

Registration No. :

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Total number of printed pages – 3

B. Tech
PCME 4201

Third Semester (Back/ Special) Examination – 2013

FLUID MECHANICS AND HYDRAULIC MACHINES

BRANCH : CIVIL, MECH, MINERAL, MINING

QUESTION CODE : D 232

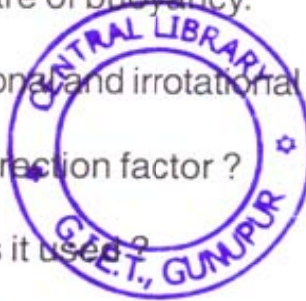
Full Marks – 70

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
- Define compressibility. How is it related to bulk modulus of elasticity ?
 - State Pascal's law and give two examples where this principle used.
 - Define buoyancy and centre of buoyancy.
 - Distinguish between rotational and irrotational flow.
 - What is kinetic energy correction factor ?
 - What is siphon ? Where is it used ?
 - Explain unit discharge and unit power of a hydraulic turbine.
 - What is indicator diagram ?
 - Show the relationship between absolute pressure, gauge pressure and vacuum pressure.
 - What do you mean by circulation ?



P.T.O.

2. (a) A cylinder tank 5m diameter and 10m height is completely filled with water. Find
- the intensity of pressure and the total force on the bottom of the tank,
 - minimum, maximum and average intensities on the vertical surfaces,
 - the total force on vertical surface. 5
- (b) Calculate the maximum capillary rise of water to be expected between two vertical clean glass plates spaced 1mm apart. If the water is replaced by mercury, what would be the maximum capillary depression of mercury in the same space ? If surface tension of water is 0.073 N/m and angle of contact is 0 degree. 5
3. (a) A uniform body of size 3 m long, 2 m wide and 1m deep floats in water. What is the weight of the body if depth of immersion is 0.8 m ? Determine the metacentric height. 5
- (b) The stream function for a two-dimensional flow is given by $\Psi = 8xy$, calculate the velocity at the point P(4,5). Find the velocity potential function ϕ . 5
4. Derive the energy equation for irrotational flow. State the assumptions made in the derivation. 10
5. (a) A 20 cm \times 10 cm venturimeter is inserted in a vertical pipe carrying oil of specific gravity 0.8, the flow of oil is in upward direction. The difference of levels between the throat and inlet section is 50cm. The oil mercury differential manometer gives a reading of 30cm of mercury. Find the discharge of oil. Neglect the losses. 5
- (b) A pipe 50 mm diameter is 6 m long and the velocity of flow of water in the pipe is 2.4 m/s. What loss of head and the corresponding power would be saved if the central 2 m length of pipe was replaced by 75 mm diameter pipe, the change of section being sudden ? Take $f = 0.04$ for the pipe of both diameters. 5

6. (a) Explain with neat diagram the working of a single stage centrifugal pump. 5
- (b) A double acting reciprocating pump, running at 40 rpm, is discharging 1.0m^3 of water per minute. The pump has a stroke of 400 mm. the diameter of the piston is 200 mm. the delivery and suction heads are 20 m and 5 m respectively. Find the slip of the pump and power required to drive the pump. 5
7. A propeller turbine runner has outer diameter of 4.5 meter and the diameter of hub is 2m. It is required to develop 20600 kW when running at 150 rpm, under a head of 21 m. Assuming hydraulic efficiency of 94%, determine the runner vane angles at inlet and exit at the mean diameter of the vanes. Also determine the runner vane angles at inlet and exit at two sections near hub and the outer periphery. 10
8. Write short notes on any **four** of the following: 2.5×4
- (a) Newton's law of viscosity
- (b) Air vessel
- (c) Cavitation
- (d) Total energy line
- (e) Pitot tube.

