INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**MECHANICS OF FLUIDS AND HYDRAULIC MACHINES**
Course Code	:	A40112
Class	:	II-II
Branch	:	**MECHANICAL ENGINEERING**
Year	:	2016 –2017
Course coordinator	:	Mr. G Sarat Raju, Associate Professor
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OBJECTIVES:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

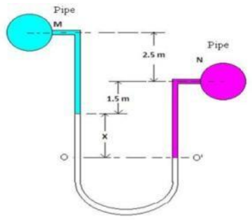
In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

S. No	Question	Blooms Taxonomy Level	Course Outcomes
UNIT-I Fluid Statics			
Part- A(Short Answers)			
1	Define mass density and state its SI units	Remembering	1
2	Define Weight density and state its SI units	Remembering	1
3	Define Specific volume and state its SI units	Remembering	1
4	Define specific gravity of a fluid and state its SI units	Remembering	1
5	Differentiate between Liquids and gases	Analyzing	1
6	Differentiate between Real fluids and ideal fluids	Analyzing	1
7	Differentiate between Specific weight and specific volume of a fluid.	Analyzing	1
8	Differentiate between Newtonian and non-newtonian fluids	Analyzing	1
9	Define dynamic viscosity and state its units	Remembering	1
10	Define and explain Newton's law of viscosity.	Remembering	1
11	Define and explain gauge pressure	Remembering	1
12	One litre of crude oil weighs 9.6N.calculate its specific weight, density and specific gravity.	Applying	1
13	Define vapor pressure.	Remembering	1
14	Define cavitation.	Remembering	1
15	Define surface tension.	Remembering	1
16	Define the property of capillarity.	Remembering	1
17	Define kinematic viscosity and state its units.	Remembering	1
18	Differentiate between compressible and in compressible fluids.	Remembering	1
19	What is a piezometer?	Remembering	1
20	Explain differential manometer.	Remembering	1
Part-B (Long Answers Questions)			

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	UNIT-I		
1	Explain in detail mass density, write its units and explain the effect of temperature and pressure on mass density	Remembering, Understanding	1
2	Explain in detail weight density, write its units and explain the effect of temperature and pressure on weight density	Remembering, Understanding	1
3	Derive the relation between the mass density and weight density	Remembering, Understanding	1
4	Explain in detail specific gravity, write its units and explain the effect of temperature and pressure on specific gravity	Remembering, Understanding	1
5	Explain with a neat sketch the viscosity, newton's law of viscosity, and the effect of temperature and pressure on viscosity	Remembering, Understanding	1
6	Explain in detail the kinematic and dynamic viscosity and derive the relation between them.	Remembering, Understanding	1
7	Explain in detail the Vapor pressure, surface tension.	Understanding	1
8	Explain with neat sketch atmospheric, gauge and vacuum pressure	Understanding	1
9	The pressure 3 meter below the free surface of a liquid is 13.72 kN/m^2. Determine its specific weight	Applying	1
10	If the pressure at a point below the sea is 137.7kN/m^2, what is the pressure 30m below this point? Specific weight of ocean water is 10.06 kN/m^2.	Applying	1
11	An oil of specific gravity 0.80 is under a pressure of 137.2 kN/m^2. What is the pressure head expressed in meters of oil?	Applying	1
12	An oil of specific gravity 0.80 is under a pressure of 137.2 kN/m^2. What is the pressure head expressed in meters of water?	Applying	1
13	How thick is the layer of liquid mud (specific gravity 1.6) at the bottom of a river with water 8 m deep, if there is a pressure of 343 kN/m^2 at the bottom of the mud? Treat the mud as a fluid	Applying	1
14	Two pipes are connected with an inverted U-tube differential manometer. Pipe A to the left limb and Pipe B to the right limb. Water is flowing through the pipes. The water level in the left limb connected to pipe A is 165cm. The difference of water level in the two limbs is 25cm and the level in the right limb is lower than that of the left limb. The difference of the level between two pipe centers is 50cm. Manometric fluid is the oil with specific gravity 0.9. Sketch the set up and determine the pressure difference between the pipes A and B.	Evaluating, Applying	1
15	How can you measure pressure by using differential manometers?	Applying	1
16	Explain different ways of expressing pressure and derive the relation between each other	Evaluating, Applying	1
17	Under what conditions is the meniscus between two liquids in a glass tube (i) concave upwards and (ii) concave downwards?	Understanding, Evaluating	1
18	Define and Explain a fluid from mechanics point of view.	Understanding	1
19	Explain in detail different types of fluids with a neat sketch of the graph	Remembering, Understanding	1
20	Define and explain why the following phenomena happen in fluids (i) spherical shape of a drop of liquid (ii) cavitation	Understanding	1

Part-C (Analytical Questions)

S. No.	Question	Blooms Taxonomy Level	Course Outcomes
	UNIT-I		
1	The velocity distribution for flow over a flat plate is given by $u=3/2\ y-y^{3/2}$. Where u is the point velocity in meter per second at a distance y meter above the plate. Determine the shear stress at y=9cm. Assume dynamic viscosity as 8 poise.	Analyzing, Evaluating	1
2	A plate, 0.025 mm distant form a fixed plate, moves at 50 cm/s and requires a force of 1.471 N/m^2 to maintain this speed. Determine the fluid viscosity between the plates in the poise.	Analyzing, Evaluating	1

3	Find the kinematic viscosity of an oil having density $980 kg/m^2$ .when at a certain point in the oil, the shear stress is $0.25 N/m^2$ and the velocity gradient 0.3/s.	Analyzing, Evaluating	1
4	Figure shows a differential manometer connected at two points A & B at A air pressure is $100 KN/m^2$. Determine the absolute pressure at B 	Analyzing, Evaluating	1
5	An inverted u-tube manometer is connected to two horizontal pipes A & B through which water is flowing. The vertical distance between the axis of these points is 30 cm. When an oil of sp. 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.	Analyzing, Evaluating	1
6	Why does the viscosity of a gas increases with the increases in temperature while that of a liquid decreases with increase in temperature?	Analyzing, Evaluating	1
7	What are the various ways of representing pressure? Analyze with neat sketch the expressions involved	Analyzing	1
8	Determine the gauge and absolute pressure at a point which is 2.0m below the free surface of water. Take atmospheric pressure as $10.1043 N/cm^2$.	Analyzing, Evaluating	1
9	A U-tube differential manometer connects two pressure pipes A and B. Pipe A contains carbon tetrachloride having a specific gravity 1.594 under a pressure of $11.772 N/cm^2$ and pipe B contains oil of specific gravity 0.8 under pressure of $11.772 N/cm^2$. The pipe A lies 2.5m above pipe B. find the difference of pressure measured by mercury as fluid filling U-tube.	Analyzing, Evaluating	1
10	An inverted differential manometer containing an oil of specific gravity 0.9 is connected to find the difference of pressures at two points of a pipe containing water. If the manometer reading is 40cm, find the difference of pressures.	Analyzing, Evaluating	1

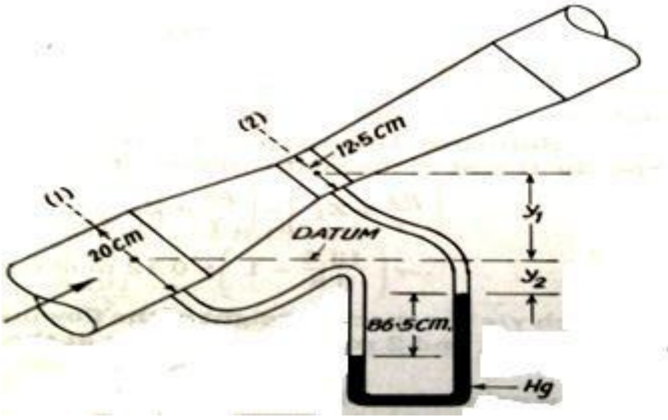
UNIT – II
Fluid Kinematics and Fluid Dynamics
Part-A(Short Answers questions)

1	Classify the fluid flow.	Understanding	2
2	Explain stream line flow pattern.	Understanding	2
3	Explain path line flow pattern.	Understanding	2
4	Explain streak line flow pattern.	Understanding	2
5	Explain stream tube.	Understanding	2
6	Differentiate steady and unsteady flow.	Analyzing	2
7	Differentiate uniform and non uniform flow.	Analyzing	2
8	Differentiate laminar and turbulent flow.	Analyzing	2
9	Differentiate rotational and irrotational flow.	Analyzing	2
10	Write the impulse momentum equation	Evaluating	2
11	Write the continuity equation for an incompressible, 1-D and steady flow.	Evaluating	2
12	What forces are included in Reynold’s equation?	Evaluating	2
13	What forces are included in Navier Stoke’s equation?	Evaluating	2
14	What forces are included in Euler’s equation?	Evaluating	2
15	What are line forces?	Remembering	2
16	What are body forces?	Remembering	2
17	What are surface forces?	Remembering	2
18	Write the assumptions of Bernoulli’s equation	Remembering	2
19	What is the principle of Continuity equation	Remembering	2

20	What is the principle of Bernolli's equation	Remembering	2

	Part-B (Long Answers Questions)		
1	Write different types of flows and Explain in detail Steady flow	Remembering,	2
2	Write different types of flows and Explain in detail Unsteady flow	Remembering	2
3	Write different types of flows and Explain in detail Uniform flow	Remembering,	2
4	Write different types of flows and Explain in detail non Uniform flow	Remembering,	2
5	Write different types of flows and Explain in detail Laminar flow	Remembering,	2
6	Write different types of flows and Explain in detail Turbulent flow	Remembering,	2
7	Write different types of flows and Explain in rotational flow	Remembering,	2
8	Write different types of flows and Explain in detail irrotational flow	Remembering,	2
9	Classify the patterns of flow and Explain in detail with neat sketch the	Remembering,	2
10	Classify the patterns of flow and Explain in detail with neat sketch the	Remembering,	2
11	Classify the patterns of flow and Explain in detail the path line flow and	Remembering,	2
12	Classify and Explain different types of forces acting on a fluid flow	Remembering,	2
13	State the principle of continuity equation. Derive the general 3-D continuity	Remembering,	2
14	State the principle of continuity equation. Derive the 1-D continuity	Remembering,	2
15	Derive Euler's equation for a fluid flow	Remembering,	2
16	State the principle and Derive Bernoulli's equation for a fluid flow	Remembering,	2
17	State the assumptions of Bernoulli's equation and list the applications of	Remembering,	2
18	State and explain the momentum equation.	Remembering	2
19	Apply momentum equation to a pipe bend and derive expressions for forces	Remembering,	2
20	Define major and minor losses.	Remembering	3
	Part-C (Analytical Questions)		
1	A pipe line carries oil of specific gravity 0.83 at a velocity of 2m/s through a 20cm pipe. At another section the diameter is 15cm. Find the velocity at this section and the mass rate of flow	Analyzing, Evaluating	2
2	A pipe 250m long has a slope of 1 in 100 and tapers from 1000mm diameter at higher end to 500mm at lower end. If 5000litres of water is flowing through the pipe per minute and the pressure of water at higher end is 1 kg/cm^2. Find the pressure at the lower end	Analyzing, Evaluating	2
3	At a certain section A of pipe line carrying water, the diameter is 1 m. the pressure is 98.1 KN/m^2 and the velocity is 3m/s. At another section B which is 2m higher than A, the diameter is 0.7m and the pressure is 59.2 KN/m^2. What is the direction of flow	Analyzing, Evaluating	2
4	Water flows at the rate of 0.71m^3/s through the pipe whose inlet is 90cm dia and out let is 60cm dia. If the pressure intensity at the centre line of the 90cm section is 9810 N/m^2 what will be the centre line pressure in the 60cm section?	Analyzing, Evaluating	2
5	Water flows at the rate of 0.71m^3/s through the pipe whose inlet is 90cm dia. and out let is 60cm dia. If the pressure intensity at the centre line of the 90cm section is 9810 N/m^2 What force will be required to produce the change in momentum of water as it passes through this transition?	Analyzing, Evaluating	2
6	Explain the difference between momentum equation and impulse momentum equation	Analyzing, Evaluating	2
7	250 litres/s of water is flowing in a pipe having a diameter of 300mm. If the pipe is bent by 135^O (that is change from initial to final direction), find the magnitude and direction of the resultant force on the bend. The pressure of water flowing is 39.24N/cm^2	Analyzing, Evaluating	2
8	Water flows through a pipe AB 1.2m diameter at 3m/s and then passes through a pipe BC 1.5m diameter. At C, the pipe branches. Branch CD is 0.8m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE.	Analyzing, Evaluating	2
9	Water is flowing through a pipe of 5cm diameter under a pressure of 29.43N/cm^2 (gauge) and with mean velocity of 2.0m/s. Find the total head or total energy per unit weight of the water at a cross-section, which is 5m above the datum line.	Analyzing, Evaluating	2
10	A pipe of diameter 400mm carries water at a velocity of 25m/s. The pressures at the points A and B are given as 29.43N/cm^2 and 22.563 N.cm^2 respectively while the datum head at A and B are 28m and 30m. Find the loss of head between A and B.	Analyzing, Evaluating	2

Unit III **Boundary layer Concepts and Closed Conduit flow** **Part-A(Short Answer Question)**			
1	Explain with neat sketch different regions of boundary layer when a fluid is flowing over a horizontal flat plate	Remembering, Understanding	6
2	Explain boundary layer separation with neat sketch.	Remembering,	6
3	Define drag and explain the difference between pressure drag and friction drag.	Understanding	6
4	Derive the equation for displacement thickness	Evaluating	6
5	Derive the equation for momentum thickness	Evaluating	6
6	Derive the equation for Energy thickness	Evaluating	6
7	Find the displacement thickness, momentum thickness and energy thickness for the velocity distribution in the boundary layer given by	Applying	6
8	Explain the concept of boundary layer separation?	Remembering	6
9	Derive Darcy-Weisbach equation	Evaluating	3
10	Explain various minor energy losses.	Understanding	3
11	Explain how to construct a hydraulic gradient and total energy line, with a neat sketch.	Understanding	3
12	Describe the working of a venturi meter with a neat sketch.	Understanding	3
13	Describe the working of an orifice meter with a neat sketch.	Understanding	3
14	What will happen when the pipes are connected in series and in parallel?	Analyzing	3
15	Derive an expression for loss of head due to sudden enlargement	Evaluating	3
16	Derive an expression for loss of head due to sudden contraction	Evaluating	3
17	Describe the working of a pitot tube with a neat sketch.	Remembering	3
18	Explain in detail Reynold's experiment with neat sketch	Remembering	3
19	Derive the expression for the Coefficient of discharge through a Venturi meter.	Evaluating	3
20	Derive the expression for the Coefficient of discharge through an orifice meter.	Evaluating	3
Part-B (Long Answers Questions)			
1	Explain with neat sketch different regions of boundary layer when a fluid is flowing over a horizontal flat plate	Remembering, Understanding	6
2	Explain boundary layer separation with neat sketch.	Remembering, Understanding	6
3	Define drag and explain the difference between pressure drag and friction drag.	Understanding	6
4	Derive the equation for displacement thickness	Evaluating	6
5	Derive the equation for momentum thickness	Evaluating	6
6	Derive the equation for Energy thickness	Evaluating	6
7	Find the displacement thickness, momentum thickness and energy thickness for the velocity distribution in the boundary layer given by	Applying	6
8	Explain the concept of boundary layer separation?	Remembering	6
9	Derive Darcy-Weisbach equation	Evaluating	3
10	Explain various minor energy losses.	Understanding	3
11	Explain how to construct a hydraulic gradient and total energy line, with a neat sketch.	Understanding	3
12	Describe the working of a venturi meter with a neat sketch.	Understanding	3
13	Describe the working of an orifice meter with a neat sketch.	Understanding	3
14	What will happen when the pipes are connected in series and in parallel?	Analyzing	3
15	Derive an expression for loss of head due to sudden enlargement	Evaluating	3
16	Derive an expression for loss of head due to sudden contraction	Evaluating	3
17	Describe the working of a pitot tube with a neat sketch.	Remembering	3
18	Explain in detail Reynold's experiment with neat sketch	Remembering	3
19	Derive the expression for the Coefficient of discharge through a Venturi meter.	Evaluating	3
20	Derive the expression for the Coefficient of discharge through an orifice meter.	Evaluating	3

Part-C (Analytical Questions)			
1	A pipe of diameter 20 cm and length 2000 m connects two reservoirs, having difference of water levels as 20 m. Determine the discharge through	Analyzing, Evaluating	3
2	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 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, also draw HGL and TEL.	Analyzing, Evaluating	3
3	An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm 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 co-efficient of discharge of the meter = 0.64.	Analyzing, Evaluating	3
4	For a linear distribution of velocity in the boundary layer on a flat plate, find the value of ratio of displacement thickness to momentum thickness.	Analyzing, Evaluating	6
5	A 20cm water pipe has in it a venturimeter of throat diameter 12.5cm as shown in the figure, which is connected to a mercury manometer showing a difference of 86.5cm. Find the velocity in the throat and the discharge. 	Analyzing, Evaluating	3
6	Find the discharge of water flowing through a pipe 30cm diameter placed in an inclined position where a venturimeter is inserted, having a throat	Analyzing, Evaluating	3
7	The rate of flow of water through a horizontal pipe is 0.25m^3/s. The diameter of the pipe which is 200mm is suddenly enlarged to 400mm. The pressure intensity in the smaller pipe is 11.772N/cm^2. Determine: (i) loss of head due to sudden enlargement, (ii) pressure intensity in the large pipe, (iii) power lost due to enlargement.	Analyzing, Evaluating	3
8	A horizontal pipe of diameter 500mm is suddenly contracted to a diameter of 250mm. The pressure intensities in the large and smaller pipe is given as	Analyzing, Evaluating	3
9	Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300mm and length 400m. The rate of flow of water through the pipe is 300litres/s. Consider all losses and take the value of coefficient of friction = 0.008	Analyzing, Evaluating	3
10	Three pipes of lengths 800m, 500m and 400m and of diameters 500mm, 400mm and 300mm respectively are connected in series. These pipes are to be replaced by a single pipe of length 1700m. find the diameter of the single pipe.	Analyzing,	3
Unit IV Basic of tubro machinery, Hydraulic Turbines, Performance of Hydraulic Turbines Part-A(Short Answer Question)			
1	Differentiate impulse and reaction turbines.	Analyzing	4
2	What is specific speed?	Remembering	4
3	Mention different specific speeds for different turbines.	Analyzing	4
4	What is the purpose of draft tube?	Remembering	4
5	What is mass curve?	Remembering	4
6	Differentiate axial and radial flow turbines.	Analyzing	4
7	What are the different heads in turbines?	Analyzing	4
8	How governing of a turbine takes place?	Understanding	4
9	How cavitation occurs?	Understanding	4

S. No	Question	Blooms Taxonomy Level	Course Outcomes
10	What are unit quantities?	Remembering	4
11	What is overall efficiency of turbine?	Remembering	4
12	When do you use pelton wheel turbine?	Applying	4
13	Name different types of draft tubes.	Remembering	4
14	What is water hammer?	Understanding	4
15	Draw O.C curves for turbines	Applying	4
16	What is the force exerted by the jet of water on flat moving inclined plate?	Applying	4
17	Write formulae for unit speed and unit power.	Remembering	4
18	Draw the velocity triangles in the jet of water striking at the tip of unsymmetrical moving curved vane .	Applying	4
19	What is the formula for draft tube efficiency?	Remembering	4
20	What is the efficiency of radial curved vane ?	Remembering	4
	Part-B (Long Answers Questions)		
1	A Pelton wheel having a mean bucket diameter of 1.0 m is running at 1000 r.p.m. the side clearance angle is 150 and discharge through the nozzle is 0.1 m^3/s, determine power available at the nozzle and hydraulic efficiency of the turbine.	Applying	4
2	A jet of water 75 mm in diameter having velocity of 20 m/s strikes a series of the flat plates arranged around the periphery of a wheel such that each plate appears successively before the jet. If the plates are moving at a velocity of 5 m/s, calculate the force exerted by the jet on the plate, the work done per second on the plate and the efficiency of the jet.	Evaluating	4
3	A jet of water of diameter 60mm moving with a velocity of 40 m/sec, strikes a curved fixed symmetrical plate at the centre. Determine the force exerted by the jet of water in the direction of the jet, if the jet is deflected by an angle of 160 degrees at the outlet of the curved plate.	Evaluating	4
4	A jet of water 50 mm in diameter issues with a velocity of 10m/sec and impinges normally on a stationary flat plate which moves in forward motion. Determine the force exerted by the jet on the plate and the work done.	Applying	4
5	Derive an expression for work done/sec and efficiency when the jet of water striking tangentially at the tip of the vane of an un symmetrical curved vane.	Evaluating	4
6	Derive work done and efficiency when the jet of water striking tangentially of a radial curved vanes.	Evaluating	4
7	Explain the main parts of the pelton turbine with a neat sketch	Understanding	4
8	Two turbo-generators each of capacity 25000kW have been installed at a hydel power station. During a certain period the load on the hydel plant varies from 15000kW to 4000kW. Calculate i. The total installed capacity, ii The load factor, iii The plant factor and The utilization factor.	Analyzing	4
9	Derive an expression for efficiency of a series of radial curved vanes when the jet of water striking the vanes.	Evaluating	4
10	A jet of water having a velocity of 35m/s impinges on a series of vanes moving with a velocity of 20 m/s the jet makes an angle of 30^0 to the director of motion of vanes. When entering and leaves at angle of 120^0	Evaluating	4
11	A jet of water of diameter 50mm, having a vel of 20m/s. strikes a curved vane which moving a velocity of 10m/s in the direction of the jet. The jet leaves the vane at an angle of 60^0 to the direction of motion of vane	Applying	4
12	How to govern the impulse turbines? Explain with a neat sketch.	Evaluating	4
13	A turbine develops 9000 KW when running at 100 rpm. The head on the turbine is 30 m. if the head on the turbine reduced to 18m, determine the speed and power developed by the turbine.	Applying	4
14	What is the necessity of a surge tank in turbines. Explain different types of surges with the aid of neat diagrams.	Remembering	4
15	A hydraulic turbine under a head of 25 metres develops 7260 kW running at 110 rpm. What is the specific speed of the turbine? What types of turbine is this. Find also the normal speed and output if the head on the turbine is reduced to 20 metres.	Evaluating	4

16	A turbine Turbine develops 3000 Kw under a head of 300m.The overall efficiency of the turbine is 83%.If speed ratio=0.46,C_v=0.98 and specific speed is 16.5 then find the diameter of the turbine and diameter of jet.	Applying	4
17	Define unit Head, unit discharge and unit power of a turbine and derive the expressions for the same.	Remembering	4
18	A hydraulic turbine working under a head of 165 metres runs at 300 rpm, the discharge of the turbine being 0.60m^3/sec. The overall efficiency of the turbine is 85%. Find the type of turbine.	Applying	4
19	A turbine is to operate under a head of 30 metres at 250 rpm. The discharge is 10.5m^3/sec. if the efficiency is 85% determine i. Power generated ii. The specific speed of the turbine iii. Type of turbine	Analyzing	3,4
20	Derive the expression for the specific speed of turbine.	Evaluating	4
Part-C (Analytical Questions)			
1	The following data is given for a Francis turbine: Net head =70m,speed=600r.p.m.,shaftpower=367.875kw, η_o=85%, η_h=95%,flowrat i o=0.25,breadth ratio=0.1, outer diameter of the runner =2 x inner diameter of runner. The thickness of vanes occupy 10% of the circumferential area of the runner. Velocity of flow is constant at inlet and outlet and discharge is radial at outlet and discharge is radial at outlet.	Evaluating	4
2	A turbine is to operate under a head of 30 meters at 250 rpm. The discharge is 10.5m^3/sec. if the efficiency is 85% determine (i) Power generated. (ii) The specific speed of the turbine. (iii) Type of turbine. (iv) Performance under a head of 25 meters.	Applying	4
3	A hydraulic turbine under a head of 25 m develops 7260 kW running at 110 rpm. What is the specific speed of the turbine? What types of turbine is this. Find also the normal speed and output if the head on the turbine is reduced to 20 m.	Evaluating	4
4	A turbine develops 9000 KW when running at 100 rpm. The head on the turbine is 30 m. if the head on the turbine reduced to 18m, determine the speed and power developed by the turbine	Applying	4
5	Design a pelton wheel for a head of 80 m and speed 300 r.p.m. The pelton wheel develops 103 kw S.P.Take c_v=0.98, speed ratio =0.45 and overall efficiency =0.80.	Evaluating	4
6	A single jet Pelton wheel is required to drive a generator to develop 10000kw.The available head at the nozzle is 760 m. Assume generator efficiency as 95%, efficiency of runner as 87%, the velocity of coefficient	Applying, Evaluating	4
7	Find the power, resultant force and overall efficiency of a pelton wheel having 400m head running at 250 rpm. The jet has been deflected by an angle of 150˚ by the vane and has relative velocity reduced by 20% due to friction. Assume mechanical efficiency as 10%, co-efficient of velocity as 0.91 and specific co-efficient as 0.41, Diameter of the jet as 250mm.	Applying, Evaluating	4
8	Design a Francis turbine having radial blades with width to diameter ratio at inlet and outlet 0.5 and 0.7 respectively .Head of 70 m, speed 500 rpm, brake power 300kW, flow ratio 0.2, speed ratio 0.7, hydraulic efficiency 95% and overall efficiency 85%.	Applying, Evaluating	4
9	Design diameters of runner, absolute blade velocities, discharge and runner vane angles at the hub and outer periphery, for a kaplan turbine with having width to diameter ratio 0.5, head of 40m, speed 300 rpm, power 2500kW, overall efficiency 90%, hydraulic efficiency 85% and diameter of hub is 10 m. Assume no whirl at exit of the runner.	Applying, Evaluating	4

10	Determine the power developed by turbine, diameter of jet and diameter of pipeline of a pelton wheel setup having flow rate of 3 m^3/s and 150 m head from nozzle to head race of the reservoir. The two turbines have two jets per runner and all the four jets have same diameter. Take the pipeline as 2500 m long, efficiency of nozzle as 91%, efficiency of each runner as 90%, the velocity of coefficient of each nozzle as 0.975 and friction factor	Applying, Evaluating	4
Unit IV **Centrifugal Pumps** **Part-A(Short Answer Question)**			
1	What is the function of pump?	Remembering	5
2	Draw the neat diagram of centrifugal pump.	Applying	5
3	What is static head?	Remembering	5
4	What is Manometric head?	Remembering	5
5	Define specific speed for centrifugal pump?	Remembering	5
6	Draw the O.C curves for centrifugal pump.	Applying	5
7	Draw the Muschel curves for centrifugal pump.	Applying	5
8	How cavitation occurs in centrifugal pumps.	Understanding	5
9	What water hammer?	Understanding	5
10	What is NPSH?	Remembering	5
11	Name different efficiency of centrifugal pump	Remembering	5
12	What are the functions of multistage centrifugal pump?	Remembering	5
13	Define priming of centrifugal pump.	Understanding	5
14	How can you prevent cavitations?	Applying	5
15	Write expression for Thomas cavitation factor	Applying	5
16	Define slip of reciprocating pump.	Understanding	5
17	What is meant by indicator diagram?	Remembering	5
18	Write an expression for work done by reciprocating pump.	Remembering	5
19	Define suction head and delivery head .	Remembering	5
20	Draw constant efficiency curves for centrifugal pump.	Applying	5
Part-B (Long Answers Questions)			
1	A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 rpm against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller.	Creating	5
2	The diameter of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Determine the minimum starting speed of the pump, if it works against a head of 30 m.	Creating	5
3	Derive an expression specific speed of a centrifugal pump.	Evaluating	5
4	Draw and explain characteristic curves for centrifugal pumps.	Applying	5
5	What will happen when the pumps are connected in series and parallel?	Analyzing	5
6	What is Cavitation. Explain how it is detected. What are the effects of Cavitation. Explain how cavitation can be avoided.	Remembering	
7	A centrifugal pump having an overall efficiency of 80% delivers 1850 liters of water per minute to a height of 20 meters through a pipe of 100mm diameter and 95 meters length. Taking *f*=0.0075, find the power required to drive the pump.	Evaluating	5
8	Draw and explain centrifugal pump working with neat sketch.	Applying	5
9	Explain different efficiencies of centrifugal pump.	Understanding	5
10	How number of vanes effects head and efficiency of a centrifugal pump.	Applying	5
11	Derive an expression for work done and power Required to Drive the reciprocating pump..	Creating	5
12	How acceleration effects in suction and delivery pipes on Indicator diagram with a sketch?	Applying	5
13	Draw and explain main parts of a reciprocating pump and find the slip % of reciprocating pump?	Evaluating	5
12	The diameter of an impeller of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Determine the minimum starting speed of the pump, if it works against a head of 30 m.	Evaluating	5
13	A centrifugal pump having an overall efficiency of 80% delivers 1850 liters of water per minute to a height of 20 meters through a pipe of 100mm diameter and 95 meters length. Taking *f*=0.0075, find the power required to drive the pump.	Evaluating	5
14	Derive an expression specific speed of a centrifugal pump.	Evaluating	5

15	Draw and explain characteristic curves for centrifugal pumps.	Applying	5
16	What will happen when the pumps are connected in series and parallel?	Analyzing	5
17	What is Cavitation. Explain how it is detected. What are the effects of Cavitation. Explain how cavitation can be avoided.	Remembering	5
18	How friction effects in suction and delivery pipes on Indicator diagram with a neat sketch?	Analyzing	5
19	Draw and explain ideal indicator diagram?	Remembering	5
20	A single acting reciprocating pump, running at 50 r.p.m., delivers 0.01m^3/s of water The diameter of the piston is 200 mm and stroke length 400 mm. Determine: (i) The theoretical discharge of the pump, (ii) Coefficient of discharge, and (iii) Slip and the percentage slip of the pump.	Evaluating	5
	UNIT-V		
1	The internal and external diameters of the impeller of a centrifugal pump are 300 mm and 600 mm respectively. The pump is running at 1000 r.p.m. the vane angles at inlet and outlet are 20^0 and 30^0 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.	Applying	5
2	A centrifugal pump is running at 1000 r.p.m. the outlet vane angle of the impeller is 30^0 and velocity of flow at outlet is 3 m/s. the pump is working against a total head of 30m and the discharge through the pump is 0.3 m^3/s. If the manometric efficiency of the pump is 75%, determine: (i) the diameter of the impeller, and (ii) the width of the impeller at outlet.	Evaluating	5
3	The diameters of an impeller of a centrifugal pump at inlet and outlet are 20 cm and 40 cm respectively. Determine the minimum speed for starting the pump if it works against a head of 25m.	Applying	5
4	A centrifugal pump is to discharge 0.118 m^3/s at a speed of 1450 rpm against a head of 25 m .The impeller diameter is 250 mm it's width outlet is 50 mm and Manometric efficiency is 75%.Determine the vane angle at the outer periphery of the impeller.	Evaluating	5
5	The cylinder bore diameter of a single acting reciprocating pump is 150 mm and its stroke is 300mm.The pump runs at 50 r.p.m. and lifts water through a height of 25 m .The delivery pipe is 22 m long and 100 mm in diameter. Find the theoretical discharge and the theoretical power required to run the pump. If the actual discharge is 4.2 liters/s, find the percentage of slip. Also determine the acceleration head at the beginning and middle of the delivery stroke.	Evaluating	5
6	Determine the work done, relative velocity at the outlet impeller tip, manometric, mechanical efficiency and overall efficiency of a centrifugal pump having outer diameter of the impeller as 720 mm, width as 100 mm, vane angle at outlet of the impeller as 50˚, and runs at a speed of 600 rpm and delivers a flow rate of 0.6 m^3/s with an effective head of 40 m. Assume water enters radially at inlet and a motor of 500kW is used to drive the pump.	Applying, Evaluating	5
7	A centrifugal pump rotating at 1500 rpm delivers 0.2 m^3/s at ahead of 15m. Calculate the specific speed of the pump and the power input. Assume overall efficiency of the pump is 0.68. If the is pump were to operate at 900 rpm, what would be the head, discharge and power required homogenous conditions? Assume overall efficiency remains unchanged at new rpm.	Applying, Evaluating	5
8	Two geometrically similar pumps are running at the same speed of 1000 rpm. One has an impeller diameter of 0.4 m and discharges 30 lit/s against ahead of 20 m. If the other pump gives half of this discharge rate, determine the head and diameter of the second pump.	Applying, Evaluating	5
9	Determine the theoretical discharge, coefficient of discharge, power developed, slip percentage, if a single reciprocating pump delivers 0.003 m^3/s of water while running with a speed of 75 rpm. The diameter of the piston and stroke length of the piston is 175 mm and 210 mm respectively. Assume the suction and the delivery heads as 4m and 15m respectively.	Applying, Evaluating	5
10	Determine the effective area of the piston, theoretical discharge, coefficient of discharge, Work done theoretical , if a double acting reciprocating pump having 25 mm of piston rod diameter delivers 0.003 m^3/s of water while running with a speed of 75 rpm. The diameter of the piston and stroke length of the piston is 175 mm and 210 mm respectively. Assume the suction and the delivery heads as 4m and 15m respectively.	Applying, Evaluating	5

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