COURSE TITLE : HYDRAULIC MACHINES
COURSE CODE : 6022
COURSE CATEGORY : A
PERIODS/ WEEK : 5
PERIODS/ SEMESTER : 75
CREDIT : 5

TIME SCHEDULE

MODULE	TOPIC	PERIODS
1	Impact of jet and jet propulsion.	19
2	Impulse Turbine	18
3	Reaction turbine	19
4	Pumps and pumping devices	19
TOTAL		75

COURSE OUTCOME :

sl.no.	sub	student will be able to
1	1	Understand the impact of jet and jet propulsion.
	2	Comprehend the working of impulse turbine.
	3	Understand the working of reaction turbine.
2	4	Appreciate the classification of pumps
	5	Comprehend the working of centrifugal and reciprocating pumps
	6	Understand the working of other pumping devices.

SPECIFIC OUTCOME

MODULE I

1.1.0 Understand the impact of jet and jet propulsion.

1.1.1 Explain the jet of water and its applications

1.1.2 Derive the 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 the problems on 1.1.2

1.1.4 Derive the equations for force exerted by the jet striking on stationary curved plate at the center, Stationary symmetrical & unsymmetrical curved plates at one end tangentially.

1.1.5 Solve the simple problems on 1.1.4

1.1.6 Derive the equations for force of jet striking on hinged plate

1.1.7 Solve the simple problems on 1.1.6

1.1.8 Derive the equations for force developed, work done and efficiency by the jet striking on a moving flat vertical plate, moving flat inclined plate and moving curved plates.
1.1.9 Solve the simple problems on 1.1.8
1.1.10 Derive the equations for force developed, work done and efficiency by the jet striking on a series of vanes
1.1.11 Solve simple problems on 1.1.10
1.1.12 Derive the 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 the principle of jet propulsion
1.1.15 Explain the Propulsion of ships by water jet (no derivation)

MODULE II

2.1.0 **Comprehend the working of impulse turbine**
2.1.1 Explain the advantages of water turbines
2.1.2 Classify the water turbines
2.1.3 Explain the 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 the governing of an impulse turbine with sketches.
2.1.7 Solve the problems for work done & efficiency on Pelton wheel.

MODULE III

3.1.0 Understand the working of reaction turbine
3.1.1 Compare the 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 the different types of draft tubes with sketches
3.1.6 Define specific speed and unit quantities of Turbines
3.1.7 Define Unit power, Unit speed, and Unit discharge
3.1.8 Explain the significance of the specific speed
3.1.9 State the selection of Turbines based on specific speed and head.

MODULE IV

4.1.0 Appreciate the classification of Pumps
4.1.1 Classify pumps: Positive displacement, Roto Dynamic (constant head) pumps
4.2.0 Comprehend the working of centrifugal and reciprocating pumps
4.2.1 Explain the different types of casing of centrifugal pumps
4.2.2 State the equations for work done, power and efficiencies of centrifugal pump (No derivation)

4.2.3 Compute the simple problems on 4.1.3
4.2.4 Explain the specific speed of centrifugal pumps (no derivation -simple problems)
4.2.5 Explain the selection of centrifugal pumps based on specific speed and head
4.2.6 Describe the Concept of NPSH – (Net Positive Suction Head)
4.2.7 Explain the cavitation and priming in centrifugal pumps.
4.2.8 Explain the multistage centrifugal pumps with sketches
4.2.9 Illustrate the Performance curves of centrifugal pumps -w.r.t to the effect speed on discharge, head & power
4.2.10 Distinguish static head & dynamic head required for a system of pumping system.
4.2.11 Explain the System characteristic curve of a pumping system
4.2.12 Explain the selection of centrifugal pump for best efficiency condition by matching system curve & considering NPSH
4.2.13 Explain the principle of working of reciprocating pump (single acting & double acting)
4.2.14 List the classification of Reciprocating pumps.
4.2.15 Compare centrifugal pump and reciprocating pump.
4.2.16 State the equations for finding discharge
4.2.17 Explain the slip and significance of negative slip
4.2.18 State the equations for power required to drive a reciprocating pump
4.2.19 Solve simple problems on 4.2.4, 4.2.5 and 4.2.6
4.2.20 Explain the air vessels.

4.3.0 Understand the working of other pumping devices

4.3.1 Explain the Hydraulic rams with sketches.
4.3.2 Describe the air lift pump with sketches.
4.3.3 Illustrate the jet pump with sketches
4.3.4 Describe the mono block, coupled, submersible (open well &deep well) , Propeller pumps & Turbine pumps

CONTENT DETAILS

MODULE I

Impact of Jets - Introduction – force exerted by the jet – stationary vertical plate – stationary inclined plate – 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)with problems - stationary curved plate at the centre- stationary curved plate at one end tangentially – simple problems – Inclined plate – simple problems – moving flat vertical plate – moving flat inclined plate – moving curved plate – Derive equations for force of jet striking on hinged plate- series of vanes – simple problems – force exerted by jet of water on unsymmetrical moving curved plate when the jet strikes tangentially at one of the tips – simple problems- Derive equations for force developed- work done and efficiency by the jet striking on a moving flat vertical plate- moving flat inclined plate and moving curved plates. – Principle of jet propulsion – propulsion of ship.

MODULE II

Impulse turbines - Introduction-development of water Turbines-classification-impulse Turbine-Pelton wheel components- State the equations and solve the problems for number of jets of a Pelton wheel -Pitch circle dia- dia of jets-quantity of water supplied to the wheel- Problems for number of jets – problems for work done - efficiency on Pelton wheel-governing of Impulse turbines.

MODULE III

Reaction turbines -introduction –components—difference between impulse& reaction—classification of reaction turbines –discharge—power produced-work done—efficiencies—francis turbine—kaplan turbine—(simple problems)- draft tubes-types- unit quantities—specific speed—selection of turbine—selection based on specific speed- head of water (simple problems).

MODULE IV

Centrifugal pump - Introduction – classify pumps: based on head-positive displacement - roto dynamic-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— concept of NPSH – (net positive suction head)-cavitation—priming.–performance curves of centrifugal pumps - static head & dynamic head required for a system of pumping system- characteristic curve of a pumping system- Selection of centrifugal pump for best efficiency condition by matching system curve- considering NPSH-

reciprocating pump types -comparison of CP & RP –discharge—slip—power required –air vessels (simple problems) - hydraulic ram—air lift pump—jet pump- the mono block- coupled- submersible (open well &deep well) - propeller pumps - turbine pumps.

TEXT BOOKS

1. Hydraulic, Fluid mechanics and Hydraulic machines– R.S.Khurmi
2. Fluid mechanics and hydraulic machines – Dr. R.K. Bansal.
3. Turbo Machines – A Valsan and A Raju- Vikas Publications

REFERENCE

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