COURSE TITLE : FLUID MECHANICS AND MACHINERY
COURSE CODE : 3052
COURSE CATEGORY : B
PERIODS/WEEK : 5
PERIODS/SEMESTER : 90
CREDITS : 5

TIME SCHEDULE

MODULE	TOPICS	PERIODS
1	Introduction Properties of Fluids Power screws Fluid pressure and its measurements	21
	Text I	1
2	Kinematics and Dynamics of Fluid flow Flow through Orifices, Notches, Pipes	22
	Test II	
3	Centrifugal pumps Reciprocating pumps Positive displacement pumps	22
	Test III	1
4	Hydraulic system Pneumatic system	21
	Test IV	1
	Total	**90**

OBJECTIVES

Upon completion of the study of this subject, the student should be able to:

MODULE – I

1.1.0 Understand the importance of Hydraulics

1.1.1 Explain the areas of application of Hydraulics

1.2.0 Appreciate the properties of Hydraulic Fluids

1.2.1 Explain the various properties of commonly used hydraulic fluids

1.2.2 Solve the problems related to density, specific weight, specific volume, and specific gravity.

1.3.0 Understand Fluid Pressure and the methods to Measure it

1.3.1 Explain the terms pressure and pressure head and solve problems on these

1.3.2 State and explain Pascal's law

1.3.3 Explain Absolute, Gauge, Atmospheric and Vacuum pressure and Solve simple problems on those.

1.3.4 State the fundamental principles of pressure measuring devices balancing by liquid columns

1.3.5 Explain and illustrate the principle of working of piezometer, simple U-tube manometer, differential manometer, inverted differential manometer bourdon's tube pressure gauge and solve simple problems on those.

1.3.6 Explain the term total pressure

1.3.7 Solve problems using equations of total pressure on an immersed surface in positions of horizontal, vertical and inclined

MODULE – II

2.1.0 Understand the Principles Kinematics and Dynamics of Fluid Flow

2.1.1 Explain the term Kinematics

2.1.2 Explain the types of fluid flow – steady and unsteady flow, uniform and non-uniform flow, Laminar and Turbulent flow, compressible and incompressible flow – rotational and Irrotational flow, one dimensional flow, two dimensional flow, and three dimensional flow

2.1.3 Explain Rate of Discharge

2.1.4 Explain the equation for continuity of flow

2.1.5 Solve simple problems on 2.1.3 and 2.1.4

2.1.6 Explain the energies possessed by a liquid particle that is potential, kinetic and pressure

2.1.7 Define total energy and total head

2.1.8 State Bernoulli's equation

2.1.9 State the limitations of the Bernoulli's theorem

2.1.10 Solve problems using Bernoulli's equation

2.1.11 Explain practical applications of Bernoulli's equation venturi meter and solve problems using it

2.2.0 Appreciate the Flow of Liquids through Orifices Notches and Pipes

2.2.1 Explain the Orifices, types of Orifices, point of vena-contracta and Hydraulic coefficient Cc, Cv and Cd

2.2.2 Solve simple problems of hydraulic coefficients

2.2.3 Explain Notches, types of Notches

2.2.4 Know the equation for discharge over rectangular Notches, Triangular Notches and Trapezoidal Notches.

2.2.5 Mention the advantages of Triangular Notch over a Rectangular Notch

2.2.6 Define coefficient of discharge of a Notch

2.2.7 Solve simple problems on 2.2.4

2.2.8 Explain losses of head in pipes and identify Major losses and Minor losses

2.2.9 Explain the significance of losses of head due to friction in pipe flow

2.2.10 Understand Darcy's formulae and Chezy's formulae for loss of head in pipes and explain the terms hydraulic mean depth and hydraulic gradient

2.2.11 Solve the problems on 2.2.10

2.2.12 Understand the equation of loss of head due to sudden enlargements and loss of head due to sudden contraction loss of at the entrance in a pipe and loss of head at the exit of a pipe

2.2.13 Solve the problems on 2.2.12

2.2.14 Understand the transmission of power though pipes and the equation for power transmitted through a pipe

2.2.15 Solve simple problems on 2.2.14

2.2.16 Explain water hammer

MODULE– III

3.1.0 Appreciate the working of Centrifugal pumps

3.1.1 Classify pumps

3.1.2 Explain priming
3.1.3 Explain the phenomenon cavitation
3.1.4 State the equations for work done, power and efficiencies of centrifugal pump (No derivation)
3.1.5 Compute simple problems on 3.1.4
3.1.6 Explain multistage CP with sketches

3.2.0 Appreciate the working of Reciprocating pump

3.2.1 Explain the principle of working of reciprocating pump(single acting & Double acting)
3.1.2 List the classification of Reciprocating pumps.
3.2.2 Compare centrifugal pump and reciprocating pump
3.2.4 State the equations for finding discharge
3.2.5 Explain slip and significance of negative slip
3.2.6 State the equations for power required to drive a reciprocation pump
3.2.7 Solve simple problems on 3.2.4, 3.2.5 and 3.2.6
3.2.8 Explain Air vessels

3.3.0 Appreciate the working of positive displacement pumps

3.3.1 Identify Positive displacement pumps
3.2.2 Explain the working principle of Positive displacement pumps
3.2.3 Describe gear pumps, vane pumps, piston pumps,lobe pump etc

MODULE -IV

4.1.0 Understand the Fluid Power Technology

4.1.1 Understand the basic laws
4.1.2 Identify the applications of fluid power
4.1.3 Know the essential properties of the fluids such as viscosity index, Oxidation stability, Demulsibility, Lubricity, Rust prevention, Pour point, Flash and fire point, Neutralisation number.

4.2.0 Identify the elements of Hydraulic System

4.2.1 Identify the components of hydraulic s
4.2.2 Explain the Types of Hydraulic Actuators – Rotary (Hydraulic motor) – Semi- rotary- linear motion type (Hydraulic cylinders)
4.2.3 Understand the various control elements of hydraulic control System
4.2.4 Describe the working principle of different control valves – pressure control valves, direction control valves and flow control valves.
4.2.5 Know the applications of valves

4.3.0 Understand the basic concept of pneumatic system

4.3.1 Compare Pneumatic system with hydraulic system
4.3.2 Identify standard pneumatic symbols
4.3.3 Know the basic component of pneumatic system – air filters, pressure regulator – lubricator – mufflers
4.3.4 Understand pneumatic control elements and components
4.3.5 Explain with sketches pneumatic valves – direction control valves- pressure control valve and flow control valves
4.3.6 Describe the pneumatic actuators – pneumatic cylinders, air motors – types applications

4.3.7 Understand the simple pneumatic circuit

4.3.8 Describe the principle of power operated holding devices, chuck, mandrel, collet clamping circuits

CONTENT OUTLINE

MODULE I

Introduction ,Properties of Fluids

Importance of hydraulics. Density – specific weight – specific volume – specific gravity problems – viscosity – kinematic viscosity – Newton's law of viscosity – types of fluids – compressibility – surface tension – capillarity

Fluid pressure and its measurement

Fluid pressure at a point – pressure head – problems – Pascal's law – absolute, gauge, atmospheric and vacuum pressures – simple problems – measurement of fluid pressure – Piezometer tube – simple manometer – differential manometer – inverted differential manometer – Bourdon's tube pressure gauge – problems – total pressure – total pressure on immersed surface – horizontal – vertical – inclined – problems

MODULE II

1. **Kinematics of fluid flow**

   Introduction – types of fluid flow – steady and unsteady flow – uniform and non-uniform flow – laminar and turbulent flow – compressible and incompressible flow – rate of flow or discharge – equation of continuity of a liquid flow – simple problems – energy of a liquid in motion – potential energy – kinetic energy – pressure energy – total energy – total head of liquid in motion – Bernoulli's equation – simple problems – practical applications of Bernoulli's equation – venturimeter –

2. **Flow through Orifices, Notches& Pipes**

   Orifices – types of orifices – Vena contracta – coefficient of contraction – coefficient of velocity – coefficient of discharge – problems

   Notches – types of notches – Rectangular notches – triangular notch – trapezoidal notch – discharge over notches – simple problems

   Simple pipes – loss of head in pipes – major energy losses – minor energy losses – loss of energy due to friction – Darcy's formulae(No derivation) for loss of head in pipes – Chezy's formula (No derivation)for loss of head in pipes – simple problems – water hammer

MODULE III

PUMPS

Centrifugal pump

Introduction –working —priming ,cavitation—efficiencies –discharge—power required to drive –multistage pumps –simple problems.

Reciprocating pump

Types –comparison of centrifugal and reciprocatingpunp –discharge—slip—power required air vessels (simple problems)

Principles of working of Positive displacement pump – Classifications – Gear pumps, Screw Pump, Vane pumps, Lobe pump, Simple piston pumps.

MODULE IV

Fluid Power

Introduction – Basic laws– Applications of fluid power – properties of fluids such as viscosity index, Oxidation stability, Demulsibility, Lubricity, Rust prevention, Pour point, Flash and fire point,

Hydraulic system

Basic elements of hydraulic system – Flow control valves – types – gate, globe, butterfly valves, non return valve, application circuits of control valves – Functions – classifications – Describe the working of pressure control valves such as relief valves - poppet valve – Direction control valves – types – sliding spool type – check valves – 1 way, 2 way, 3 way directional control valves, solenoid control valve.

Pneumatic System

Comparison of pneumatic system with hydraulic system – identification of standard pneumatic symbols – basic pneumatic system – air filter – pressure regulator – lubricator – mufflers. Air cylinders – types - light, medium, heavy, tandem, duplex, double end types

TEXT BOOKS

Hydraulics and pneumatics	Srinivasan, Mc Graw Hill publishers
Fluid mechanics and machines	N Narayana Pillai, Universities Press

REFERENCE BOOKS

1. Hydraulics and Fluid mechanics - R.S.Khurmi.(S.Chand &Co)
2. Support materials in pneumatics - NITTR, Chennai
3. Basic fluid power - John Oster
4. Pneumatic Systems Principles and maintenance - Majumdar (Tata Mc Graw Hill)
5. Fluid Mechanics - White, Universities Press
6. Fluid Mechanics and Pneumatics -M.R.Thomas &C.K.M.Sagir(M&C Publishers)