Code No: 09A40304 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD
B.Tech II Year II Semester Examinations, November / December-2013
MECHANICS OF FLUIDS AND HYDRAULIC MACHINES
(Common to ME, MIE, MIM)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

- - -

1.a) Develop the expression for the relation between gauge pressure P inside a droplet of liquid and the surface tension.

b) Explain
i) Newtonian and Non-Newtonian fluids,
ii) vapour pressure and compressibility. [15]

2.a) Explain the terms:
(i) Path line, (ii) Streak line, (iii) Stream line, and (iv) Stream tube.

b) In a 45^0 bend a rectangular air duct of 1 m^2 cross-sectional area is gradually reduced to $0.5m^2$ cross sectional area. Find the magnitude and direction of the force required to hold the duct in position, if the velocity of flow at the $1m^2$ section is 10 m/s and pressure is 2.943 N/cm^2. Take density of air as 1.16 kg/m^3. [15]

3. For a town water supply, a main pipe line of diameter 0.4 m is required. As pipes more than 0.35 m diameter are not readily available, two parallel pipes of the same diameter were used for water supply. If the total discharge in the parallel pipes is same as in the single main pipe, find the diameter of the parallel pipe. Assume the co-efficient of friction same for all pipes. [15]

4.a) Explain
i) Total drag on a body,
ii) Resultant force on a body,
iii) co-efficient of drag and co-efficient of lift.

b) A sub-marine which may be supposed to approximate a cylinder 4 m in diameter and 20 m long travels sub-merged at 1.3 m/s in sea-water. Find the drag exerted on it, if the drag co-efficient for Reynolds number greater than 10^5 may be taken as 0.75. The density of sea-water is given as 1035 kg/m^3 and kinematic viscosity as 0.015 stokes. [15]

5.a) Find an expression for the efficiency of a series of moving curved vanes when a jet of water strikes the vanes at one of its tips. Determine the maximum efficiency.

b) A jet of water having a velocity of 30m/s strikes a curved vane, which is moving with a velocity of 15m/s. The jet makes an angle of 30^0 with the direction of motion of vane at inlet and leaves at an angle of 120^0 to the direction of motion of vane at outlet. Calculate
i) Vane angles, if the water enters and leaves the vane without shock
ii) Work done per second per unit weight of water striking the vanes per second. [15]

6.a) Obtain an expression for the work done per second by water on the runner of a Pelton wheel. Hence derive an expression for maximum efficiency of the Pelton wheel giving the relationship between the jet speed and bucket speed.

b) An inward flow reaction turbine has an exit diameter of 1 meter and its breadth at inlet is 250 mm. If the velocity of flow at inlet is 2 m/s, find the mass of water passing through the turbine per second. Assume 10% of the area of flow is blocked by blade thickness. If the speed of the runner is 210 r.p.m and guide blades make an angle of 10^0 to the wheel tangent, draw the inlet velocity triangle, and find:

i) The runner vane angle at inlet,
ii) Velocity of wheel at inlet,
iii) The absolute velocity of water leaving the guide vanes, and
iv) The relative velocity of water entering the runner blade. [15]

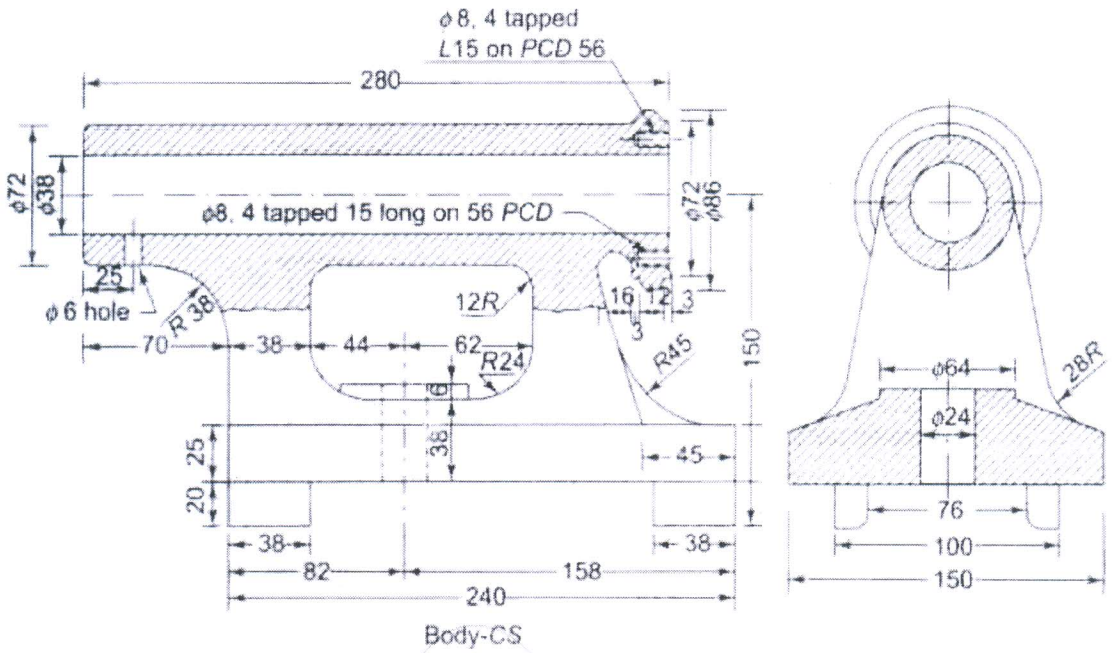
7.a) Define the specific speed of a turbine? Derive an expression for the specific speed. What is the significance of the specific speed?

b) Define the terms unit power, unit speed and unit discharge with reference to a hydraulic turbine. Also derive expressions for these terms. [15]

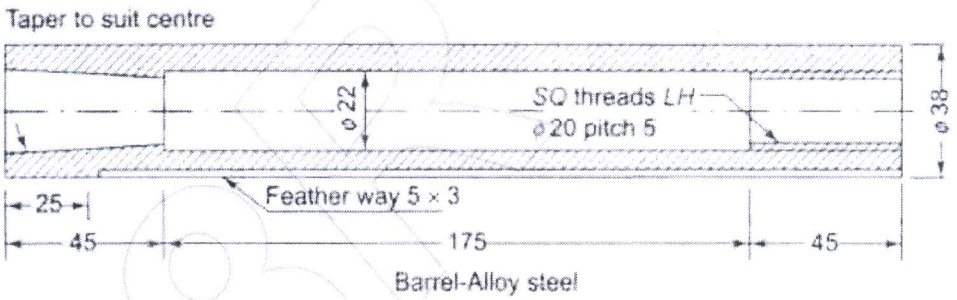
8.a) What is cavitation and what are its causes? How will you prevent the cavitation in hydraulic machines?

b) Explain the principle and working of a reciprocating pump with a neat sketch. [15]

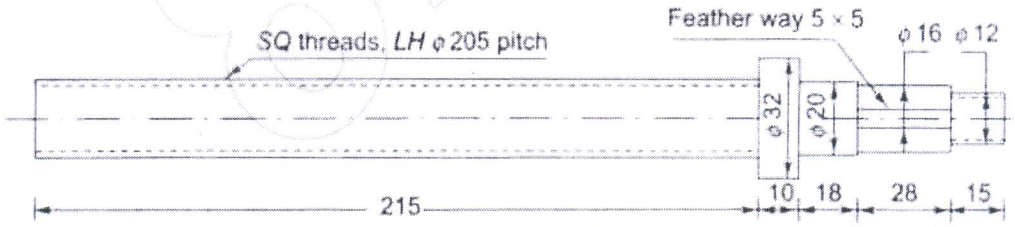
****



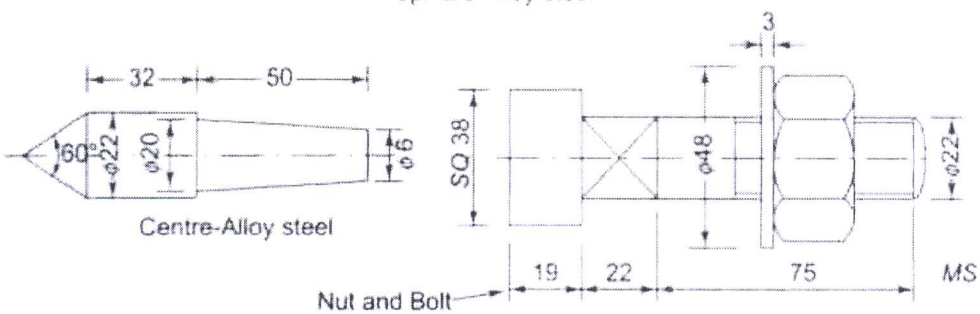
Body-CS



Barrel-Alloy steel

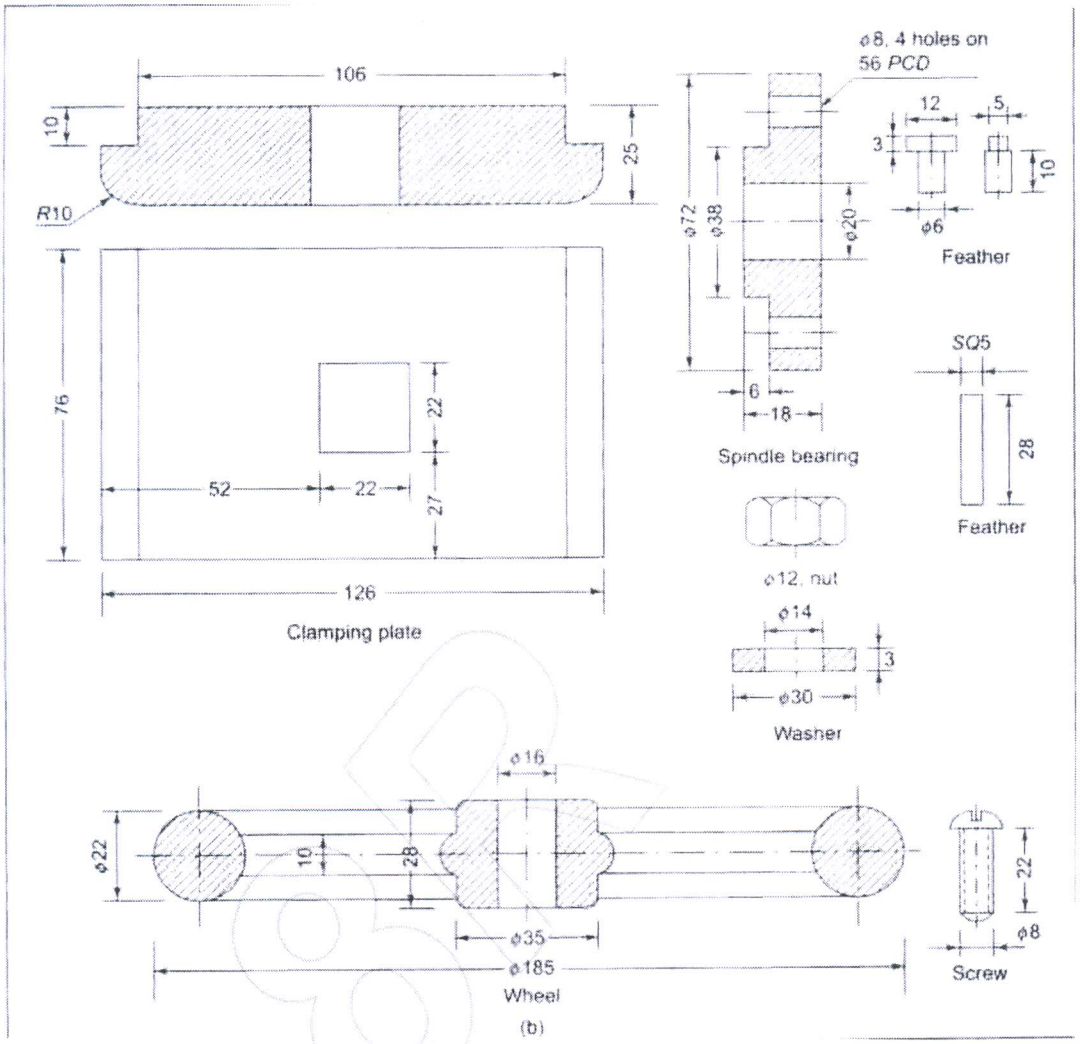


Spindle-Alloy steel



Centre-Alloy steel

Nut and Bolt



Bill of Material

S.No	Part	Quantity	Material
1	Talstock body	1	Cast Steel
2	Barrel	1	Alloy Steel
3	Spindle	1	Alloy Steel
4	Center	1	Alloy Steel
5	Nut, Bolt assembly	1set	Mild Steel
6	Clamping Plate	1	Cast Steel
7	Spindle bearing	1	Non-Ferrous
8	Feather	1set	Non-Ferrous
9	Nut Φ 12	1	Alloy Steel
10	Washer Φ 30 x Φ 14 x 3	1	Alloy Steel
11	Hand Wheel	1	Cast Iron
12	Screw	4	Mild Steel

---oo0oo---