GANPAT UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

Programme	Diploma Engineering		Branch	Mechatronics Engineering	
Semester	IV		Version	1.0.0.0	
Effective from Academic Year	2019-20		Effective for the batch Admitted in	June 2018	
Subject code	1MC2402	Subject Name	Fundamentals of Thermal and Fluid Power		

Teaching scheme						Examination scheme (Marks)			
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50

Pre-requisites:
Students must have knowledge of concepts of thermal energy, properties of liquids and gases. Students must aware with electric motor, pump and other prime movers.

Course Learning Outcomes:
The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes: • To understand the basics of thermodynamics. • To analyse the thermodynamic processes of pure substance and steam formation process. • To apply thermodynamic cycles with P-V and T-S diagrams. • To implement heat transfer basics in various applications. • To analyse the applications of fluid mechanics and develop hydraulic devices like pumps & turbines. The practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate course learning outcomes.

Course Content				
Name of UNIT	Unit Content	Unit Learning Outcomes	Marks	Hrs
UNIT – 1 Fundamentals of	1.1. Forms of energy and energy interaction, Steady flow energy equation. 1.2. Law of conservation of energy;	1a. Explain forms of energy interaction (energy transfer) and the law of conservation of energy.	16	12

Thermodynamics	concepts of heat, specific heat, work, process and cycles. 1.3. Thermodynamic systems, properties; Zeroth law, First law, Second law of thermodynamics, two phase system. 1.4. Continuity of mass flow; heat reservoir, source-sink, heat engine, heat pump and refrigerator. 1.5. Different Thermodynamic processes and it's representation on P-V and T-S diagrams; P-V and T-S diagrams of pure substance. 1.6. Steam formation process on above diagrams.	1b. Explain properties of thermodynamics systems and the Zeroth, First, Second laws of thermodynamics with sketches for two phase system. 1c. Explain the principle of heat reservoir, source-sink, refrigerator, heat engine and pump. 1d. Analyse the thermodynamic processes of pure substance and steam formation process with P-V and T-S diagrams.		
UNIT – 2 Thermodynamic system and cycles	2.1. Thermodynamic cycle; Close and open system. 2.2. Reversibility and irreversibility. 2.3. Thermodynamics cycles with PV and T-S diagram and related expression (no derivation) • Carnot cycle • Otto cycle • Diesel cycle • Brayton cycle • Rankine cycle	2a. Compare Close and open system. 2b. Explain thermodynamics cycles with P-V and T-S diagrams. 2c. Describe application of different thermodynamic cycles and the relations of variables of the thermodynamics cycles with simple numerical examples. 2d. Differentiate between reversibility and irreversibility	12	10
UNIT – 3 Heat Transfer	3.1. Various mode of heat transfer. 3.2. Conduction heat transfer, Fourier's law, thermal conductivity and heat transfer through composite wall and cylinders. 3.3. Convection heat transfer, Newton's law of convection, Free and force convection, Coefficient of convection. 3.4. Radiation heat transfer, Stefan and Boltzmann's law, Black body concept. 3.5. Heat exchanger: types and applications.	3a. Describe modes of heat transfer. 3b. Explain conduction of heat transfer. 3c. Explain convection of heat transfer. 3d. Explain radiation of heat transfer. 3e. Describe heat exchanger	8	6
UNIT – 4 Basics of Fluid Mechanics	4.1. Concept, classification and properties of fluid. 4.2. Law governing fluid flow a. Pascal's Law b. Bernoulli's theorem c. Continuity Equation 4.3. Types of fluid flow	4a. Explain the effect of fluid properties on a flow system. 4b. Understand the laws used in fluid mechanics 4c. Differentiate types of fluid flow	8	6

UNIT – 5 Hydraulic Pumps and Prime movers	**Pumps:** 5.1. Concept and classification of pumps. 5.2. Detailed study(construction, working and applications) of a. Centrifugal pump. b. Reciprocating pump. c. Rotary pump. 5.3. Performance (efficiency, discharge, head, specific speed and power consumption) of centrifugal pump and reciprocating pump with simple numerical example. 5.4. Need for priming of centrifugal pump. **Prime Movers:** 5.5. Classification, construction, working principle and applications of: a. Pelton wheel turbine. b. Francis turbine. c. Kaplan turbine. 5.6. Selection criteria of prime movers	5a. Understand classification and working of pumps. 5b. Calculate example to find out efficiency of pump. 5c. Understand basics and working of prime movers.	16	11

List of Practical		
No.	**Unit**	**Name of Practical**
1	4	Demonstration of Bernoulli's theorem.
2	4	Experiment to determine Reynold's number.
3	5	Demonstration of Reciprocating and rotary pumps.
4	5	Demonstration of Centrifugal pump.
5	5	Demonstration of Pelton, Kaplan and Francis turbines.
6	5	Demonstration of Air compressor.
7	3	Study about different types of heat transfer modes.
8	3	Demonstration of counter flow and parallel flow heat exchangers.
9	5	Demonstration of basic hydraulic trainer kit.
10	5	Perform practical to control double acting cylinder.

List of Instruments/Equipment/TrainerBoard	
1	Bernoullie apparatus
2	Reynold's apparatus
3	Pelton, Kaplan and Francis Turbine
4	Electro-hydraulic Trainer kit
5	Reciprocating and rotary pumps

List of Reference Books			
No	Title of Reference Books	Authors	Publication
1	Fluid Mechanics and Hydraulics	Khurmi R. S.	S. Chand publication
2	Thermodynamics	Varia R. B.	ATUL PRAKASHAN
3	Oil Hydraulic Systems	Majumdar S.R.	Tata Mcgraw-Hill
4	Hydraulic and Pneumatic Controls	Srinivasan, R.	Vijay Nicole Imprints
5	Thermodynamic for Engineers	Mathur.M.L., Gupta.S.C.	Metropolitan Book Company-1985
6	Fluid Mechanics and Hydraulics	Varia R. B.	ATUL PRAKASHAN
7	Hydraulics & Hydraulic machinery	Patel.R.C. & Pandya.A.D.	Acharya Book Depot (1967)
8	Heat and Mass Transfer	Rajput R. K.	S. Chand publication

Link of Learning Web Resource	
1	https://www.youtube.com/watch?v=xdRtWK1_2Eo
2	https://www.youtube.com/watch?v=OmhXb-miAhw
3	https://www.youtube.com/watch?v=YvQp2qy5l60
4	https://en.wikipedia.org/wiki/Thermodynamics
5	http://www.howstuffworks.com/search.php?terms=hydraulics
6	http://www.youtube.com/watch?v=FVR7AC8ExIM
7	http://www.youtube.com/watch?v=iOXRoYHdCV0

8	http://hyperphysics.phy-astr.gsu.edu/hbase/fluid.html#flucon
9	https://nptel.ac.in/courses/112105123/
10	https://nptel.ac.in/courses/112103174/21
11	https://www.youtube.com/watch?v=k0BLOKEZ3KU

Mock test	
1	https://www.indiabix.com/mechanical-engineering/hydraulic-machines/
2	https://www.prep.youth4work.com/Practice-Tests/Mechanical-Engineering-Test/Hydraulics-and-Fluid-Mechanics-Test
3	https://www.indiabix.com/mechanical-engineering/thermodynamics/

CO'S AND PO'S MAPPING

PO'S/ CO'S		CO1	CO2	CO3	CO4	CO5
PO1	Proficiently applies concepts, theories and techniques of the relevant natural, physical sciences and knowledge in mathematics.	**SLI**	**SUB**	**SLI**	**SLI**	**SUB**
PO2	Explain and Classify various Sensors, Transducer and Actuators according to the applications also develop a program in Computer Numerical Machine to build given part geometry.	**SLI**	**SLI**	**SLI**	**SLI**	**SUB**
PO3	Apply their engineering knowledge, critical thinking and problem solving skills in professional engineering practice or in non-engineering fields, such as law, medicine or business.	**MED**	**SUB**	**SUB**	**SUB**	**SUB**
PO4	Continue their intellectual development,through, for example, graduate education or professional development courses	**MED**	**SLI**	**SLI**	**SUB**	**SUB**
PO5	Use of appropriate computer languages, modern tool and application software that pertain to Mechatronics engineering technology systems.	**NONE**	**NONE**	**NONE**	**NONE**	**MED.**
PO6	Build Hydraulic and Pneumatics circuits to operate hydraulic and pneumatics actuators as per given logic also able to build logic in Programmable Logic Controller, Micro Controller and Visual Basic to make system works automatic.	**NONE**	**NONE**	**NONE**	**NONE**	**SUB.**
PO7	Retain the intellectual curiosity that motivates lifelong learning and allows for a flexible response to the rapidly evolving challenges of the 21st century	**NONE**	**SLI**	**MED.**	**MED.**	**SUB.**
PO8	Design a system component or process to meet desired need within realistic constraints, such as economic, environmental and social.	**MED.**	**SUB.**	**SUB.**	**SUB.**	**SUB.**
PO9	Values the need for, and demonstrates, ethical conduct and professional accountability.	**NONE**	**NONE**	**NONE**	**NONE**	**NONE**
PO10	Demonstrates effective communication to professional and wider audiences.	**SLI**	**SLI**	**SLI**	**SLI**	**SLI**
PO11	Appreciates entrepreneurial approaches to engineering practice.	**MED.**	**MED.**	**MED.**	**MED.**	**SUB.**
PO12	Apply commitment to quality, timeliness, and continuous improvement.	**SLI**	**MED.**	**MED.**	**MED.**	**MED.**