



**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY ::PUTTUR
(AUTONOMOUS)**

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QUESTION BANK(DESCRIPTIVE)

Subject with Code: FM & HM (20CE0160)

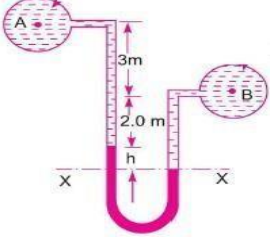
Course & Branch: B.Tech – AGE

Year & Sem: II- B.Tech & II- Sem

Regulation:R20

**UNIT –I
FLUID PROPERTIES AND FLUID STATICS**

1	a) Define and mention units for the following fluid properties: Density, specific weight, specific volume and specific gravity of a fluid.	[L1][CO1]	[8M]
	b) Calculate the density, specific weight and weight of one liter of petrol of specific gravity is 0.7.	[L3][CO1]	[4M]
2	a) Differentiate kinematic viscosity and dynamic viscosity. Give their dimensions.	[L4][CO1]	[6M]
	b) A plate 0.025mm at a distance from a fixed plate moves at 60 cm/sec and requires a force of 2 N/m ² to main this speed. Determine the fluid viscosity between the plates.	[L3][CO1]	[6M]
3	a) Define surface tension? Derive the expression for surface tension on liquid droplet.	[L2][CO1]	[7M]
	b) The surface tension of water in contact with air at 20 ⁰ C is 0.0725 N/m. The pressure inside of water droplet of water is to be 0.02 N/cm ² greater than the outside pressure. Calculate the diameter of the droplet of water.	[L3][CO1]	[5M]
4	a) Explain the terms of compressibility and bulk modulus.	[L2][CO1]	[6M]
	b) Obtain an expression for capillary fall of a liquid.	[L2][CO1]	[6M]
5	a) Obtain an expression for capillary rise of a liquid.	[L2][CO1]	[6M]
	b) Calculate the capillary rise in a glass tube of 2.5mm diameter when immersed vertically in (a) water (b) mercury. Take surface tension is 0.0725 N/m for water and 0.52 N/m for mercury in contact with air. The specific gravity of mercury is given as 13.6 and angle of contact is 130 ⁰ .	[L3][CO1]	[6M]
6	a) State Pascal's law. What do you understand the terms Absolute, Gauge & vacuum pressure?	[L1][CO1]	[6M]
	b) What is the gauge pressure at a point 3m below the free surface of a liquid having a density 1.53 x 10 ³ kg/m ³ , if the atmospheric pressure is equivalent to 750 mm of mercury. The Specific gravity of mercury is 13.6 and density of water is 1000kg/m ³ .	[L3][CO1]	[6M]
7	Derive the expression for pressure difference in differential manometers with neat sketches.	[L2][CO1]	[12M]
8	a) Derive the expression for pressure measurement of U-Tube manometer with neat sketches.	[L2][CO1]	[6M]
	b) An inverted U – tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective center lines of the pipes) are found to be same and equal to 35 cm. Determine the difference of pressure between the pipes.	[L3][CO1]	[6M]

9	<p>a) List out different types of manometers. Explain about piezometer in detail.</p> <p>b) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity is 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40cm and the height of fluid in the left from the center of pipe is 15cm below.</p>	<p>[L1][CO1] [L4][CO1]</p>	<p>[6M] [6M]</p>
10	<p>A differential manometer is connected at two points A and B of two pipes as shown in the figure. The pipe A contains a liquid of specific gravity 1.5 while pipe B contains a liquid of specific gravity 0.9 pressure at A and B are 1 kgf/cm^2 and 1.80 kgf/cm^2 respectively. Find the difference in mercury level in a differential manometer.</p> 	<p>[L4][CO1]</p>	<p>[12M]</p>

UNIT –II
FLUID KINEMATICS AND FLUID DYNAMICS

1	a) Define the terms: Stream line, streak line, path line, stream tube.	[L1][CO2]	[6 M]
	b) Define rate of flow and derive continuity equation for one dimensional flow.	[L1][CO2]	[6 M]
2	Explain the different types of fluid flows in detail.	[L2][CO2]	[12M]
3	Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE.	[L4][CO2]	[12M]
4	Obtain an expression for continuity equation for three - dimensional flow with neat sketch.	[L2][CO2]	[12M]
5	a) Recall Local acceleration and convective acceleration.	[L1][CO2]	[6 M]
	b) Define the following terms: Velocity potential function, stream function and flow net.	[L1][CO2]	[6 M]
6	Derive Bernoulli's equation and what are the assumptions of Bernoulli's equation.	[L3][CO2]	[12M]
7	Define moment of momentum equation and impulse momentum equation.	[L1][CO2]	[12M]
8	Derive the Euler's equation of a motion with neat sketch.	[L2][CO2]	[12M]
9	a) The water is flowing through a pipe having diameters 20cm and 10cm at section 1 and 2 respectively. The rate of flow through pipe is 35 liters/s. The section 1 is 6 m above the datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm^2 , Find the intensity of pressure at section 2.	[L4][CO2]	[8 M]
	b) Explain Energy gradient line and Hydraulic gradient line.	[L2][CO2]	[4 M]
10	A 300 mm diameter pipe carries water under a head of 20 m with a velocity of 3.5 m/s. If the axis of the pipe turns through 45° , find the magnitude and direction of the resultant force at the bend.	[L4][CO2]	[12 M]

UNIT –III
FLOW MEASUREMENT & ANALYSIS OF PIPE FLOW

1	Derive expression for rate of flow through Venturimeter with neat sketch.	[L2][CO3]	[12M]
2	An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30cm diameter. The pressure difference measured by a mercury oil differential manometer on the two sides of the orifice meter gives a reading of 50 cm of mercury. Find the rate of flow of oil of specific gravity 0.9 when the coefficient of discharge of the orifice meter is 0.64.	[L4][CO3]	[12M]
3	Explain about orifice meter and Derive expression for rate of flow through orifice meter.	[L2][CO3]	[12M]
4	a) Explain pitot tube and pitot static tube. b) A sub-marine moves horizontally in sea and has its axis 15m below the surface of water. A pitot tube properly placed just in front of the sub- marine and along its axis is connected to the two limbs of a U – tube containing mercury. The difference of mercury level is found to be 170mm. Find the speed of the sub-marine knowing that the specific gravity of mercury is 13.6 and that of sea water is 1.026 with respect of fresh water.	[L2][CO3] [L4][CO3]	[6M] [6M]
5	An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil-mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take $C_d = 0.98$.	[L4][CO3]	[12M]
6	Derive the expression for head loss in pipes due to friction by using Darcy- Weisbach equation.	[L2][CO3]	[12M]
7	List out minor losses in pipe flow and write the equations for all minor losses.	[L1][CO3]	[12M]
8	a) Recall the concept of pipes in series and parallel. b) Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/s using darcy formula. Take ν for water is 0.01stokes.	[L1][CO3] [L4][CO3]	[6M] [6M]
9	Derive the expression for head loss in pipes due to sudden contraction.	[L2][CO3]	[12M]
10	A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take $f = 0.01$ for both sections of the pipe.	[L3][CO3]	[12M]

UNIT –IV
IMPACT OF JETS & INTRODUCTION TO HYDROELECTRIC POWER PLANT

1	a) Derive an expression for the force exerted by a jet of water on an inclined flat plate in the direction of the jet.	[L2][CO4]	[6M]
	b) A jet of water of diameter 50 mm moving with a velocity of 40 m/s, strikes a curved fixed symmetrical plate at the centre. Find the force extracted by jet of water in the direction of the jet, if the jet is deflected through an angle of 120° at the outlet of the curved plate.	[L4][CO4]	[6M]
2	a) Derive an expression for jet strikes the curved plate at one end tangentially when the plate is symmetrical.	[L2][CO4]	[6M]
	b) A nozzle of 50 mm 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 (i) the force on the plate, (ii) the work done and (iii) the efficiency of jet.	[L4][CO4]	[6M]
3	Derive an expression for jet strikes the curved plate at the centre and at one end tangentially when the plate is unsymmetrical.	[L2][CO4]	[12M]
4	A 7.5 cm diameter jet having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 45° to the axis of the jet. Find the normal pressure on the plate: (i) when the plate is stationary, and (ii) when the plate is moving with a velocity of 15 m/s and away from the jet. Also determine the power and efficiency of the jet when the plate is moving.	[L4][CO4]	[12M]
5	A jet of water of diameter 50mm moving with a velocity of 25 m/s impinges on a fixed curved plate tangentially at one end at an angle of 30° to the horizontal. Calculate the resultant force of the jet on the plate if the jet is reflected through an angle of 50° . Take $g = 10 \text{ m/s}^2$.	[L3][CO4]	[12M]
6	A jet of water having a velocity of 40 m/s strikes a curved vane, which is moving with a velocity of 20 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at an angle of 90° to the direction of the motion of the vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that the water enters and leaves the vane without shock.	[L4][CO4]	[12M]
7	A jet of water moving at 12 m/s impinges on vane shaped to deflect the jet through 120° when stationary. If the vane is moving at 5 m/s, find the angle of the jet so that there is no shock at inlet. What is the absolute velocity of the jet at exit in magnitude and direction and the work done per second per unit weight of water striking per second. Assume that the vane is smooth.	[L4][CO4]	[12M]
8	A jet of water having a velocity of 15 m/s, strikes a curved vane which is moving with a velocity of 5 m/s in the same direction as that of the jet at inlet. The vane is so shaped that the jet is deflected through 135° . The diameter of jet is 100 mm. Assuming the vane to be smooth, find: (i) force exerted by the jet on the vane in the direction of motion, (ii) Power exerted on the vane, and (iii) Efficiency of the vane.	[L4][CO4]	[12M]
9	Explain what are the components of hydroelectric power plants.	[L2][CO4]	[12M]
10	Explain the different types of hydroelectric power stations or power plants with neat sketch.	[L2][CO4]	[12M]

UNIT –V
HYDRAULIC TURBINES & CENTRIFUGAL PUMPS

1	Derive the expression for velocity triangles and work done by the Pelton wheel with a neat sketch.	[L2][CO5]	[12M]
2	Explain what are the component parts of Kaplan turbines with neat sketch.	[L2][CO5]	[12M]
3	A Pelton wheel is to be designed for the following specifications: Shaft power = 11,772 kW, Head = 380 m, Speed = 750 r.p.m, Overall efficiency = 86%; Jet diameter is not to exceed one-sixth of the wheel diameter. Determine: (i) The wheel diameter, (ii) The number of jets required and (iii) Diameter of jet. Take $K_{v1} = 0.985$ and $K_{u1} = 0.45$.	[L3][CO5]	[12M]
4	A Francis turbine with an overall efficiency of 75% is required to produce 148.25kW power. It is working under a head of 7.62m. The peripheral velocity = 0.26 root of $2gH$ and the radial velocity of flow at inlet is 0.96 root of $2gh$. The wheel runs at 150r.p.m. and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine: (i) The guide blade angle, (ii) The wheel vane angles at inlet (iii) Diameters of the wheel at inlet, and (iv) Width of the wheel at inlet.	[L3][CO5]	[12M]
5	Explain the Classifications and efficiencies of turbines in detail.	[L2][CO5]	[12M]
6	Derive the expression for workdone by the centrifugal pump with neat sketch.	[L2][CO5]	[12M]
7	Explain Definitions of Heads and Efficiencies of a centrifugal pump.	[L2][CO5]	[12M]
8	a) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 r.p.m. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller per unit weight of water. b) Write a short note on multistage centrifugal pump.	[L3][CO5]	[8M]
9	a) A centrifugal pump delivers water against a net head of 14.5m and a design speed of 1000 r.p.m. The vanes of curved back to an angle of 30° with the periphery. The impeller diameter is 300mm and outlet width is 50mm. Determine the discharge of the pump if manometric efficiency is 95%. b) Explain pumps in series and parallel.	[L3][CO5]	[7M]
10	a) Derive the expression for specific speed. b) Write a short note on net positive suction head (NPSH).	[L2][CO5] [L1][CO5]	[6M] [6M]

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