SCHEME OF COURSE WORK (R- 2020)

Course Details:

Course Title	**FLUID MECHANICS AND MACHINERY**		
Course Code	**22ME1106**	**L T P C**	**3 0 0 3**
Program:	**B.Tech**		
Specialization:	**Mechanical Engineering**		
Semester	**III**		

Course Outcomes (COs): At the end of the course, the student will able to

CO-1	describe the types of fluid flow and fluid flow patterns
CO-2	apply Bernoulli's equation to analyze incompressible fluid flows and study laminar flows
CO-3	explain the concepts of boundary layer fluid flows and losses in pipe flows
CO-4	determine the forces exerted by jet of water on vanes and compare working of different turbines
CO-5	explain the working of reciprocating pump and analyze the performance of centrifugal pump

Program Outcomes (POs): A graduate of mechanical engineering will be able to

PO-1	Apply the knowledge of mathematics, science, engineering fundamentals to solve complex mechanical engineering problems.
PO-2	Attain the capability to identify, formulate and analyse problems related to mechanical engineering.
PO-3	Design solutions for mechanical system components and processes that meet the specified needs with appropriate consideration for public health and safety.
PO-4	Perform analysis, conduct experiments and interpret data by using research methods such as design of experiments to synthesize the information and to provide valid conclusions..
PO-5	Select and apply appropriate techniques from the available resources and current mechanical engineering and software tools.
PO-6	Carry out their professional practice in mechanical engineering by appropriately considering and weighing the issues related to society.
PO-7	Understand the impact of the professional engineering solutions on environmental safety and legal issues.
PO-8	Transform into responsible citizens by resorting to professional ethics and norms of the engineering practice.
PO-9	Function effectively in individual capacity as well as a member in diverse teams and in multidisciplinary streams.
PO-10	Communicate fluently with the engineering community and society, and will be able to prepare reports and make presentations effectively.
PO-11	Apply knowledge of the engineering and management principles to managing projects and finance in multidisciplinary environments.
PO-12	Engage themselves in independent and life-long learning to continuing professional practice in their specialized areas of mechanical engineering.

Course Outcome Versus Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	2	1									
CO-2	3	2	1									
CO-3	3	2	1									
CO-4	3	2	1									
CO-5	3	2	1									

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), put -: No Correlation

Program Specific Objectives (PSOs):

PSO-1	Design, analyse and optimize mechanical systems along with control mechanisms
PSO-2	Manufacture mechanical components by selecting effective processing methods and efficient tools
PSO-3	Design, analyse and evaluate thermal systems

The student must attain the knowledge and skills to

Course Outcome Versus Program Specific Outcomes:

COs	PSO1	PSO2	PSO3
CO-1			3
CO-2			3
CO-3			3
CO-4			3
CO-5			3

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), put -: No Correlation

Assessment Methods:	Assignment / Quiz / Mid-Test / End Exam

Teaching-Learning and Evaluation

Week	TOPIC / CONTENTS	Course Outcomes	Sample questions	TEACHING-LEARNING STRATEGY	Assessment Method & Schedule
1	FLUID PROPERTIES AND PRESSURE MEASUREMENT: Mass density, specific weight, specific volume, specific gravity, viscosity, vapor pressure, compressibility, surface tension and capillarity	CO-1	Define mass density, specific weight, specific gravity and specific volume.	Lecture Problem solving	Assignment-1 Quiz-1 Mid-1
2	Fluid pressure at a point, variation of pressure in a fluid, Pascal's law, atmospheric, absolute, gauge and vacuum pressures, manometers simple manometers, differential manometers.	CO-1	Derive Pascal's law and explain the concept of manometers.	Lecture Problem solving	Assignment-1 Quiz-1 Mid-1
3	KINEMATICS OF FLUID FLOW: Velocity and acceleration of fluid particle, types of fluid flow, description of the fluid pattern, continuity equation, rotational and irrotational flows, velocity potential and stream function.	CO-1	Derive continuity equation	Lecture Problem solving	Assignment-1 Quiz-1 Mid-1
4	DYNAMICS OF FLUID FLOW: Forces acting on fluid in motion, Euler's and Bernoulli's equation (along stream line only),	CO-2	Derive Euler and Bernoulli's equation.	Lecture Problem solving	Assignment-1 Quiz-1 Mid-1

5	Application of Bernoulli's equation venturi meter, orifice meter and Pitot tube, introduction to vortex motion.	CO-2	A pipe 300m long has a difference in datum level of 3m and tapers from 1m diameter at the high end to 0.5m at the low end. Quantity of water flowing is 5400 litres per minute. If the pressure at the high end is 70 kPa, find the pressure at the low end.	Lecture Problem solving	Assignment-1 Quiz-1 Mid-1
6	Impulse momentum equation - forces on pipe bend.	CO-2	A 30 cm diameter pipe carries water under a head of 20 meters with a velocity of 3.5 m/s. if the axis of the pipe turns	Lecture Problem solving	Assignment-1 Quiz-1 Mid-1

			through 45o, find the magnitude and direction of the resultant force on the bend.		
7	LAMINAR FLOW: Relation between shear and pressure gradient, steady laminar flow in circular pipes.	CO-2	Derive the shear and pressure gradient relations for laminar flow in circular pipes.	Lecture Problem solving	Assignment-1 Quiz-1 Mid-1
8	Steady laminar flow between parallel flat plates-both plates at rest	CO-2	Derive the shear and pressure gradient relations for laminar flow in between flat pipes.	Lecture Problem solving	Assignment-1 Quiz-1 Mid-1
9	**Mid-Test 1**	CO-1, CO-2			
10	BOUNDARY LAYER THEORY: Introduction, thickness of boundary layer, boundary layer along a long thin plate, boundary layer equations	CO-3	Explain concept of boundary layer theory.	Lecture Problem solving	Assignment-2 Quiz-2 Mid-2
11	Momentum integral equation of the boundary layer, laminar boundary layer, turbulent boundary layer, laminar sub layer, separation of boundary layer, methods to prevent boundary layer separation.	CO-3	Explain the methods of controlling boundary layer	Lecture Problem solving	Assignment-2 Quiz-2 Mid-2
12	FLOW THROUGH PIPES: Reynolds experiment, energy loss due to friction – Darcy Weisbach equation, minor energy losses, transmission of power through pipes, flow through nozzle at the end of pipe.	CO-3	Calculate the pressure drop and the power required to maintain 0.05 m^3/sec of petrol (Sp.gr 0.7) flow through a steel pipe 0.2 m diameter and 1000 m long. Take coefficient of friction f = 0.0025 in the Darcy equation.	Lecture Problem solving	Assignment-2 Quiz-2 Mid-2
13	IMPACT OF JETS: Force exerted by fluid jet on stationary flat plate and curved vane, force exerted by fluid jet on moving flat plate and curved vane. Torque exerted on a wheel with radial curved vanes.	CO-4	A nozzle of 5 cm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. find the force on the	Lecture Problem solving	Assignment-2 Quiz-2 Mid-2

			plate, the work done and the efficiency of jet.		
14	HYDRAULIC TURBINES: Elements of hydraulic power plants, head and efficiencies of hydraulic turbines, classification of turbines - Pelton wheel, Francis and Kaplan – work done, efficiencies, working proportions and design	CO-4	A Pelton wheel is required to develop 6MW when working under a head of 300 m. It rotates with a speed of 550 rpm. Assuming jet ratio as 10 and overall efficiency as 85% calculate: (i) diameter of wheel (ii) quantity of water required and (iii) number of jets. Assume velocity coefficient as 0.98 and speed ratio as 0.46.	Lecture Problem solving	Assignment-2 Quiz-2 Mid-2
15	Draft tube theory. Performance under unit head – unit quantities, performance under specific conditions – specific speed, performance characteristic curves, model testing of turbines.	CO-4	What is draft tube and explain its functions	Lecture Problem solving	Assignment-2 Quiz-2 Mid-2
16	RECIPROCATING PUMPS: Main components and working of a reciprocating pump, types of reciprocating pumps, work done by reciprocating pump, coefficient of discharge; slip; ideal indicator diagram.	CO-5	Derive the expression for work done by reciprocating pump.	Lecture Problem solving	Assignment-2 Quiz-2 Mid-2
17	CENTRIFUGAL PUMPS: Working of centrifugal pump, types of centrifugal pumps, work done by the impeller, head of the pump, losses and efficiencies, minimum starting speed, Specific speed, model testing of pumps, multistage pumps - pumps in series and parallel, performance of pumps-characteristics curves, limitation of suction lift, NPSH, cavitation, priming devices, pump troubles and remedies.	CO-5	A three stage centrifugal pump has impellers 30 cm diameter and 1.5 cm width at outlet. The velocity of water at inlet is radial; the vanes are curved back at an angle of 30^{o} to the tangent at outlet and occupy 8 percent of the outlet area. While running at 1000 rpm, the pump delivers 40 litres/sec with 85% manometric efficiency and 75% overall efficiency. Calculate the head generated by the pump and the input power.	Lecture Problem solving	Assignment-2 Quiz-2 Mid-2

18	**Mid-Test 2**	CO-3, CO-4, CO-5			
19/ 20	**END EXAM**				