DIRECTORATE OF TECHNICAL EDUCATION

DIPLOMA IN MECHANICAL ENGINEERING

M SCHEME

2015 -2016 onwards

II YEAR

IV SEMESTER

32043 – FLUID MECHANICS AND FLUID POWER

CURRICULUM DEVELOPMENT CENTRE

M-SCHEME

(Implements from the Academic year 2015-2016 onwards)

Course Name : DIPLOMA IN MECHANICAL ENGINEERING

Course Code : 1020

Subject Code : 32043

Semester : IV

Subject Title : FLUID MECHANICS & FLUID POWER

TEACHING AND SCHEME OF EXAMINATIONS:

No. of Weeks per Semester: 15 Weeks

Subject	Instructions		Examination			
	Hours /Week	Hours/ Semester	Marks			Duration
Fluid Mechanics and Fluid Power	5	75	Internal Assessment	Board Examination	Total	3 Hrs
			25	75	100	

Topics and Allocation of Hours:

Unit	Topics	Hours
I	PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS	14
II	FLOW OF FLUIDS AND FLOW THROUGH PIPES	14
III	IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS	14
IV	PNEUMATIC SYSTEMS	13
V	HYDRAULIC SYSTEMS	13
	TEST AND REVISION	7
	Total	75

RATIONALE:

The main objective of this subject Fluid mechanics and Fluid power is to study the behavior of fluids under the condition of rest and motion. This chapter deals with

fluid pumps, turbines, hydraulic and pneumatic operation. The overall object is to impart knowledge of pumps, hydraulic and pneumatic operation of tools and equipments.

OBJECTIVES:

- Define the properties of Fluids.
- Explain the working of pressure measuring devices
- Explain continuity equation and Bernoulli's Theorem
- Assess the impact of frictional loss of head in flow through pipes
- Estimate the discharge through orifices
- Distinguish the working principles of pumps and turbines.
- Explain the working of centrifugal pumps and reciprocating pumps.
- Compare pneumatic system with hydraulic system
- Draw Pneumatic circuits for industrial application.
- State the properties of hydraulic Systems
- Develop hydraulic circuit for machine tools applications.

FLUID MECHANICS & FLUID POWER
DETAILED SYLLABUS

Contents: Theory

Unit	Name of the Topic	Hours
I	**PROPERTIES OF FLUIDS AND PRESSURE MEASUREMENTS**	**14**
	Introduction - Definition of fluid - Classification of Fluids - ideal and real fluids -Properties of a fluid – definition and units - Pressure-units of Pressure - Pressure head-atmospheric, gauge and absolute pressure – problems - Pascal's law- proof - applications of Pascal's law - Hydraulic press - Hydraulic jack - Pressure measurement - Piezometer tube - Simple U-tube manometer - Differential U-tube manometer - Inverted Differential manometer - Micro-manometer - Inclined tube micro-manometer - Mechanical Gauges -Bourdon's Tube Pressure Gauge - Diaphragm pressure gauge - Dead weight pressure gauge.	

II FLOW OF FLUIDS AND FLOW THROUGH PIPES **14**

Types of fluid flow - path line and stream line - mean velocity of flow - discharge of a flowing fluid - equation of continuity of fluid flow - energies of fluid - Bernoulli's theorem - statement, assumptions and proof - applications and limitations of Bernoulli's theorem - problems on Bernoulli's theorem – venturimeter - derivation for discharge - orifice meter - derivation for discharge - difference between venturimeter and orifice meter -problems on venturimeter and orifice meter - Pitot tube – description only – orifice –types – applications - hydraulic co-efficient - determining hydraulic co-efficient – problems - discharge through a small orifice discharging freely only - problems – experimental method of finding C_v, C_c and C_d - Flow through pipes - laws of fluid friction - hydraulic gradient line - total energy line - wetted perimeter - hydraulic mean radius - loss of head due to friction – Darcy - Weisbach equation and Chezy's formula –problems - minor losses (description only) - Power transmission through pipes - problems.

III IMPACT OF JETS, HYDRAULIC TURBINES, CENTRIFUGAL AND RECIPROCATING PUMPS **14**

Impact of jet - on a stationary flat plate held normal to the jet and inclined to the direction of jet - Impact of jet on a flat plate moving in the direction of jet - Impact of jet on a series of moving plates or vanes - force exerted and work done by the jet - problems. Hydraulic turbines – classifications - Pelton wheel - components and working - speed regulation (theory only) - Francis and Kaplan turbines - components and working - draft tube - functions and types - surge tank - differences between impulse and reaction turbines.

Centrifugal Pumps – classifications - construction and working of single stage centrifugal pumps - components with types - theory only - multi stage pumps – advantages - priming – cavitation.

Reciprocating Pumps – classifications - construction and working of single acting and double acting reciprocating pumps - plunger and piston pumps - discharge of a reciprocating pump - theoretical power

required - coefficient of discharge – slip – problems - negative slip - indicator diagram – separation - air vessel (functions and working) - Special pumps - Jet pump - Turbine pump - Submersible pump.

IV PNEUMATIC SYSTEMS **13**

Pneumatic Systems **–** elements – filter – regulator - lubricator unit - pressure control valves - pressure relief valves - pressure regulation valves - directional control valves - 3/2 DCV - 5/2 DCV – 5/3 DCV flow control valves – throttle valves –shuttle valves – quick exhaust valves – ISO symbols of pneumatic components – pneumatic circuits – direct control of single acting cylinder – operation of double acting cylinder – operation of double acting cylinder with metering-in control - operation of double acting cylinder with metering-out control – use of shuttle valve in pneumatic circuits – use of quick exhaust valve in pneumatic circuits - automatic operation of double acting cylinder single cycle – multiple cycle – merits and demerits of pneumatic system - applications.

V HYDRAULIC SYSTEMS **13**

Hydraulic system – Merits and demerits – Service properties of hydraulic fluids Hydraulic accumulators – Weight of gravity type accumulator – Spring loaded type accumulator - Gas filled accumulator – Pressure intensifier – Fluid power pumps – External and internal gear pump, Vane pump, Radial piston pump – ISO symbols for hydraulic components – Hydraulic actuators – Cylinders and motors – Valves – Pressure control valves, Flow control valves and direction control valves – types – including 4/2 DCV and 4/3 DCV – their location in the circuit.

Hydraulic operation of double acting cylinder with metering-in and metering-out control – application of hydraulic circuits – Hydraulic circuit for - shaping machine - table movement in surface grinding machine and milling machine – comparison of hydraulic and pneumatic systems.

Text Books :

1) A Text Book of Hydraulics, Fluid Mechanics and Hydraulic Machines, R.S. Khurmi, - Edn.18, S.Chand & Co., Ram Nagar, New Delhi – 110 055, Ram Nagar, New Delhi

2) A Text Book of Fluid Mechanics and Hydraulic Machines – by, R. K Rajput and S.Chand & Co,Ram Nagar, New Delhi – 110 055.

Reference Books:

1) Hydraulic Machines, Jagadishlal, , Metropolitan Book Co. Pvt. Ltd., 1, Faiz Bazaar, New Delhi – 110 006.
2) Hydraulics,Andrew Parr (A Technician's and Engineer's Guide)
3) Fundamentals of pneumatic control Engineering -FESTO Manual
4) Fluid Mechanics and Hydraulic Machines,R. K. Bansal, Laxmi Publications Pvt.,Ltd,22,Golden House, Daryaganj, New Delhi – 110 002