SHANTILAL SHAH ENGINEERING COLLEGE-BHAVNAGAR
PRODUCTION ENGINEERING DEPARTMENT
QUESTION BANK

SUBJECT CODE: 2141906
SUBJECT: Fluid Mechanics
Enrollment No: _____ Batch:_____

Sr. No.	Detail	GTU Year	Marks
1. FLUIDS AND THEIR PROPERTIES:			
1.	Define terms, viscosity, specific gravity, surface tension.	Winter - 2017	3
2.	Prove the compressibility is reciprocal of bulk modulus. Also derive relation between bulk modulus and pressure for a gas for isothermal and adiabatic process.	Summer - 2017	4
3.	State Newton's law of viscosity and give an example.	Winter - 2017	4
4.	Explain following terms: 1) relative density 2) kinematic viscosity 3) cavitation 4) Vapour pressure 5) continuum. 6) Compressibility 7) capillary effect.	Summer - 2015	7
5.	What is capillarity? Derive an expression for capillary rise in case of water.	Summer - 2015	7
6.	State Newton's law of viscosity and give an example.	Winter - 2016	4
7.	Two plates are placed at distance of 0.2 mm apart. Lower plate is fixed while upper plate having surface area one m2 is pulled at 0.2 m/s. Find force and power required to maintain this speed. If the fluid separating them is having viscosity of 2.0 poise.	Winter - 2015	7
8.	Define the following terms. (1) Mass density (2) Specific volume (3) Specific gravity (4) Weight density (5) Dynamic viscosity (6) Kinematic viscosity (7) Surface tension	Winter - 2015	7
9.	What is Capillarity?Derive an expression for capillary rise in case of water.	Summer - 2015	7
10.	Calculate the capillary rise in a glass tube of 3mm diameter inserted in water.Surface tension for water is 0.075 N/m.What will be the percentage increase in capillary height if the diameter of glass tube is 2mm.	Summer - 2015	7
2. PRESSURES AND HEAD:			
1.	Explain the working of bellows pressure gauges with schematic diagram	Winter - 2017	4
2.	Prove that the pressure is exerted equally in all direction at any point in a liquid at rest.	Winter - 2017	7
3.	Explain pressure diagram for inclined and submerge surface.	Winter - 2017	7
4.	Differentiate between (i) absolute and gauge pressure (ii) simple and	Summer -2017	3

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	differential manometer (iii) piezometer and pressure gauge		
5.	Define total pressure and centre of pressure. Derive expression of total pressure force and center of pressure for vertical plane surface remains submerged in liquid.	Summer -2017	7
6.	State advantages and limitation of manometer	Winter - 2016	3
7.	Explain with neat diagram construction and working of bourdon tube pressure gauge.	Winter - 2016	7
8.	Explain with neat diagram construction and working of bellow and diaphragm pressure gauge.	Winter - 2016	7
9.	Explain total pressure and center of pressure.	Winter - 2016	4
10.	Derive an expression for calculating time period of oscillation of floating body.	Winter - 2016	7
11.	Define gauge pressure, absolute pressure and atmospheric pressure.	Winter - 2016	3
12.	Derive an equation for loss of head loss to sudden enlargement	Winter - 2016	4
13.	State and prove Pascal's law with usual notations.	Summer - 2016	4
14.	State and explain Pascal's law .	Winter -2015	7
15.	What do you understand by single column manometer ? Deduce an expression for the pressure measurement.	Winter -2015	7
16.	Differentiate between the following : (1) Absolute Pressure and Gauge Pressure (2) U-tube differential manometer and inverted U tube differential manometer	Winter -2015	7
3.STATIC FORCES ON SURFACE AND BOYANCY:			
1.	A rectangular plane surface 2 m wide and 3 m high immerged in water, it plan is making an angle 450 with the free surface of water. The upper edge of rectangular plate is 1.5 m below the free surface. Calculate the position of center of pressure.	Winter - 2017	3
2.	Determine the metacentric height of a floating vessel if the angle of tilt Θ caused by moving load P placed over the center of the floating body.	Winter - 2017	4
3.	A solid cylinder of diameter 4 meters has a height 3 meters. Find the meta centric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder is 0.6.	Winter - 2017	7
4.	Define metacenter and metacentric height. Derive expression to find metacentric height using analytical method for floating body	Summer -2017	7
5.	Describe stability condition of floating bodies.	Summer -2017	3
6.	Explain Archimedes Principle.	Winter - 2016	3
7.	Write the practical significance of metacentric height.	Winter - 2016	4
8.	A circular plate 1.5 m diameter is submerged in water, with its greatest and least depths below the surface being 2 m and 0.75 m respectively. Determine:	Summer - 2016	7

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	(i) Total pressure on one of the face of the plate (ii) The position of centre of pressure		
9.	Derive expressions for total pressure and centre of pressure for vertically immersed surface.	Summer - 2016	7
10.	A solid cylinder 2 m in diameter and 2 m high is floating in water with its axis vertical. If the specific gravity of the material of cylinder is 0.65 find its metacentric height. State whether the equilibrium is stable or unstable.	Summer - 2016	7
11.	Explain stability of a floating body.	Summer - 2016	4
12.	Define total hydrostatic force and centre of pressure. Deduce an expression for both when the surface is vertically immersed.	Winter - 2015	7
13.	A rectangular plane surface is 2 m wide and 3 m deep. It lies in vertical plane in water. Determine the total pressure and position of centre of pressure on the plane surface when its upper edge is horizontal and (1) Coincides with water surface (2) 3.0 m below the free water surface.	Winter - 2015	7
14.	A rectangular pontoon is 5 m long, 3 m wide and 1.3 m high. The depth of immersion of the pontoon is 0.80 m in sea water. If the centre of gravity is 0.6 m above the bottom of the pontoon, determine the meta centric height. The density for sea water = 1025 kg/m3	Winter - 2015	7
15.	Deduce an expression for the meta centric height of a floating body experimentally with usual notation	Winter - 2015	7
4.MOTION OF FLUID PARTICLES AND STREAMS:			
1.	Explain different types of fluid flows.	Winter - 2016	7
2.	Derive continuity equation in three dimensional Cartesian coordinate system.	Summer - 2016	7
3.	Differentiate between the following : (1) Laminar flow and Turbulent flow (2) Compressible flow and Incompressible flow	Winter - 2015	7
4.	Give an expression for the continuity equation for unsteady, three dimensional and compressible flow in cartesian co ordinate. Hence deduce it for steady and incompressible fluid in three dimensional flow. A 40 cm diameter pipe carries oil of specific gravity 0.8 at a velocity of 2m/s. At another section the diameter is 20 cm. Find velocity at this section and mass flow rate of oil.	Winter - 2015	7
5.	Explain the analytical method of determining the meta centirc height of a floating body.	Summer - 2015	7
6.	A logwood 1meter diameter and 2.5 meter long is floating in water.Calculate the depth of immersion of logwood in water if the specific gravity of logwood is 0.6	Summer - 2015	7
5. THE ENERGY EQUATIONS AND THEIR APPLICATIONS:			

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1.	Derive an expression for the discharge through a venturimeter and compare it with orifice meter for measurement of flow through pipes.	Winter - 2017	7
2.	Derive an expression for discharge over rectangular notch.	Winter - 2017	4
3.	Explain capillary tube viscometer.	Winter - 2017	4
4.	A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm2 and the vacuum pressure at throat is 30 cm of mercury. Find the discharge of water through venturimeter. Take Cd = 0.98.	Summer -2017	4
5.	Derive expression for discharge over a rectangular notch or weir.	Summer -2017	3
6.	Derive the expression for rate of flow through venturimeter.	Summer -2017	3
7.	Derive Bernoulli's equation for adiabatic process in compressible fluid flow.	Winter - 2016	4
8.	A horizontal venturimeter with inlet diameter 150 mm and throat diameter 75 mm is used to measure discharge. The differential manometer gives reading of 150 mm of mercury. Determine the rate of flow if Cd is 0.98.	Summer -2016	3
9.	Derive Euler's equation of motion along a stream line.	Summer -2016	4
10.	Deduce the expression of discharge over a rectangular notch.	Summer -2016	4
11.	Explain the working of Venturimeter with neat sketch. A horizontal Venturimeter 40 cm x 20 cm is used to measure the water flow through a pipe. The head causing the flow is measured as 16 cm of Hg by mercury U tube manometer. Find the flow rate in liters/min. Take Cd=0.96	Winter- 2015	7
12.	Derive an expression for the discharge of water over the V notch with usual notation.	Winter- 2015	7
6. TWO DIMENSIONAL IDEAL FLUID FLOW:			
1.	What is the irrotational velocity field associated with the potential ϕ = 3x2 -3x +3y2 +16t2 +12zt. Does the flow field satisfy the incompressible continuity equation?	Winter - 2017	4
2.	A fluid flow is given by V = 18x3i – 20x2yj. State the flow is rotational or irrotational.	Winter - 2017	3
3.	Distinguish between free vortex flow and forced vortex flow.	Winter - 2017	4
4.	The velocity components in a two- dimensional flow are u = y3/3 + 2x –x2y and v = xy2 -2y – x3/3. Show that these functions represent a possible case of an irrotational flow.	Summer - 2017	4
5.	What do you understand by stream function, velocity potential function and flownet. Give the relation between stream function and velocity potential function.	Summer - 2017	3
6.	Define the terms: Streamline, Streak line, Uniform flow	Winter - 2017	3

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7.	Define path line, stream line and streak line.	Winter - 2016	3
8.	Define vortex flow. Derive an expression of stream function and velocity potential function for vortex flow.	Winter - 2016	7
9.	Define: Stream line, Streak line and Path line.	Summer - 2016	3
10.	The stream function of a two dimensional flow is given by $\psi = 2xy + 25$. Calculate the velocity at the point (1, 2). Also find the velocity potential function Ø.	Summer - 2016	7
11.	Explain the term Vorticity.	Summer - 2016	3
7. DIMENSIONAL ANALYSIS AND SIMILARITIES:			
1.	State the dimensional homogeneity. Prove that the following equations are homogeneous equation. i. Q =AV ii. $T = 2\pi\sqrt{L/g}$ iii. $V = \sqrt{2gH}$	Winter - 2017	7
2.	Using Buckingham's π- theorem, show the efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q.	Winter - 2017	7
3.	Using Buckingham's π- theorem show that the velocity through a circular orifice is given by, $V=\sqrt{2gH}\ \emptyset[\ DH\ ,\mu\rho VH\ ]$ Where H is head causing flow, D is the diameter of the orifice, μ is the coefficient of viscosity, ρ is mass density and g is the acceleration due to gravity.	Summer - 2017	7
4.	Define dimensional analysis with an example.	Winter - 2016	3
5.	Explain different types of hydraulic models.	Winter - 2016	4
6.	Enlist the various methods of dimensional analysis. Explain Buckingham's π theorem for dimensional analysis with illustration.	Winter - 2016	7
7.	Explain the procedure for selection of repeated variables in dimensional analysis.	Summer - 2016	7
8.VISCOUS FLOW:			
1.	State the different observations in Reynold experiment for various states of flow.	Winter - 2017	3
2.	Calculate (i) the pressure gradient along flow (ii) the average velocity and (iii) the discharge for an oil of viscosity 0.02 Ns/m2 flowing between two stationary parallel plates 1 m wide maintained 10 mm apart. The velocity midway between the plates is 2 m/s.	Summer - 2017	3
3.	Derive an expression for the velocity distribution for viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe.	Summer - 2017	7
4.	Derive Hagen - Poiseullie equation stating the assumption made.	Winter - 2016	7
5.	Derive an expression for Hagen-Poiseuille's formula for viscous flow.	Summer - 2016	7
6.	Derive an expression for the Hagen Poiseuille's Formula with usual notation.	Winter - 2015	7
9. TURBULENT FLOW:			

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1.	Determine the head lost due to friction in a pipe using Chezy's formula.Diameter and length of pipe = 250 mm and 60 m Velocity of water flowing in pipe = 2.5 m/s Chezy's constant = 60	Winter - 2017	3
2.	Derive Darcy-Weisbach equation for head loss due to friction in pipe flow.	Winter - 2016	7
3.	Obtain Darcy-Weisbach formula for head loss due to friction.	Summer - 2016	4
10. FLOW THROUGH PIPES:			
1.	State the momentum correction factor and list the momentum correction factor for different flow in pipes.	Winter - 2017	3
2.	Calculate the loss of head and power required to maintain the flow in a horizontal circular pipe of 40 mm diameter and 750 m long when water flow at a rate of 30 liters/minute. Take Darcy's friction factor is 0.032.	Winter - 2017	4
3.	Prove the friction head losses is equal to one third of total head at inlet for maximum power transmission through pipe.	Winter - 2017	7
4.	Prove that the average velocity is half of the maximum velocity in circular pipe with steady laminar flow.	Winter - 2017	7
5.	Derive the expression for the loss of head due to friction in pipes.	Summer - 2017	7
6.	200 liters/s of water is flowing in a pipe having a diameter of 250 mm through which the water is flowing having pressure 38 N/cm2. If the pipe is bent by 125o (that is change from initial to final direction 125o). Find the magnitude and direction of the resultant force on the bend.	Summer - 2017	7
7.	A syphon of diameter 200 mm connects two reservoirs having a difference in elevation of 20 m. The length of the syphon is 500 m and the summit is 3.0 m above the water level in the upper reservoir. The length of the pipe from upper reservoir to the summit is 110 m. Determine the discharge through the syphon and also pressure at the summit. Neglect minor losses. The co-efficient of friction f= 0.005	Summer - 2017	4
8.	The rate of flow of water through a horizontal pipe is 0.25 m3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm2. Determine (i) loss of head due to sudden enlargement (ii) pressure intensity in large pipe.	Summer - 2017	4
9.	What do you understand by frictional resistance offered by pipe?	Winter - 2016	3
10.	In a pipe of 200 mm diameter water is flowing, there is a shear stress of 0.12 kN/m2 at a point distant 30 mm from the pipe axis. If the coefficient of friction between the pipe and fluid is 0.04, calculate the shear stress at the pipe wall.	Summer - 2016	3
11.	An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 liters/s. Find the head lost due to friction for a 500 mm length of pipe. Also find the power required to maintain the flow. Take f = 0.079/(Re)1/4	Summer - 2016	7

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11. COMPREEIBLE FLOW:			
1.	Prove the velocity of a sound wave in a compressible fluid is given by C =$\sqrt{\gamma RT}$.	Winter - 2017	3
2.	Prove the velocity of sound wave in compressible fluid is given by C = $\sqrt{k\rho}$ where k = bulk modulus of fluid and ρ = density of fluid.	Summer - 2017	4
3.	Define compressible and incompressible.	Winter - 2016	3
4.	Obtain Bernoulli's equation for compressible flow considering adiabatic process.	Summer - 2016	7
5.	Find the expression of velocity of sound in terms of Bulk Modulus.	Summer - 2016	3
6.	Explain propagation of sound waves for Sub sonic and Sonic flow.	Summer - 2016	4
7.	State the Bernoulli's theorem for a compressible flow. Derive an expression for Bernoulli's equation when the process is : (1) Isothermal process (2) Adiabatic process	Winter - 2015	7

SUBJECT CO ORDINATOR
PROF.M.V.GOHIL

H.O.D
PRODUCTION ENGG.DEPT.
DR.(PROF.) A.V.GOHIL