

## II B.Tech I Semester(R05) Supplementary Examinations, May/June 2010

## FLUID MECHANICS AND HYDRAULIC MACHINERY

(Electrical &amp; Electronic Engineering and Electronics &amp; Communications Engineering))

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) Distinguish between ideal fluids and real fluids. Explain the importance of compressibility in fluid flow.
- (b) The velocity distribution in a flow of thin film of oil down an inclined channel is given by  $u = \frac{\gamma}{2\mu} \sin \alpha * (d^2 - y^2)$ . Where d=depth of flow,  $\alpha$  = angle of inclination of that channel to the horizontal, u = velocity at a depth 'y' below the free surface,  $\gamma$  = unit weight of oil and  $\nu$ = dynamic viscosity oil. Calculate the shear stress
  - i. on the bottom of channel,
  - ii. at mid depth and
  - iii. at the free surface.[8+8]
2. (a) Distinguish between rotational and irrotational flow. [4+12]
- (b) A pipe line, 600 mm diameter carrying oil of specific gravity 0.85 at the flow rate of 1800 lit/s has a 90° bend in the horizontal plane. The pressure at the entrance to the bend is 1.471 bars and loss of head in the bend is 2 m of oil. Find the magnitude and direction of the force exerted by the oil on the bend and show the direction of the force on a sketch of the bend.
3. (a) Explain how the following flow problems are analyzed.
  - i. Series pipe connection
  - ii. Parallel pipe connection
  - iii. Equivalent pipe connection.
- (b) Water flows through a 10cm diameter, 30m long pipe at a rate of 1400 rpm. What percent of head would be gained by replacing the central one third length of pipe by another pipe of 20cm diameter. Assume that the changes in section are abrupt and  $f = 0.008$  for all pipes. Neglect entrance and exit losses but consider major loss and losses due to sudden contraction and sudden expansion. [9+7]
4. (a) Derive the expressions for force and work done per second by the jet when it strikes a curved plate moving in the direction of the jet.
- (b) A jet of water 20cm in diameter and moving with a velocity of 20m/sec impinges normally on a series of flat vanes mounted on the periphery of a wheel. If the velocity of the vanes is 8m/sec, determine
  - i. the force exerted by the jet on the wheel
  - ii. work done by the jet on the wheel per second and
  - iii. hydraulic efficiency.[7+9]
5. (a) What do you understand by pumped storage type of power station? What are its merits and demerits when compared with other types ? Use sketches if necessary.
- (b) The gross head and discharge of a hydro electric plant are 40m and 200 m<sup>3</sup> / sec respectively. The losses in Penstock are 12%. If the turbine works with an efficiency of 92%, what will be the power developed. [10+6]
6. (a) What is an axial flow turbines ? What are its parts ? Explain with sketches.
- (b) Derive the equation for work done on the runner of an axial flow turbine from fundamentals. [6+10]
7. (a) Explain what you understand by governing of a hydraulic turbine with neat sketches.
- (b) A Pelton wheel turbine is working under varying conditions and the head drops down from 450m to 300 m. How will the speed , discharge and power change under constant efficiency and homologous conditions. [6+10]
8. (a) What is NPSH ? How will it relate to the working of a centrifugal pump ? List all the losses of centrifugal pumps.
- (b) Explain the working of a reciprocating pump with a neat sketch. Prove that the discharge of a single acting reciprocating pump is given by  $Q = ALN / 60$  [8+8]

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