Registration no:

Total Number of Pages: 02 **B.Tech**

PCME4201

3rd Semester Back Examination 2016-17
FLUID MECHANICS AND HYDRAULIC MACHINES
BRANCH(S): AERO, CIVIL, MECH, MINERAL, MINING

Time: 3 Hours

Max Marks: 70

Q.CODE: Y638

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) A hydraulic press has a ram of 30cm diameter and a plunger of 4.5 cm diameter. Find the weight lifted by the hydraulic press when the force applied at the plunger is 500N.

b) Differentiate between kinematic viscosity and dynamic viscosity.

c) Name the different types of forces present in fluid flow.

d) Derive the force exerted by a jet on a curved vane moving in the direction of the jet.

e) Why priming is necessary for centrifugal pump.

f) Determine the density, specific weight and specific volume of ait if the specific gravity (water as reference fluid) is 0.011614.

g) What is hydrostatic pressure distribution? Give one example where pressure distribution is no hydrostatic.

h) A fluid flow is given by $V_r=(1-a/r^2)\cos\theta$, $V\theta= -(1+a/r^2)\sin\theta$. Determine whether the flow is rotational or irrotational.

i) What is draft tube? Why it is used in reaction turbine.

j) What do you mean by cavitation? How to avoid cavitation in turbine.

Q2 **(a)** With a diagrammatical representation describe the different types of fluids with an example. **(5)**

(b) Two large fixed parallel planes are 12mm apart. The space between the surfaces is filled with oil of viscosity 0.972Ns/m^2.A flat thin plate 0.25m^2 area moves through the oil at a velocity of 0.3m/s. Calculate the drag force (1) when the plate is equidistant from both the planes.(2)When the thin plate is at a distant of 4mm from one of the plane surfaces. **(5)**

Q3 **a)** A body has the cylindrical upper portion of 3m diameter and 1.8m deep. The lower portion o is a curved one, which displaces a volume of 0.6m^3 of water. The center of buoyancy of the curved portion is at a distance of 1.95m below the top of the cylinder. The center of gravity of the whole body is 1.20m below the top of the cylinder. The total displacement of water is 3.9 tonnes. Find the metacentric height of the body. **(5)**

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

Q4 **a)** A 30cmx15cm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30cm.The differential u tube mercury manometers shows a gauge deflection of 25cm.calculate(1) the discharge of oil(2) the pressure difference between entrance and throat section .Take Cd as 0.98 and specific gravity of mercury as 13.6. **(5)**

b) Find the acceleration and vorticity components at a point (1,1,1) for the following flow field: $u=2x^2+3y$, $v= -2xy+3y^2+3zy$, $w= -3/2\ z^2+2xz-9y^2z$. **(5)**

Q5 **a)** Define specific speed of a turbine and derive an expression for the same. State its significance. **(5)**

b) The water available for a pelton wheel is 4cumec and the total head from the reservoir to the nozzle is 250m.The turbine has two runners with two jets per runner .All the four jets has the same diameters. The pipe line is 3000m long. The efficiency of power transmission through the pipe line and the nozzle is 91% and efficiency of each runner is 90%.The velocity of each nozzle is 0.975 and coefficient of friction '4f' for the pipe is 0.0045.Determine (1) The power developed by the turbine (2) the diameter of the jet (3) The diameter of the pipe. **(5)**

Q6 **a)** What do you mean by Indicator diagram? With a neat sketch explain ideal indicator diagram for reciprocating pump. **(5)**

b) The impeller of a centrifugal pump having external and internal diameters 500mmmm and 250mm, width at outlet 50mm and running at 1200 rpm works against a head of 48m.The velocity of flow through the impeller is constant and equal to 3.0m/s. The vanes are set at an angle of 40^0 at outlet. Determine (1) inlet vane angle.(2) work done by the impeller on water per sec. (3) manometeric efficiency. **(5)**

Q7 Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumptions. Explain how Bernoulli's equation is derived from Euler's equation. **(10)**

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

a) Difference between impulse and reaction turbine.

b) Differential manometer.

c) Multistaging of centrifugal pump.