Registration no: | | | | | | | | | | |

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B.TECH
PCME4201

3rd Semester Regular / Back Examination 2015-16
FLUID MECHANICS AND HYDRAULIC MACHINES
BRANCH(S): AERO,CIVIL,MECH,MINERAL,MINING

Time: 3 Hours
Max Marks: 70
Q.CODE: T690

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) How viscosity varies with respect to temperature for gas and liquids?

b) The pressure at a particular location of a centrifugal pump measured by a Bourdon tube pressure gauge is found to be 2.3 kgf/cm^2. Determine the equivalent water head at this location.

c) Define Mach number. Define its importance with respect to fluid compressibility.

d) Assuming own notations find the buoyant force on a body floating at the surface of separation between two fluid.

e) What will happen if the fluid pressure at the throat of a venturimeter is too low?

f) Define impulse momentum equation, where this equation is used?

g) What is meant by equivalent pipe?

h) Mention two possible causes of trouble in case of a centrifugal pump if no water is delivered.

i) Differentiate between runaway speed and synchronous speed of a hydraulic turbine.

j) Why the reciprocating pump is called as the positive displacement pump?

Q2 **a)** A plate of metal having dimensions 1.2 m x 1.2 m x 2 mm is to be lifted up with a velocity of 0.14 m/s through an infinitely extending gap 26 mm wide containing an oil of specific gravity 0.9 and viscosity 21.6 poise. Find the force required assuming the plate to remain midway in the gap. Assuming the weight of the plate to be 35 N. **(5)**

b) A circular opening, 2.5 m diameter, in a vertical side of a tank is closed by a disc of 2.5 m diameter which can rotate about horizontal diameter. Find force on the disc and the torque required to maintain the disc in equilibrium in vertical position when the head of water above the horizontal diameter is 3.5 m. **(5)**

Q3 **a)** In 2-D incompressible flow, the fluid velocity components are given by u = x - 4y and v = -y - 4x.Show that velocity potential exists and find its form as well as stream function. **(5)**

b) Show that for a completely submerged vertical surface the centre of pressure is always below the centre of gravity of the surface. **(5)**

Q4 The rate of flow of water pumped into a pipe ABC, which is 200 m long, is 20 litres/s. The pipe is laid on an upward slope 1 in 40. The length of the portion AB is 100 m and its diameter is 100 mm, while the length of the portion BC is 100 m but its diameter is 200 mm. The change of diameter at B is sudden. The flow is taking place from A to C, where the pressure at A is 19362 N/cm^2 and end C is connected to a tank. Find the pressure at C and draw the hydraulic gradient and total energy line. Take f = 0.008. **(10)**

Q5 **a)** Find the density of metallic body which floats at the interface of mercury, oil of specific gravity 0.85 and water such that 30% of its volume is submerged in mercury, 60% in water and 10% in oil. **(5)**

b) The maximum flow through a 300 mm diameter horizontal pipe line is 300 litre/s. A venturimeter is introduced at a point of the pipe where the pressure head is 5 m of water. Find the diameter of throat so that the pressure at the throat is never negative. Take $C_d = 0.98$ **(5)**

Q6 **a)** Explain why draft tube is provided for Kaplan turbine when compared with a Pelton wheels. Describe with sketches two different types of draft tubes. **(4)**

b) A double jet Pelton wheel turbine is supplied with water through pipe line 1635 metres long from a reservoir in which the level of the water is 367.5 metres above that of the wheel. The turbine runs at 5oo rpm and develops a runner power of 4920 KW. If the pipe line losses are 10 percent of the gross head and f = 0.005, calculate the diameter of the pipe, the cross-sectional area of the jets, and mean diameter of the bucket. Assume C_v for the jets is 0.98; speed ratio = 0.45; hydraulic efficiency of the turbine is 86%. **(6)**

Q7 **a)** A centrifugal pump is used to deliver water and it has an impeller of external diameter 600 mm and internal diameter 200 mm. The width of the impeller is 100 mm at inlet and 40 mm at outlet. The vane angle at inlet and outlet are 15° and 25° respectively. The impeller rotates at 1500 rpm. Neglecting losses and vane thickness, determine (a) the discharge for shockless radial entry, (b) the head developed, (c) the power required to drive the pump if the overall efficiency is 70% and (d) the pressure rise through the impeller. **(6)**

b) Derive an expression for the acceleration head in a reciprocating pump and show its value at the beginning, middle and end of stroke. **(4)**

Q8 Write short notes on any two: **(5 x 2)**

a) Piezometer and Barometer

b) Types of Motion of Fluid Elements

c) Hydrostatic Paradox

d) Surge Tanks