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Total number of printed pages – 3

B. Tech  
PCME 4201

**Third Semester Examination – 2013**  
**FLUID MECHANICS AND HYDRAULIC MACHINES**

**BRANCH : MECH, MINERAL, MINING, CIVIL**

**QUESTION CODE : C- 488**

**Full Marks – 70**

**Time : 3 Hours**

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

1. Answer the following questions :

2×10

- Distinguish between intensity of pressure and pressure head.
- The pressure at a particular location of a centrifugal pump measured by a Bourdon tube pressure gauge is  $3.23 \text{ Kgf/cm}^2$ . Determine the equivalent water head at this location.
- A differential manometer with mercury fitted to a venturimeter gives a difference of pressure 7.5 cm between inlet and throat. What is the equivalent water head ?
- State three possible method to increase the sensitivity of a manometer.
- With the help of a sketch, explain about atmospheric pressure, absolute pressure and gauge pressure.
- What do you mean by runaway speed of a turbine and find a situation when it occurs.
- What do you mean by degree of reaction of a turbine ?
- What do you mean by negative slip in a reciprocating pump and when it occurs ?

P.T.O.

- (i) Where draft tubes are used ? Write two functions of draft tube.
- (j) Define specific speed separately for turbine and pump.
2. (a) In a three-dimensional incompressible fluid flow field is given by expression  $V = (x^2 + y^2z^3) i - (xy + yz + zx)j + (w)k$ . Find  $w$  component of a velocity so that the case is possible for a steady incompressible fluid flow. 5
- (b) When the pressure of a fluid increased from 3.5 MPa to 6.5 MPa and the corresponding decreased in volume is found to be 0.08 per cent. Determine the bulk modulus of elasticity. 5
3. (a) Discuss one-dimensional, two-dimensional and three-dimensional flow. 5
- (b) Water is flowing in a pipe of 90 mm diameter with a mean velocity of 2 m/s. The pressure is measured to be 350 kPa. If the pipe is 8 m above the datum, determine the total head of water. Neglect head lost in friction. 5
4. Discuss, in detail, regarding the constructional features of a venturimeter. What is its basic principle of working ? Derive for the theoretical discharge for a horizontally laid venturimeter. 10
5. (a) Draw a neat velocity vector diagram at both inlet and outlet for a jet striking tangentially an unsymmetrical moving curved vane. Label all velocity components. 5
- (b) A double-acting reciprocating pump has piston diameter 250 mm and piston rod of diameter 50 mm. Length of the piston stroke is 350 mm and speed of the crank moving the piston is 60 rpm. The suction and delivery heads are 4.5 m and 18 m respectively. Determine the discharge capacity of the pump and the power required to operate the pump. 5
6. A double overhung Pelton wheel unit is to operate at 30000 kW generator under an effective head of 300 m at the base of the nozzle. Find the size of the jet, mean diameter of runner, synchronous speed of each wheel. Assume generator efficiency 93%, Pelton wheel efficiency 85%, coefficient of nozzle velocity 0.97, speed ratio 0.46 and jet ratio 12. 10

7. (a) What do you mean by NPSH in case of a centrifugal pump ? 5
- (b) Water is to be pumped out of a deep well under a total head of 95 m . A number of identical centrifugal pumps of design speed 1000 rpm and specific speed 900 rpm with a rated capacity of 150 litres/sec are available. How many pumps will be needed and how should they be connected ? 5
8. Distinguish between the following : 2.5×4
- (a) Newtonian fluid and non-Newtonian fluid
- (b) Centre of pressure and centre of buoyancy
- (c) Centrifugal pumps in series and pumps in parallel
- (d) Unit quantity and specific quantity.
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