

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER: V

Subject Name: **Fundamentals of Thermal & Fluid Devices**

Sr. No.	Course content
1.	Fundamentals of Thermodynamics: 1.1 Thermodynamic systems, properties, and classification 1.2 Forms of energy and energy interaction 1.3 Concepts of heat, work, process and cycles. 1.4 Law of conservation of energy 1.5 Steady flow energy equation 1.6 Continuity of mass flow 1.7 Zeroth law 1.8 First law of thermodynamics 1.9 Concepts of heat reservoir, source-sink, heat engine, heat pump and refrigerator. 1.10 Second law of thermodynamics 1.11 Concept of two phase system 1.12 Concept of specific heat 1.13 Different Thermodynamic processes and its representation on P-V and T-S diagrams 1.14 P-V, T-S and H-S diagrams of pure substance 1.15 Steam formation process on above diagrams
2.	Thermodynamic Cycles: 2.1 Concept and definition of thermodynamic cycle 2.2 Close loop and open loop system 2.3 Reversibility and irreversibility 2.4 The following cycles on P-V and T-S diagram and related expression (no derivation) <ul style="list-style-type: none">• Carnot cycle• Otto cycle• Diesel cycle• Brayton cycle• Rankine cycle• Refrigeration cycle with COP 2.5 Simple examples on above cycles.
3.	Fundamentals of Fluid Mechanics: 3.1 Properties of fluid 3.2 Classification of fluids 3.3 Important terms and laws in fluid static's 3.4 Types of fluid flow and its expression (no derivation) 3.5 Bernoulli's theorem

4.	<p>Hydraulic Devices:</p> <p>Sketch, constructional features, (constructional & flow diagram with symbols), working and applications of following devices</p> <ul style="list-style-type: none"> • Various control valves • Manifold • Various fittings and consumables • Various types of pumps which includes centrifugal, gear, reciprocating & rotary • Water turbines (Pelton, Kaplan & Francis) • Intensifier • Hydraulic lift • Hydraulic ram • Accumulator • Hydraulic press
5.	<p>Pneumatic Devices:</p> <p>5.1 Sketch (constructional & flow diagram with symbols), constructional features, working and applications of following devices</p> <ul style="list-style-type: none"> • Various flow control valves (for air/gas) • Directional control valves (DCV) • Pressure control elements • Air motor • Air cylinder • Various types of signal/switching devices • Air compressor <p>5.2 Logic circuits (simple circuit including operating of double acting cylinder, quick return mechanism, press machine etc)</p> <p>5.3 Methods to detect air/gas leakages</p> <p>5.4 Precautions required to avoid leakages</p>
6.	<p>Lubrication Systems:</p> <p>6.1 Need</p> <p>6.2 Different types of lubricants, their designation, standards, properties and applications.</p> <p>6.3 Methods of lubrication and lubricating devices.</p>
7.	<p>Heat Transfer:</p> <p>7.1 Various mode of heat transfer.</p> <p>7.2 Conduction heat transfer, Fourier's law, thermal conductivity and heat transfer Through composite wall and cylinders.</p> <p>7.3 Convection heat transfer, Newton's law of convection, Free and forced convection, Coefficient of convection.</p> <p>7.4 Radiation heat transfer, Stefan and Boltzmann's law, Black body concept, Emissivity, absorptivity.</p> <p>7.5 Overall heat transfer coefficient.</p> <p>7.6 Heat exchanger: introduction, types and applications.</p> <p>7.7 Important coolants, their properties and applications.</p>

Reference Books:

1. Fundamentals of fluid mechanics, by. Dr.D.S.Kumar.
2. Fluid mechanics & hydraulic machines (in S.I.Units), by. R.S.Khurmi.
3. Hydraulic machines and fluid mechanics, Dr. Jagdishlal (Vol 1 & 2).
4. Thermodynamics for engineers, by. M.L.Mathur.
5. Heat engines, by C.S.Shah & N.C.Pandya.
6. Heat engines, by P.L.Balleny.
7. Thermodynamics, by SAAD.
8. Engineering thermodynamics, by P.K.Nag.
9. Applied thermodynamics, by R.C.Patel.
10. Standards/Manual for lubricating mediums.
11. Thermal engineering, by P.L.Balleny.
12. Heat engines, by Pandya & Shah.
13. Fundamentals of Heat Engines and Hydraulics, by Bessra Benicovk.
14. Hydraulic references Rexroth.
15. Pneumatic basic level part no. 93131 Festo.
16. Hydraulic text book basic level part no 93281 festo.