

Branch Name:	Electrical Engineering
Program Code:	ET109
Course Name:	Thermal and Hydraulic Prime Movers
Course Code:	2ET1090405T
Pre-requisite Course:	Zeal to Learn the Subject

Course Objectives:

1. To understand the concepts of energy in general.
2. To understand the fundamentals of general prime movers.
3. To apply the laws/concepts of thermodynamics to basic energy and fluid mechanics systems.
4. To understand the various types of prime movers, this can be connected to generators for power production.
5. To impart the knowledge of various types of pumps.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours Per Week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	SEE		CCA		SEE		CCA						
	L	T	P	Total	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No.	Topic	Total Hours	Weightage (%)
1	VaporPowerCycles: Carnot Cycle, Rankine Cycle, Thermodynamic Variables Effecting Efficiency and output of Rankine Cycle, Analysis of simple Rankine Cycle and Re-heat cycle Steam turbines, Schematic layout of steam power plant, Classification of Steam Turbines: Impulse Turbine and Reaction Turbine, compounding in Turbines, Velocity Diagrams for simple Impulse and Reaction Turbines-work done & efficiency, Properties of steam and use of steam Table, T-s and h-s Diagrams. Analysis of Various Thermodynamic Processes undergone by Steam.	15	35
2	GasTurbines: Simple gas turbine plant, ideal cycle, closed cycle, open cycle, Efficiency, Work, ratio and optimum pressure ratio for simple gas turbine cycle. Actual cycle, analysis of simple cycles & cycles with inter cooling, reheating and regeneration.	09	20

3	Impact of Jets and Pumps: Impact of Jets: Impulse momentum equation, Impact of jet on stationary and moving vanes (flat and curved). Pumps: Types of pumps, centrifugal pumps: Main components, Working principle, Multistage pumps, performance and characteristic curves.	06	15
4	Hydraulic Turbines: Classification of turbines, Working principle, Efficiency calculation of Pelton Wheel, Francis and Kaplan turbines. Governing of turbines, Performance and characteristic curves.	06	15
5	Hydro Power Plant: Components of Hydroelectric power plant, Estimation of water power potential, Estimation of load on turbines: load curve, load factor, capacity factor, utilization factor, diversity factor, load–duration curve, firm power, secondary power, prediction of load.	06	15

Reference Books:

1. A.K. Jain, “Fluid Mechanics & Hydraulic Machinery,” Khanna Publishers, Delhi, 1998.
2. Vijay Gupta, Santhosh. K. Gupta, “Fluid Mechanics and its Applications”, New Academic Science Ltd; 2012.
3. Dr. D.S. Kumar, “Fluid Mechanics and Fluid Power Engineering”, S.K. Kataria & Sons, 2013.
4. R.K. Rajput, “Thermal Engineering”, Laxmi Publications, 2020.
5. M.L. Mathur and F.S. Mehta, “Thermal Engineering”, Jain Brothers, 2009.
6. PK Nag.” Power Plant Engineering”, McGraw Hill Education, 2017.
7. Dr. P.N. Modi & S.M. Seth, “Hydraulics and Fluid Mechanics including Hydraulics Machines”, Standard Book House, 2019.

E-Resources:

1. <https://nptel.ac.in/courses/112104117>
2. <https://nptel.ac.in/courses/112107291>

Course Learning Outcomes (CLO):

CLO	Description	Bloom's Taxonomy Level
CLO1	Describe the basic components of steam power plants and working principles of different types of steam turbines.	2 Understanding
CLO2	Explain the working principle of different types of gas turbines.	2 Understanding
CLO3	Apply the laws of thermodynamics and fluid mechanics to various real life systems.	4 Analyze
CLO4	Apply the basic power cycles knowledge to power production systems.	3 Applying
CLO5	Discuss the working principle of different types of hydraulic turbines.	2 Understanding
CLO6	Illustrate the working principle of centrifugal and reciprocating pumps.	4 Analyze 2 Understanding

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1		L		L						M				
CLO2			L			L		L						H
CLO3	M			L				M						
CLO4				H		L			M		M		M	
CLO5		M			L							M		
CLO6	H				L	M		M		H			L	M

H: High, M: Medium, L: Low