RTM Nagpur University
Proposed Syllabus (Theory)
2020-21

Semester	Course Title (Subject)	Hours / Week			Credits	Maximum Marks			Exam Duration (Hrs.)
		L	T	P		Continual Assessment	University Examination	Total	
IV	**Fluid Mechanics & Hydraulic Machines**	3	1	-	4	30	70	100	3

Sr. No.	Course Objective The objective of this course is–
1	To classify fluid & their Properties under static and dynamic condition and apply the equations to various hydraulic components and working principles of various measuring devices.
2	To establish the relationship between various properties & apply mathematical treatment to various problems related to fluid system & their Design.
3	To introduce various principles & design of hydraulic Machines i.e. Turbines. Centrifugal and Positive Displacement Pump .
4	To explain the working Principles of Fluid mechanics and their Practical applications in designing the fluid systems
5	To appreciate the application of Similitude in the design of Hydraulic Machines.

Course Outcomes	
After successful completion of this course the student will be able to :	
CO1	classify and explain fluid their properties, fluid in rest condition, types of flow & flow measuring devices and mathematical application of equations on hydraulic components.
CO2	explain behavior of fluid in motion condition and application of Bernoullie's equation to fluid flow measuring devices.
CO3	apply dimensional analysis to design hydraulic machines and different losses of fluid flow through pipes.

CO4	(i) classify different layout of hydro-electric power plant and (ii) analyze design characteristics of hydraulic machines i.e. turbines (impulse and reaction), Pelton turbine , Francis turbine, propeller turbine and Kaplan turbine
CO5	explain the working principle & design of Centrifugal and reciprocating pump & practical application of similitude & model testing.

SYLLABUS	
Contents	No of hours
UNIT-I Fluid Properties: Types of fluids, Mass Density, Specific Weight, Specific Gravity, Newton's Law of Viscosity, Dynamic Viscosity, Stroke's Theorem, Surface Tension, Capillarity, Compressibility,Vapour pressure. Introduction of Fluid Kinematics, Types of Flow- steady, unsteady, uniform, non-uniform, laminar, turbulent. **Fluid Statics :-** Pressure, Measurement of pressure using manometers, Hydrostatic law, Pascal's law, Pressure at a point, Total pressure, Centre of pressure, Pressure on a plane (Horizontal, vertical, Inclined) and Curved Surfaces, Archimedes's principle, Buoyancy and stability of floating and submerged bodies, Metacentric height	09

UNIT-II Fluid Dynamics Introduction to Navier-Stroke's Equation, Euler equation of motion along a stream line, Bernoulli's equation, application of Bernoulli's equation to pitot tube, venturi meter, orifices, orifice meter. Laminar And Turbulent Flow :- Definition, Relation between pressure and shear stresses, Laminar flow through round pipe, Turbulent flow and velocity distribution. ,	09
UNIT-III Flow Through Pipes Flow Through Pipes :TEL, HGL, Energy losses through pipe, Darcy-Weisbach equation, Minor losses in pipes, TEL, HGL, Moody diagram, pipes in series and parallel, Siphons, Transmission of power. Dimensional Analysis, Dimensional Homogeneity, Rayleigh method & Buckingham's pi –Theorem. Introduction to Similitude and model testing.	09
UNIT-IV Theory of turbo machines Turbo Machine classification**,** Elements of hydro-electric power plant, **Impulse Turbine**:- principles of operation , constructional features, Velocity Diagram and Analysis,Design parameters, Performance characteristics, Governing. **Reaction or pressure Turbine**:- principles of operation, Classification , Degree of reaction, comparison over Pelton Turbine, Draft tube, Cavitation in Turbine, **Francis Turbine**, :- Types, Constructional features, Installations, Velocity Diagram and analysis, Design parameters, Performance characteristics, Governing. **Propeller Turbine, Kaplan Turbine**: -Constructional features, Velocity Diagram and analysis, ,	10
UNIT- V Hydrodynamic pumps:- Centrifugal pumps:- Principle of operation, Classification, Component of Centrifugal Pump, Various heads, Velocity triangles and their analysis, N.P.S.H., Cavitation's in pumps, Installation and operation, Performance characteristics, Introduction to self-priming pumps Reciprocating pump : Basic principle, Classification, Main Components, Slip, Work Done, Indicator Diagram, Cavitation's, Air vessels,,	09

Sr. No.	List of Tutorials
01	Applications based on fluid properties such as block sliding over an inclined plane, capillary phenomenon etc.
02	Study of Manometers
03	Study of stability of floating bodies and submerged bodies
04	Determination of coefficient of discharge of flow meters
05	Verification of Bernoulli's equation
06	Losses in pipes (Hagen Pois. Equation)
07	Design of Pelton Turbine and Francis Turbine
08	Design of Propeller & Kaplan Turbine
09	Design of Centrifugal Pump
10	Design of Reciprocating Pump

References:

Text Books Recommended:

1. Fluid Mechanics, Dr. R.K. Bansal, Laxmi Publication (P) Ltd. New Delhi
2. Engineering Fluid Mechanics, Kumar K.L.,S. Chand & company Ltd. Eurasia
3. Publication House
4. Fluid Mechanics & Hydraulic Machines, R.K. Rajput, S. Chand & Company Ltd.
5. Hydraulic and Fluid Mechanics, Modi P.N. and Seth S.M., Standard Book House.
6. Fluid Mechanics & Fluid Power Engineering – D. S. Kumar, S.K. Kataria& Sons
7. Publications

Reference Books Recommended:

1. Introduction to Fluid Mechanics, James E.A., John and Haberm W.A., Prentice Hall of India
2. Fluid Mechanics, Jain A.K., Khanna Publication
3. Engineering Fluid Mechanics, Garde R.J. and MirajGoankar, Nemchand&Bros,Roorkee, SCITECH, Publication (India) Pvt. Ltd.
4. Fluid Mechanics and Fluid Power Engineering, Dr. D.S. Kumar, S.K. Kataria& sons
5. Fluid Mechanics, Frank M. White, McGraw Hill Publication
6. Fluid Mechanics, Cengel&Cimbla, Tata McGraw Hill
7. Fluid Mechanics, Streeter V.L. and Wylie E.B., McGraw Hill International Book co.
8. Fluid Mechanics with Engineering Applications, E. Finnemore&Franzini, Tata Mc-Graw Hill
9. Hydraulic Machines-Theory and Design, V. P. Vasandani, Khanna Publishers
10. Fluid Mechanics, A. K. Jain, Khanna Publishers
11. Hydraulic & Compressible Flow Turbo-machines, A. T. Sayers, Mc-Graw Hill

RTM Nagpur University
Proposed Syllabus (Practical)

Semester	Course Title(Subject)	Hours / Week			Credits	Maximum Marks		
		L	T	P		Continual Assessment	University Examination	Total
IV	FLUID MECHANICS & HYDRAULIC MACHINES	-	-	02	01	25	25	50

Course Outcomes	
After successful completion of this Practical course the student will be able to	
CO1	Explain what is Stability condition of floating bodies, Law of conservation of Energy.
CO2	Apply Frictional losses and Hydraulic co-efficient in the pipe flow.
CO3	Estimate the Performance characteristics of Pelton Turbine
CO4	Estimate the Performance characteristics of Francis Turbine & Kaplan Turbine.
CO5	Estimate the Performance characteristics of Centrifugal Pump & Reciprocating Pump.

List of Practical's

Sr. No.	List of Practical's
01	To determine the metacentric height of given floating vessel.
02	To verify Bernoulli's theorem.
03	To find friction losses in pipe.
04	To find the value of co-efficient of given venture meter fitted in a pipe.
05	To find the value of co-efficient of Discharge for a given orifice meter.
06	Performance characteristics of Pelton wheel.
07	Performance characteristic of Francis Turbine.
08	Performance characteristic of Kaplan Turbine.
09	Performance characteristic of Variable Centrifugal speed pump
10	Performance characteristic of Reciprocating pump.
11	To find Reynold's Number

Suggested References:

1. Fluid Mechanics, Frank M. White, McGraw Hill Publication
2. Hydraulic Machines-Theory and Design, V. P. Vasandani, Khanna Publishers
3. Fluid Mechanics, John F. Douglas, Pearson
4. Introduction to Fluid Mechanics, James E.A., John and Haberm W.A., Prentice Hall of India