

**LOK JAGRUTI UNIVERSITY (LJU)**  
**INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**Department of Mechanical Engineering (710)**

**Bachelor of Engineering (B.E.) – Semester – V**

<b>Course Code:</b>	017103501	<b>Teaching Scheme</b>				
<b>Course Name:</b>	Applied Thermofluid (017103501)	<b>Lecture (L)</b>	<b>Tutorial (T)</b>	<b>Practical (P)</b>	<b>Credit</b>	<b>Total Hours</b>
<b>Prerequisite Course:</b>	Mathematics 1 (017101191), Engineering Mechanics (017102291), Thermodynamics 1 (017103301), Thermodynamics 2 (017103403), Fluid Mechanics (017103491)	3	1	2	5	40

<b>Syllabus</b>						
<b>Unit No.</b>	<b>Topic</b>	<b>Prerequisite Topic</b>	<b>Successive Topic</b>	<b>Teaching Hours</b>		
<b>01</b>	<b>Hydropower Plant</b>			<b>1 (2.5%)</b>		
	1.1 Introduction to Hydropower Plant	---	---			
	1.2 Classification of Hydropower Plant	---	---			
	1.3 Essential Components of Hydropower Plant	Applied first law of thermodynamic (017103403-Unit-03)	---			
<b>02</b>	<b>Impact of Jet</b>			<b>8 (20%)</b>		
	2.1 Introduction to Impact of Jet		---			
	2.2 Force exerted on stationary plate held normal and inclined to Jet	Moment and couple (017102291-Unit-03), Centre of gravity (017102291-Unit-08), Basic differentiation (017101191-Unit-03), Trigonometry and geometry (017101191-Unit-02)	Hydraulic Turbine - Impulse & Reaction (017103501-Unit-03,04)			
	2.3 Force exerted on moving plate held normal and inclined in direction of moving jet					
	2.4 Force exerted by liquid jet on a hinged plate					
	2.5 Force exerted by liquid jet on a stationary curved vane					
	2.5 Force exerted by liquid jet on a moving curved vane					
	2.6 Jet striking on moving curved vane tangentially at one tip and leaving at other end					
	2.7 Impact of Jet on series of flat plate mounted on wheel					
	2.8 Impact of Jet on series of radial curved vane					
<b>03</b>	<b>Hydraulic Turbine-Impulse Turbines</b>			<b>4</b>		

	3.1 Introduction and Classification of turbines	Impact of jet (017103501-Unit-02)	---	<b>(10%)</b>
	3.2 Construction and working of Pelton wheel turbine			
	3.3 Work done by Pelton wheel turbine & Design analysis of Pelton wheel Turbine			
<b>04</b>	<b>Hydraulic Turbine-Reaction Turbine</b>			<b>4 (10%)</b>
	4.1 Construction and working of Francis turbine and Kaplan Turbine	Impact of jet (017103501-Unit-02)	---	
	4.2 Work done & design analysis of Francis Turbine			
4.3 Work done & design analysis of Kaplan Turbine				
<b>05</b>	<b>Performance of Hydraulic Turbine</b>			<b>3 (7.5%)</b>
	5.1 Specific Speed of turbine	Hydraulic Turbine Impulse & Reaction (017103501-Unit-03,04)	---	
	5.2 Unit Quantities			
5.3 Model relationship				
<b>06</b>	<b>Steam Turbine-Impulse Turbine</b>			<b>4 (10%)</b>
	6.1 Principle of operation and types of steam turbines, compounding of steam turbines,	Impact of jet (017103501-Unit-02)	---	
	6.2 Impulse turbine- velocity diagram, calculation of work, power and efficiency			
6.3 condition for maximum efficiency				
<b>07</b>	<b>Steam Turbine-Reaction Turbine</b>			<b>4 (10%)</b>
	7.1 Reaction turbines-velocity diagram, degree of reaction	Impact of jet (017103501-Unit-02)	---	
	7.2 Parson turbine, work, power, efficiencies, blade height			
7.3 condition for maximum blade efficiency for Parson turbine				
<b>08</b>	<b>Centrifugal &amp; Axial Flow Compressors (Only Theory)</b>			<b>2 (5%)</b>
	9.1 Working & Work done of centrifugal compressor	Impact of jet (017103501-Unit-02)	---	
	9.2 Surging and choking			
	9.3 Working of an axial flow compressor			
9.4 Velocity diagram of axial flow compressor				
<b>09</b>	<b>Reciprocating Compressor</b>			<b>4 (10%)</b>
	8.1 Single stage reciprocating compressor without clearance	---	---	
	8.2 Condition for minimum work without clearance and perfect intercooling	---		
<b>10</b>	<b>Psychrometry</b>			<b>6 (15%)</b>
	10.1 Daltons law of partial pressure			
	10.2 Different Psychrometric	---		

Properties like Dry bulb and Wet Bulb Temperature, Dew point Temperature Specific humidity, Relative humidity, Degree of saturation, Enthalpy of air		---	
10.3 Psychrometric processes such as sensible heating, cooling, heating and humidification cooling and dehumidification, adiabatic saturation	---	---	

Major Components/ Equipment	
Sr. No.	Component/Equipment
1	Pelton Wheel test rig
2	Francis Turbine test rig
3	Kaplan Turbine test rig
4	Air conditioning test rig



Sr No.	Practical Title	Link to Theory Syllabus
1	Performance test on Pelton turbine.	Unit-3
2	Performance test on Kaplan turbine.	Unit-4
3	Performance test on Francis turbine.	Unit-4
4	To perform test on Air-conditioning test rig.	Unit-10



Proposed Theory + Practical Evaluation Scheme by Academicians (% Weightage Category Wise and it's Marks Distribution)					
<b>L :</b>	<b>3</b>	<b>T:</b>	<b>1</b>	<b>P:</b>	<b>2</b>
<b>Note : In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.</b>					
<b>Each Test will be of 25 Marks.</b>					
<b>Each Test Syllabus Weightage: Range should be 20% - 30%</b>					
Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory	4	5	MCQ	23%	29
Theory			Theory Descriptive	0%	0
Theory			Formulas and Derivation	20%	25
Theory			Numerical	37%	46
<b>Expected Theory %</b>	<b>80%</b>		<b>Calculated Theory %</b>	<b>80%</b>	<b>100</b>

Tutorial/Practical	1		Individual Project	0%	0
Tutorial/Practical			Group Project	0%	0
Tutorial/Practical			Internal Practical Evaluation (IPE)	0%	0
Tutorial/Practical			Viva	8%	40
Tutorial/Practical			Seminar	12%	60
<b>Expected Practical %</b>	<b>20%</b>		<b>Calculated Practical %</b>	<b>20%</b>	<b>100</b>
<b>Overall %</b>	<b>100%</b>			<b>100%</b>	<b>200</b>

<b>Course Outcome</b>	
	<i>Upon completion of the course students will be able to</i>
1	Recognize components of Hydropower plant & calculate impact of jet on various profiles.
2	Evaluate performance of Hydraulic turbine.
3	Evaluate performance of Steam turbine and explore characteristics of rotodynamic compressors.
4	Understand reciprocating air compressor and analyze Psychrometric process.
<b>Suggested Reference Books</b>	
1	Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Prakashan
2	Fluid Mechanics and Hydraulic Machines by R.K. Rajput , S.Chand and Co.
3	Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K. Kataria and Sons
4	Fluid Mechanics and Turbomachines by Das, Madan Mohan, PHI Learning
5	Refrigeration & Air conditioning by R.C.Arora by PHI Learning
6	Applied Thermodynamics by R.K. Rajput , Laxmi Publication

<b>List of Open Source Software/Learning website</b>	
1	<a href="http://nptel.ac.in">http://nptel.ac.in</a>
2	<a href="http://www.learnerstv.com">www.learnerstv.com</a>
3	<a href="http://www.nfpa.com">http://www.nfpa.com</a>

<b>Seminar/Practical Project/Hands on Project</b>		
<b>Sr. No.</b>	<b>Seminar/Project List</b>	<b>Linked with Unit</b>
1	Collect data of capacity and kind of turbine used in different Hydro power plant of India. (Ukai Hydro Power Plant, Sardar Sarovar Hydro power plant etc.)	 Unit 01
2	You are going to car washing center and you are giving your car for washing, now find force exerted by jet on your car body.	Unit 02
3	Find Overall efficiency of any one hydro power plant in Gujarat. (Ukai Hydro Power Plant, Sardar Sarovar Hydro power plant etc.)	 Unit 03,04,05

4	<p>Collect data of capacity and kind of turbine used in different Thermal power plant of India. (Torrent Power Plant, Gandhinagar Thermal Power Station, Wanakbori Thermal Power Station etc.)</p>		Unit 06,07
5	Find out how you can use air compressor for spray painting?	Unit 09	
6	Find out how you can use rotodynamics compressor in aviation?	Unit 08	
7	Let's say you are aeronautical engineer and there is a problem of surging and choking in axial flow compressor, now how you can recover this problem?		Unit 08,09
8	To Identify Psychrometric processes occuring in air conditioning system.	Unit 10	