spanners, pliers, screw drivers, chisels, files, hacksaw, hammers. Power tools concepts-applications, its advantages and disadvantages. Concept of industry 4.0	05	10
2.	Properties of Gases: Difference between vapour and gas, perfect gas, gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant and universal gas constant, N.T.P, S.T.P, Relation between Cp and Cv (No Derivation).	04	08
3.	Properties of Steam: Pure substance, Steam formation, Types of Steam, only concept of Degree of superheat, heat of superheat, dryness fraction, quality of steam, wetness fraction and priming.	04	08
4.	Steam Boilers: Introduction, I.B.R, Classification of boilers, Cochran and Babcock and Wilcox boiler, only Functioning of different mountings and accessories.	----	15
5.	Internal Combustion Engines: Introduction, Difference between I.C. Engine and E.C. Engine, Classification of I.C. Engine, Main Components of Engine and their functions, working four- stroke cycle Petrol/Diesel engines, Comparison between Petrol cycle and diesel cycle. Basic concept of CNG and EV. (No Numerical)	05	10



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6.	Pumps: Types, Construction and working of Reciprocating, and Centrifugal pumps, Importance of Priming.	04	08
7.	Air compressor. Working principle, Types, Application. Construction and working of single stage reciprocating air compressor	05	10
8.	Transmission of Motion and Power: Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive.	04	08
9.	Couplings, Clutches and Brakes: Concept and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc).	04	08
10	Refrigeration and air Conditioning: Working of Refrigerant, Vapor compression refrigeration system, Domestic Refrigerator, Window and split air conditioners.	04	08
11	Material Handling Devices Need of material handling. Types, principle of working and applications of material handling equipment. Hoisting equipment, Conveying equipment, Surface & overhead equipment.	06	07
Total		45	100

Note: Unit No. 4 of the above syllabus are to be covered in Practical Hours.

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
35	40	25			

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

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Suggested Course Practical List:

Sr No	List of Practical	No of Hours
1	Demonstrate use of various mechanical items, spanners, hand tools and power tools. Student will prepare the report which will include sketches of each item demonstrated with specifications and applications.	04



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2	Make simple pipe layouts using pipes and pipe fittings as per given drawing.	02
3	Demonstration of various types of boilers.	04
4	Demonstration of different boiler mountings and accessories.	02
5	Demonstration of four stroke petrol/diesel engines.	04
6	Assemble/dismantle centrifugal and reciprocating pump. (Any one)	02
7	Assemble/dismantle centrifugal, reciprocating compressor model. (Any one)	02
8	Assemble/dismantle different brakes, clutches and couplings.	04
9	To demonstrate different arrangement and application of various power transmission drives. Assemble/dismantle different brakes, clutches and couplings.	02
10	To demonstrate vapor compression refrigeration cycle of domestic refrigerator OR window air conditioner OR split air conditioner.	04
	TOTAL	30

List of Laboratory/Learning Resources Required

- Bolts, nuts, washers, bearings, valves, bushes, springs, levers, rivets, keys, o' rings, oil seals, shafts, axles.
- Different Pipe fittings
- Different Hand and Power tools
- Models of Lancashire and Babcock and Wilcox boilers,
- Models of various mountings and accessories.
- Models of various types of IC engines, Single cylinder four stroke petrol/ diesel engine.
- Centrifugal /Reciprocating pumps/Test rig.
- Reciprocating air compressors/Test rig.
- Models of various types of brakes, coupling, clutches, drives
- Charts of refrigeration and air conditioning system.
- Charts/Models of various material handling equipment.



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Suggested Project List:

- Gear: Build model of different gears from cardboard.
- Boilers: Build model of different mountings with suitable material.
- IC Engine: Collect different original I.C. Engine parts and identify material of it.
- Pump: Collect leaflets of pump from market, analyze and compare specifications
- Air Compressor: Collect leaflets of air compressor from market, analyze and compare specifications.
- Coupling: Build model of different couplings from cardboard, wood, plastic or any suitable material

Suggested Activity:

- Prepare report/chart on any actual industrial boiler based on industrial visit
- Prepare report on CNG and Electrical vehicle, air pollution by petrol, diesel and CNG.
- Calculate velocity ratio of any actual drive.

References/Suggested Learning Resources:

(a) Books:

1. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
2. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
3. Fundamental of Mechanical Engineering by G.S. Sawhney, PHI Publication New Delhi
4. Elements of Mechanical Engineering by Sadhu Singh, S. Chand Publication
5. Introduction to Engineering Materials by B.K. Agrawal, McGraw Hill Publication, New Delhi
6. Elements of Mechanical Engineering by P. S. Desai and S. B. Soni, Atul Prakashan

(b) Open-source software and website:

1. <https://nptel.ac.in>
2. www.vlab.co.in
3. <http://www.howstuffworks.com/> Tech stuff
4. <http://en.wikipedia.org/wiki/Boiler>
