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DEPARTMENT OF MECHANICAL ENGINEERING

ENGINEERINGQUESTIONBANK

PROGRAMME	:	B.E.-MECH
ACADEMICYEAR	:	2024-2025
SEMESTER	:	III(ODD)
REGULATION	:	2021
COURSECODE	:	CE3391
COURSENAME	:	FLUIDMECHANICSANDMACHINERY
COURSECOMPONENT	:	CORE
NAME OFTHE COURSEIN-CHARGE	:	Mr. P. KALIYAPPAN

UNITI FLUID PROPERTIES AND FLOW CHARACTERISTICS

Properties of fluids— Fluid statics-Pressure Measurements-Buoyancy and floatation-Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold's transportation theorem –Continuity equation,energy equation and momentum equation-Applications.

Assessment Questions for UNITI

Bloom's Taxonomy Levels:L1-Remember,L2-Understand, L3-Apply, L4-Analyze,L5-Evaluate,L6-Create.

Thinking Skills:L1,L2, and L3&L4.

Sl. No.	Questions	Marks	CO	BL	PI Code
	PART A				
1	What are the physical phenomen a which are responsible for the properties of fluids?	2	CO1	L1	1.6.2
2	Write the importance of kinematic viscosity?	2	CO1	L1	1.6.1
3	One liter of crude oil weights is 9.6N. calculate its specific weight, density	2	CO1	L3	1.6.1
4	Define viscosity and what is the effect due to temperature on liquid and gases.	2	CO1	L1	1.6.1
5	How does viscosity of liquid changes with temperature?	2	CO1	L1	1.6.1
6	State the assumption used in deriving Bernoulli's equations.	2	CO1	L1	1.6.2
7	State Bernoulli's theorem.	2	CO1	L1	1.6.2
8	Write the continuity equation.	2	CO1	L1	1.6.2
9	Differentiate system and control volume.	2	CO1	L1	1.6.2
10	What do you understand by compressibility?	2	CO1	L1	1.6.2

11	Water flows through a pipe in reduces in cross section .The center line of the pipe is horizontal. If V1 = 1.54 m/s and V2 = 2.65 m/s, p1 = 20x103 N/m^2 and p1 = 16.89x103 N/m^2, what is the energy loss between section 1 and 2? Give the answer in meters of water.	2	CO1	L3	1.6.1
12	Define fluid mechanics.	2	CO1	L1	1.6.1
13	The capillary rise at 20^O c in clean glass tube of 1mm diameter containing water is approx.?	2	CO1	L3	1.6.1
14	What is meant by capillary rise and capillary depression?	2	CO1	L1	1.6.1
15	Recall the Euler's equation of motion.	2	CO1	L1	1.6.1

16	Differentiate between surface tension and capillarity.	2	CO1	L2	1.6.2
17	Calculate the density and specific weight of one liter of petrol of specific gravity 0.7.	2	CO1	L3	1.6.2
18	State Surface Tension.	2	CO1	L1	1.6.2
19	Define Impulse Momentum Equation (or) Momentum Equation.	2	CO1	L1	1.6.2
20	What is mean by parallel pipe and write the governing equations.	2	CO1	L1	1.6.2

PART B					
1	Derive energy equations and state the assumptions made while deriving	13	CO1	L3	1.6.2
2	Calculate the specific weight, mass density, specific gravity and specific volume of oil having a volume of 4.5$m^3$and weight of 40KN	13	CO1	L3	1.6.2
3	A 15cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.1cm. Both cylinders are 25cm high. The space between the cylinders is filled with a liquid. If a torque11.77N-misrequired to rotate the inner cylinder at 100rpm , determine the viscosity of the liquid.	13	CO1	L3	1.6.2
4	A venturimeter is used for the measurement of discharge of water in a horizontal pipe line .The up stream diameter is 300mm. the throat is 150mm diameter and the pressure difference between inlet and throat is 3m head of water .If the loss of head through converging section of the meter is1/8 Of the throat velocity head, calculate the discharge in the pipe line.	13	CO1	L3	1.6.2
5	Water flows at a rate of 200 lit/s upwards through a tapered vertical pipe. The diameter of bottom is 240 mm and the top is 200 mm length is 5m, the pressure at the bottom is 8 bar and pressure at the top is 7.3 bar. Determine the head loss through the pipe. Express as the function of exit velocity head.	13	CO1	L2	1.6.1
6	A U tube manometer is used to measure water in a pipe line which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere/ The contact between the water and mercury is in the left limb. Calculate the pressure of water in the mainline if the difference in level of mercury in the limbs is 10.5 cm and free surface of mercury is in level with centre of pipe. If the pressure of water in the pipe is reduced by (i) 10000N/m^2 and (ii) 12000 N/m^2. Find the new difference if level of mercury.	13	CO1	L4	1.6.1
7	Calculate the dynamic viscosity of an oil which is used for lubrication between a square plate of size 0.8m x 0.8 m in an inclined plane with an angle of inclination 30° to the horizontal. The weight of the square plate is 300 N and it slides down the inclained plane with an uniform velocity of 0.3m/s. The thickness of the oil flim is 1.5mm(b)An oil of sp. gravity 0.8 is flowing through venturimeter having inlet dia 20cm and throt dia 10cm. The oil mercury differential manometer shows a reading of 25cm. Calculate the discharge of oil through the horizontal venturimeter. Take Ca=0.98	13	CO1	L1	1.6.1
8	Derive Bernoullis equation with basic assumptions.	13	CO1	L1	1.6.1
9	Determine the viscous drag torque and power absorbed on one surface of collar bearing of 0.2m ID and 0.3 m OD with a oil film thickness of 1mm and viscosity of 30 centi-poise if it rotates at 500 rpm	13	CO1	L3	1.6.1
10	Find the surface tension in a soap bubble of 40 mm diameter when the inside pressure is 2.5 N/m^2 above atmospheric pressure.	13	CO1	L1	1.6.1

PART C					
12	Oil flows through a 25mm diameter orifice under a head of 5.5m at a rate of 3lit/s. The jet strikes1.5m away and 120mm vertically below the Centre line of jet .Calculate the co-efficient of velocity, discharge and contraction.	13	CO1	L3	1.6.2
13	Water flows through a pipe AB of diameter 50mm, which is in series with pipe BC of diameter 75mm in which the velocity is 2m/s At C the pipe forks and one branch CD is of unknown diameter such that velocity is 1.5m/s. the other branch CE is of diameter 25mm and condition are such that the discharge in the pipe BC divides so that discharge in the pipe CD is equal to two times of discharge in CE. Calculate (I) the discharge in pipe AB and CD.(ii) Velocity in pipe AB and CE.(iii) Diameter of pipe CD.	13	CO1	L3	1.6.2

UNIT II FLOW THROUGH PIPES AND BOUNDARY LAYER

Reynold's Experiment-Laminar flow through circular conduits-Darcy Weisbach equation-friction factor- Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel-Boundary layer concepts- Types of boundary layer thickness.

Assessment Questions for UNITII

Bloom's Taxonomy Levels:L1-Remember, L2-Understand, L3-Apply,L4-Analyze,L5-Evaluate,L6- Create

Thinking Skills: L1,L2,andL3&L4.

Sl. No.	Questions	Marks	CO	BL	PI Code
	Part A				
1	What do you understand by the terms a)major energy losses ,b)minor energy losses.	2	CO2	L1	1.6.1
2	Define the terms a) Hydraulic gradient line[HGL] b)Total Energy line [TEL]	2	CO2	L1	1.6.1
3	What is meant by Moody's chart?	2	CO2	L1	1.6.2
4	Mention the range of Reynold's number for laminar and turbulent flow in a pipe.	2	CO2	L1	1.6.1
5	What does Haigen-Poiseulle equation refer to?	2	CO2	L1	1.6.1

6	Recall Hagen poiseuille's formula?	2	CO2	L1	1.6.1
7	State Darcy-Weisbach equation OR What is the expression for head loss due to friction?	2	CO2	L1	1.6.2
8	What are the fact or stobe determined when viscous fluid flows through the circular pipe?	2	CO2	L1	1.6.1
9	What is meant by energy loss in a pipe?	2	CO2	L1	1.6.2
10	Define momentum correction factor(ù):	2	CO2	L1	1.6.1
11	What is mean by boundary layer growth?	2	CO2	L1	1.6.1
12	Define momentum thickness.	2	CO2	L1	1.6.1
13	What are the factors influencing the friction a loss in pipe flow?	2	CO2	L1	1.6.1
14	State the major and minor losses in a pipe.	2	CO2	L1	1.6.2
15	What are the losses experienced by a fluid when it is passing through a pipe?	2	CO2	L1	1.6.1
16	What conditions minor losses will be higher than the major	2	CO2	L1	1.6.2
17	Differentiate Laminar & Turbulent Flow	2	CO2	L2	1.6.1
18	What is the application of Moody's diagram?	2	CO2	L1	1.6.1
19	Draw the velocity distribution and shear stress distribution for the flow through circular pipes	2	CO2	L1	1.6.1
20	State the significance of Navier-Stokes equation.	2	CO2	L1	1.6.1
	PARTB				
1	Derive an expression for Darcy–Weisbach formula to determine the head loss due to friction. Give the expression for relation between friction factor 'f' and Reynolds's number 'Re' for laminar and turbulent flow.	13	CO2	L1	2.6.2
2	A 30 cm diameter pipe of length 30 cm is connected in series to a 20 cm diameter pipe of length 20 cm to convey discharge. Find the equivalent length of pipe of diameter 25 cm, assuming that the	13	CO2	L1	2.6.2
3	An oil of viscosity 9 poise and specific gravity 0.9 is flowing through a horizontal pipe of 60 mm diameter. If the pressure drop in 100 m length of the pipe is 1800 kN/m2 , determine . i. The rate of flow of oil. ii. The centre-line velocity, iii. The total frictional drag over 100 m length, iv. The power required to maintain the flow, v. The velocity gradient at the pipe wall, vi .The velocity and shear stress at 8 mm from the wall.	13	CO2	L1	2.6.2
4	The rate of flow of water through a horizontal pipe is 0.25 m3/sec. The diameter of the pipe is suddenly enlarged from 200 mm to 400 mm. The pressure intensity in the smaller pipe is 11.772N/cm2. Determine (i) loss of head due to sudden enlargement (ii) pressure intensity in the large pipe and (iii) power lost due to enlargement.	13	CO2	L1	2.6.2

5	A piping system consists of three pipes arranged in series; the lengths of the pipes are 1200 m,750 m, and 600 m and diameters 750 mm, 600 mm and 450 mm respectively. (1) Transform the system to an equivalent 450 mm diameter pipe and (2) Determine an equivalent diameter for the pipe 2550 m long.	13	CO2	L2	2.6.2
6	Oil at 27º C (ρ=900 kg/m3 and μ = 40 centi-poise) is flowing steadily in a 1.25 cm diameter,40m long. During the flow, the pressure at inlet and exit of pipe is 8.25 bar and 0.97 bar. Determine the flow rate of oil through the pipe if pipe is (a) horizontal (b) inclined 20º upward (c) inclined 20º downward.	13	CO2	L1	2.6.2
7	A crude oil of kinematic viscosity 0.4 Strokes is flowing through a pipe of dia 300mm at the rate of 300 lit/s Find the head loss due to friction for a length of 50m of the pipe. Take the Co-efficient of friction as 0.06	13	CO2	L3	2.6.2
	PART C				
8	Three pipes of diameters 400 mm, 200 mm and 300 mm and lengths 400 m, 300 m and 200 m respectively are connected in series. The difference in water surface levels in two tanks is 16m. If the coefficients of friction of all the pipes are same and equal to 0.005, determine the discharge through the compound pipe neglecting first the minor losses and then including them.	13	CO2	L2	2.6.2
9	Water at 15°C is to be discharged from reservoir at a rate of 20L/s using two horizontal cast iron pipes connected in series and a pump between them. The first pipe is 22 m long and has a 6 cm diameter, while the second pipe is 33 m long and has a 4 cm diameter. The water level in the reservoir is 30 m above the centerline of the pipe. The pipe entrance is sharp-edged, losses associated with the connection of pump is negligible. Determine the required pumping head and the minimum pumping power to maintain the indicated flow rate. The density and dynamic viscocity of water at 15°C are ρ= 999.1 kg/m3 and μ= 1.138 x 10-3kg/ms. The roughness of cast iron pipe is 0.00026 m.	13	CO2	L2	2.6.2
10	Water flowing through a 10cm diameter pipe enters a porous section of same diameter which allows a uniform radial velocity Vw through the wall surfaces for a distance of 2m (i) If the entrance average velocity V1 = 12m/s Find the exit velocity V2 If Vw= 15cm/s out of the pipe walls; Vw= 10cm/s into the pipe what value of Vw will make V2 = 9m/s (ii) If the entrance average velocity V1 is 18m/s find the exit velocity V2 If Vw= 18cm/s out of the pipe walls; Vw=12cm/s into the pipe. What value of Vw will make V2= 12m/s?	13	CO2	L1	2.6.2

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES

Fundamental dimensions-Dimensional homogeneity-Rayleigh's method and Buckingham theorem

Dimension less parameters –Similitude and model studies-Distorted and undistorted models.

Assessment Questions for UNIT III

Bloom's Taxonomy Levels:L1-Remember, L2-Understand, L3-Apply,L4-Analyze,L5-Evaluate,L6- Create
Thinking Skills: L1,L2,andL3&L4.

Sl. No.	Questions	Marks	CO	BL	PI Code
	Part A				
1	What is the importance of dimensional analysis?	2	CO3	L1	1.6.1
2	What is a model study?	2	CO3	L1	1.6.1
3	What do you understand by dimensional homogeneity ?	2	CO3	L1	1.6.1
4	Write short notes on the principle of similitude	2	CO3	L1	1.6.1
5	State Buckingham Π theorem	2	CO3	L1	1.6.1
6	Give the uses of dimensional analysis	2	CO3	L1	1.6.1
7	What are non-dimensional numbers?	2	CO3	L1	1.6.1
8	Define kinematic similarity?	2	CO3	L1	1.6.1
9	State hydraulic similarity?	2	CO3	L1	1.6.1
10	What is dynamic similitude?	2	CO3	L1	1.6.1
11	What are the types of physical quantities which are used in dimensional analysis?	2	CO3	L1	1.6.1
12	Write the fundamental dimensions of power and dynamic viscosity	2	CO3	L1	1.6.1
13	Define specific Head	2	CO3	L1	1.6.1
14	State the advantages of dimensional analysis.	2	CO3	L1	1.6.1
15	What is dimensional homogeneity?	2	CO3	L1	1.6.1
16	List the repeating variables used in Buckingham theorem.	2	CO3	L1	1.6.1
17	Write the advantages of model analysis.	2	CO3	L1	1.6.1
18	List the various model laws applied in model analysis.	2	CO3	L1	1.6.1
19	State Euler's model law.	2	CO3	L1	1.6.1
20	State Froude's model law.	2	CO3	L1	1.6.1
	PART B				
1	A pipe of diameter 1.m is required to transport an oil specific gravity 0.9 and viscosity 3 x 10-2 poise at the rate of 3000 liters/s. Tests were conducted on a 15 cm diameter pipe using water at 20oC. Find the velocity and the rate of flow in the model. Viscosity of water at 20oC is 0.01 poise.	13	CO3	L2	1.6.2
2	In an airplane model size 1/10 of its prototype the pressure drop is 7.5 kN/m2. The model is tested in water. Find the corresponding pressure drop in the prototype. Take density of air is 1.24 kg/m3, density of water is 1000 kg/m3, Viscosity of air is 0.00018 poise and viscosity of water is 0.01 poise	13	CO3	L2	1.6.2

3	Convective heat transfer coefficient in free convection over a surface is found to be influenced by the density, viscosity, thermal conductivity, coefficient of cubical expansion, temperature difference, gravitational acceleration, specific heat, the height of surface and flow velocity. Using dimensional analysis, determine the dimensionless parameters that will correlate the phenomenon.	13	CO3	L2	1.6.2
4	The resisting force (R) of a supersonic flight can be considered as dependent upon the length of the air craft 'ℓ', velocity 'v', air viscosity 'μ', air density 'ρ' and bulk modulus of air is 'k'. Express the functional relationship between these variables and the resisting force**.**	13	CO3	L2	1.6.2
5	A model of a hydro electric power station tail race is proposed to built by selecting vertical scale 1 in 50 and horizontal scale 1 in 100. If the design pipe has flow rate of 600 m3/s and the allowable discharge of 800 m3/s. Calculate the corresponding flow rates for the model testing**.**	13	CO3	L1	1.6.2
6	Consider flow over a very small object in a viscous fluid. Analysis of the equation of motion shows that the inertial terms are much smaller than the viscous and pressure terms. It turns out, the fluid density drops out of the equation of the motion. The only important parameter of the problem are velocity of motion U, Viscosity of the fluid μ and length scale of the body, using the Buckingham pi theorem generate an expression for two dimensional drag D2-Das a function of other parameter of the problem. Use cylinder diameter d as the appropriate length scale. Repeat the dimensional analysis with ρ included as a parameter. Find the non-dimensional relationship between	13	CO3	L3	1.6.2
7	It is desired to obtain the dynamic similarity between a 30 cm diameter pipe carrying linseed oil at 0.5 m3/s and a 5 m diameter pipe carrying water. What should be the rate of flow of water in lps? If the pressure loss in the model is 196 N/m2, what is the pressure loss in the prototype pipe? Kinematic viscosities of linseed oil and water are 0.457 and 0.0113 stokes respectively. Specific gravity of linseed oil = 0.82.	13	CO3	L1	1.6.2
8	The pressure difference P□ in a pipe of diameter D and length l due to turbulent flow depends on the velocity V, viscosity μ, density ρ and roughness K. By using dimensional analysis, obtain an expression for the pressure difference P	13	CO3	L2	1.6.2
	PART C				
9	A model of submarine is scaled down to 1/20 of the prototype and is to be tested in a wind tunnel where free stream pressure is 2 MPa and absolute temperature is 50oC. The speed of the prototype is 7.72 m/s. Determine the free stream velocity of air and the ratio of the drags between model and prototype. Assume kinematic viscosity of sea water as 1.4 x 10-6 m2/s and viscosity of air as 0.0184 Cp.	13	CO3	L4	1.6.1
10	An object of diameter 900 mm is to move in air at 60 m/s. Its drag is to be estimated from tests on a half scale model in water. The drag on the model is 1140 N. Estimate the speed of the model and drag on the full scale object. Given, air □ = 1.2 kg/m3,air □ = 1.86 □ 10–5 Ns/m2,water □= 1.01□10–3 Ns/m2,water □ = 1000 kg/m	13	CO3	L2	1.6.1

11	A model of a hydro electric power station tail race is proposed to built by selecting vertical scale 1 in 50 and horizontal scale 1 in 100. If the design pipe has flow rate of 600 m3/s and the allowable discharge of 800 m3/s. Calculate the corresponding flow rates for the model testing.	13	CO3	L1	1.6.2
12	The temperature difference θ at location x at time τ in a slab of thickness L originally at a temperature difference θ_o with outside is found to depend on the thermal diffusivity α, thermal conductivity k and convection coefficient h. using dimensional analysis, determine dimensionless parameter that will correlate the phenomenon	13	CO3	L1	1.6.2

UNIT IV **TURBINES**

Impact of jets-Velocity triangles-Theory of roto dynamic machines-Classification of turbines-Working principles-Pelton wheel-Modern Francis turbine-Kaplan turbine-Work done-Efficiencies-Draft tube

Specific speed-Performance curves for turbines- Governing of turbines

Assessment Questions for UNIT IV

Bloom's Taxonomy Levels:L1-Remember, L2-Understand, L3-Apply,L4-Analyze,L5-Evaluate,L6-Create

Thinking Skills: L1,L2,andL3&L4.

Sl. No.	Questions	Marks	CO	BL	PI Code
	Part A				
1	Define Hydraulic turbine.	2	CO4	L1	1.6.1
2	Classify the turbine based on water flow.	2	CO4	L2	1.6.1
3	Give an example for a low head turbine ,medium head turbine and high head turbine.	2	CO4	L1	1.6.1
4	Differentiate the impulse and reaction turbine.	2	CO4	L2	1.6.1
5	What is Radial flow turbine?	2	CO4	L1	1.6.1
6	Differentiate the inward flow reaction turbine and outward flow reaction turbine	2	CO4	L2	1.6.1
7	Differentiate the Francis turbine and Kaplan turbine.	2	CO4	L2	1.6.1
8	What is penstock in pelton wheel?	2	CO4	L1	1.6.1
9	Why does a Pelton wheel not posses any draft tube?	2	CO4	L1	1.6.1
10	What is the function of outer casing?	2	CO4	L1	1.6.1
11	Define Water power.	2	CO4	L1	1.6.1
12	Define bucket power.	2	CO4	L1	1.6.1
13	Mention the function of guide vanes or wicket gates in Francis turbine?	2	CO4	L1	1.6.1
14	What is meant by draft tube?	2	CO4	L1	1.6.1
15	Define unit speed of turbine.	2	CO4	L1	1.6.1
16	Define unit discharge.	2	CO4	L1	1.6.1
17	What is meant by surge tank?	2	CO4	L1	1.6.1
18	Write any two types of surge tank.	2	CO4	L1	1.6.1
19	Write the function of draft tube in turbine outlet?	2	CO4	L1	1.6.1

20	Differentiate between the turbines and pumps.	2	CO4	L2	1.6.1
	PART B				
1	A Pelton wheel works under a gross head of 510 m. One third of gross head is lost in friction in the penstock. The rate of flow through the nozzle is 2.2 m3/sec. The angel of deflection of jet is 165°. Find the (i) power given by water to the runner (ii) hydraulic efficiency of Pelton wheel. Take CV = 1.0 and speed ratio = 0.45	13	CO4	L2	2.6.2
2	A 137 mm diameter jet of water issuing from a nozzle impinges on the buckets of a Pelton wheel and the jet is deflected through an angle of 165□ by the buckets. The head available at the nozzle is 400m. Find: (a) Force exerted on the buckets and (b) Power developed. Assume Cv as 0.97, speed ratio as 0.46 and reduction in velocity while passing through the buckets as 15%.	13	CO4	L2	2.6.2
3	A Pelton turbine is required to develop 9000 KW when working under a head of 300 m the impeller may rotate at 500 rpm. Assuming a jet ratio of 10 and an overall efficiency of 85% calculate (i) Quantity of water required, (ii) Diameter of the wheel, (iii) No of jets, (iv) No and size of the bucket vanes on the runner.	13	CO4	L2	2.6.2
4	A reaction turbine works at 450 r .p .m . under a head of 120 m. Its diameter at inlet is 1.2 m and the flow area is 0.4 m2. The angles made by absolute and relative velocities at inlet are 20□ and 60□ respectively with the tangential velocity. Determine: (i)the volume rate of flow, (ii) the power developed, and (iii) the hydraulic efficiency.	13	CO4	L3	2.6.2
5	The velocity of whirl at inlet to the runner of an inward flow reaction turbine is 3.15H m/s and the velocity of flow at inlet is 1.05H m/s. The velocity of whirl at exit is 0.22H m/s in the same direction as at inlet and the velocity of flow at exit is 0.83H m/s, where H is head of water 30 m. The inner diameter of the runner is 0.6 times the outer diameter. Assuming hydraulic efficiency of 80%, compute angles of the	13	CO4	L1	2.6.2
6	A Kaplan turbine develops 24647.6kW power at an average head of 39m. Assuming the speed ratio of 2, flow ratio of 0.6, diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine	13	CO4	L1	2.6.2
7	Explain the performance Characteristics curves of turbine.	13	CO4	L1	2.6.2
	PART C				
8	A Kaplan turbine delivering 40 MW work under a head of 40 m. And runs at a speed of 150 rpm, the hub diameter is 6m. The overall efficiency is 90%. Determine the blade angles of the hub and tip also at a dia of 4m. also find the speed ratio and flow ratio based on tip velocity. Assume hydraulic efficieny as 95%	13	CO4	L2	2.6.1

9	A hub diameter of a Kaplan turbine, working under a head of 12m, is 0.35 times the diameter of the runner. The turbine is running at 100rpm. If the vane angle of the runner at outlet is 15deg. And flow ratio 0.6, find (i) diameter of the runner, (ii) diameter of the boss, and (iii) Discharge through the runner. Take the velocity of whirl at outlet as zero.	13	CO4	L2	2.6.1
10	At a location selected to install a hydro electric power plant, the head estimated as 540 ms . The flow rate was determined as 22 m3/s. The plant is located at a distance of 2 km from the entry to the penstock pipes along the pipes. Two pipes of 2 m diameter are proposed with a frictional factor of 0.03. Additional loses amount to about 1/4th of frictional loss. Assuming an overall efficiency of 85%, determine how many single jet unit running at 330 rpm will be required.	13	CO4	L1	2.6.1

UNIT V PUMPS

Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies– Velocitytriangles - Work done by the impeller - Performance curves - Reciprocating pump working principle -Indicatordiagramandit'svariations-Work savedbyfittingairvessels-Rotary pumps.

Assessment Questions for UNIT V

Bloom's Taxonomy Levels:L1-Remember, L2-Understand, L3-Apply,L4-Analyze,L5-Evaluate,L6- Create

Thinking Skills: L1,L2,andL3&L4.

Sl. No.	Questions	Marks	CO	BL	PI Code
	Part A				
1	Define Fluid Machines.	2	CO5	L1	1.6.2
2	Where the suction pipe is placed? For what?	2	CO5	L1	1.6.2
3	Define Mechanical Efficiency.	2	CO5	L1	1.6.2
4	What are backward curved vanes?	2	CO5	L1	1.6.2
5	How can we obtain a high head in a pump network?	2	CO5	L1	1.6.2
6	Mention the types of characteristic curves.	2	CO5	L1	1.6.2
7	What is meant by cavitations?	2	CO5	L1	1.6.2
8	What is priming?	2	CO5	L1	1.6.2
9	Why the reciprocating pump called a positive displacement pump?	2	CO5	L1	1.6.2
10	How reciprocating pumps are classified According to the number of cylinders?	2	CO5	L1	1.6.2
11	What is the main difference between single acting and double acting reciprocating pump?	2	CO5	L1	1.6.2
12	What are the causes for negative slip in a reciprocating pump?	2	CO5	L1	1.6.2
13	What is meant by indicator diagram?	2	CO5	L1	1.6.2
14	Define Suction head.	2	CO5	L1	1.6.2
15	What is an air vessel?	2	CO5	L1	1.6.2
16	Mention any four objectives of air vessel.	2	CO5	L1	1.6.2
17	What are the Advantages of air vessel?	2	CO5	L1	1.6.2

18	When will you select a reciprocating pump?	2	CO5	L1	1.6.1
19	What are rotary pumps?	2	CO5	L1	1.6.1
20	Give Examples for Rotary pumps.	2	CO5	L1	1.6.1
	PART B				
1	Explain about working principle of centrifugal pump.	2	CO5	L2	1.6.2
2	A centrifugal pump is to discharge 0.12 m3/sec at a speed of 1450 rpm against a head of 25m. The impeller diameter is 250mm, its width at outlet is 50mm and manometric efficiency is 75 percent. Find the vane angle at the outer periphery of the impeller.	2	CO5	L2	1.6.2
3	The diameter and stroke length of a single acting reciprocating pump are 150mm and 300mm respectively, the pump runs at 50rpm and lifts 4.2 lps of water through a height of 25m. The delivery pipe is 22m long and 100mm in diameter. Find (i) Theoretical power required to run the pump (ii) % of slip and (iii) Acceleration head at the beginning and middle of the delivery stroke	2	CO5	L1	1.6.2
4	A double acting reciprocating pump running at 60 rpm is discharging 1.5 m3 of water per minute. The pump has a stroke length of 400 mm. The diameter of the piston is 250 mm. The delivery and suction heads are 20m and 5m respectively. Find the power required to drive the pump and the slip of the pump.	2	CO5	L1	1.6.2
5	A centrifugal pump running at 920 rpm and delivering 0.32 m3/s of water against a head of 28 m , the flow velocity being 3m/s . If the manometric efficiency is 80% . Determine the diameter and width of impeller. The blade angle at outlet is 25º.	2	CO5	L1	1.6.2
6	Explain about performance characteristics of centrifugal pumps	2	CO5	L1	1.6.2
7	The dimensionless specific speed of a centrifugal pump is .006. Static head is 32 m. Flow rate is 50l/s. The suction and delivery pipes are each of diameter 15cm. The friction factor is 0.002. Total length is 60 m. other losses equal 4 times the velocity head in the pipe. The vanes are forward curved at120º. The width is one tenth of diameter . There is a 7 % reduction in flow area due to blade thickness . The manometric efficiency is 80%. Determine the impeller diameter if inlet is radial.	2	CO5	L3	1.6.2
	PART C				
8	Explain about rotary positive displacement pumps.	2	CO5	L2	1.6.2
9	The internal and external dia of an impeller of a centrifugal pump which is running at 1200 rpm are 300 mm and 600 mm. The discharge through the pump is 0.05m3/s and the velocity of flow is constant and equal to 2.5 m/s. the diameter of the suction and delivery pipes are 150 mm and 100 mm respectively and suction and delivery heads are 6 m and 30 m of water. If the outlet vane angle is 45° and power required to drive the pump is 17 kW. Determine 1. Vane angle of the impeller at inlet. 2. Overall efficiency of the pump. 3. Manometric efficiency of the pump.	2	CO5	L2	1.6.2
10	A centrifugal pump running at 920 rpm and delivering 0.32 m3/s of water against a head of 28 m, the flow velocity being 3m/s . If the manometric efficiency is 80% . Determine the diameter and width of impeller. The blade angle at outlet is 25º.	2	CO5	L2	1.6.2

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