

**COURSE TITLE** : **HYDRAULIC MACHINES**  
**COURSE CODE** : **3044**  
**COURSE CATEGORY** : **B**  
**PERIODS/WEEK** : **4**  
**PERIODS/YEAR** : **72**  
**CREDITS** : **4**

**TIME SCHEDULE**

<b>MODULE</b>	<b>TOPICS</b>	<b>PERIODS</b>
1	Impact of jets	17
2	Impulse Turbines	17
	TEST I	2
3	Reaction turbines Specific speed and unit quantities of Turbines	17
4	Centrifugal Pumps Reciprocating Pumps	17
	TEST II	2
	<b>Total</b>	<b>72</b>

**OBJECTIVES**

**MODULE – I**

- 1.1.0 Understand Impact of Jets
  - 1.1.1 Explain jet of water and its applications
  - 1.1.2 Derive equations for force exerted by the jet striking on stationary vertical plate and stationary inclined plate (normal to the plate, in the jet direction and normal to the flow)
  - 1.1.3 Solve problem on 1.1.2
  - 1.1.4 Derive equations for force exerted by the jet striking on stationary curved plate at the center stationary curved plate at one end tangentially
  - 1.1.5 Solve simple problems on 1.1.4
  - 1.1.6 Derive equations for force of jet striking on hinged plate
  - 1.1.7 Solve simple problems on 1.1.6
  - 1.1.8 Derive equations for force of jet and work done by the jet striking on a moving, flat vertical plate, moving flat inclined plate and moving curved plate
  - 1.1.9 Solve simple problems on 1.1.8
  - 1.1.10 Derive equations for force of jet, work done and efficiency of jet striking on a series of vanes
  - 1.1.11 Solve simple problems on 1.1.10
  - 1.1.12 Derive equation for work done by a jet of water striking on unsymmetrical moving curved plates when the jet strikes tangentially at one of the tips
  - 1.1.13 Solve simple problems on 1.1.12
  - 1.1.14 Explain principle of jet propulsion
  - 1.1.15 propulsion of ships by water jet (no derivation)

**MODULE– II**

**2.1.0 Describe the working of Impulse Turbines**

- 2.1.1 Explain advantages of water turbines
- 2.1.2 Classify water turbines
- 2.1.3 Explain impulse turbines
- 2.1.4 Describe the principle of working of Pelton wheel with sketches
- 2.1.5 State the equations and solve the problems for number of jets of a Pelton wheel Pitch circle dia, dia of jets, and quantity of water supplied to the wheel

- 2.1.6 Explain governing of an impulse turbine with sketches.

### **MODULE- III**

#### **3.1.0 Describe the principle of working of reaction turbines, radial flow reaction turbine (inward flow and outward flow) and solve simple problems**

- 3.1.1 Compare impulse and reaction turbines  
3.1.2 Describe the principle of working of Francis turbine and Kaplan turbine  
3.1.3 State the equation of work done, power produced, discharge and efficiencies (Hydraulic, mechanical and overall) of reaction turbines (No derivations)  
3.1.4 State the equation for discharge of Kaplan Turbine and solve simple problems  
3.1.5 Explain with sketches different types of draft tubes

#### **3.2.0 Specific speed and unit quantities of Turbines**

- 3.2.1 Understand the Unit power, Unit speed, and Unit discharge  
3.2.2 Define specific speed  
3.2.3 Understand the significances of the specific speed  
3.2.4 Understand the selection of Turbines based on specific speed and head

### **MODULE- IV**

#### **4.1.0 Appreciate the working of Centrifugal pumps**

- 4.1.1 Classify pumps- Positive displacement pump, Roto Dynamic pumps  
4.1.2 Explain different types of casing of centrifugal pumps  
4.1.3 State the equations for work done, power and efficiencies of centrifugal pump (No derivation)  
4.1.4 Compute simple problems on 4.1.3  
4.1.5 State and define specific speed of CP (no derivation -simple problems)  
4.1.6 Know the selection of CP based on specific speed and head  
4.1.7 Explain cavitation and priming in centrifugal pumps.  
4.1.8 Explain multistage CP with sketches

#### **4.2.0 Appreciate the working of Reciprocating pump**

- 4.2.1 Explain the principle of working of reciprocating pump(single acting & Double acting )  
4.2.2 List the classification of Reciprocating pumps.  
4.2.3 Compare centrifugal pump and reciprocating pump  
4.2.4 State the equations for finding discharge  
4.2.5 Explain slip and significance of negative slip  
4.2.6 State the equations for power required to drive a reciprocation pump  
4.2.7 Solve simple problems on 4.2.4, 4.2.5 and 4.2.6  
4.2.8 Explain Air vessels

#### **4.3.0 Appreciate the working of different Pumping Devices**

- 4.3.1 Explain Hydraulic rams with sketches  
4.3.2 Explain air lift pump with sketches  
4.3.3 Explain with sketches jet pump

### **CONTENT OUTLINE**

#### **MODULE –I**

##### **Impact of Jets**

Introduction – force exerted by the jet – stationary vertical plate – stationary inclined plate – stationary curved plate at the center stationary curved plate at one end tangentially – simple problems – Inclined plate – simple problems – moving flat vertical plate – moving flat inclined plate – moving curved plate – series of vanes – simple problems – force exerted by

a jet of water on unsymmetrical moving curved plate when the jet strikes tangentially at one of the tips – simple problems – principle of jet propulsion – propulsion of ship.

## **MODULE- II**

### **Impulse turbines**

Introduction-development of water Turbines-classification-impulse Turbine-Pelton wheel components- Problems for number of jets –governing of Impulse turbines.

## **MODULE- III**

### **Reaction turbines**

Introduction –components—difference between impulse& Reaction—Classification of Reaction Turbines –discharge—power produced—efficiencies—Francis Turbine—Kaplan Turbine—(Simple problems)-Draft tubes.

Unit quantities—Specific speed—Selection of Turbine—selection based on specific speed and head of water (Simple problems)

## **MODULE- IV**

### **Centrifugal pump**

Introduction – types of casing—piping system of CP—work done, manometric head—efficiencies –discharge—power required to drive –multistage pumps –simple problems.

-specific speed of CP—selection of pumps based on specific speed and head—cavitation—priming.

### **Reciprocating pump**

Types –comparison of CP & RP –discharge—slip—power required –air vessels ( simple problems), Hydraulic ram—air lift pump—jet pump

## **TEXT BOOKS**

1. Hydraulic, Fluid mechanics and Hydraulic machines– R.S.Khurmi
2. Fluid mechanics and hydraulic machines – Dr. R.K. Bansal.

## **REFERENCE BOOKS**

1. Hydraulics and Fluid mechanics - Dr.P.N.Modi & Dr.S.M.Seth
2. Hydraulics, Fluid mechanics and fluid machines – S.Ramamurtham
3. Hydraulic and Hydraulic machines – Dr. Jagadish Lal
4. Hydraulic machines - M.R.Thomas &C.K.M.Sagir.