

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2152003
Date: 31/05/2019
Subject Name: Fluid Mechanics & Machines
Time: 02:30 PM TO 05:00 PM
Total Marks: 70
Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

| | MARKS |
|---|-----------|
| Q.1 (a) What is capillarity? Derive expression for height of capillary rise. | 03 |
| (b) Describe the terms atmospheric, absolute, gauge and vacuum pressure with neat sketch. | 04 |
| (c) An isosceles triangular lamina of base 3m and altitude 3m is immersed vertically in an oil of specific gravity 0.8 with its axis of symmetry horizontal. If the depth of oil on the axis of symmetry is 5m, Determine the total pressure and center of pressure. | 07 |
| Q.2 (a) What is the difference between dynamic viscosity and kinematic viscosity? State their units. | 03 |
| (b) Obtain the equation to the stream lines for the velocity field given as: $\mathbf{V} = 2x^3\mathbf{i} - 6x^2y\mathbf{j}$ | 04 |
| (c) Derive expressions for total force and centre of pressure on a vertical plane surface submerged in static liquid. | 07 |
| OR | |
| (c) Derive Darcy-Weisbach equation for the loss of head due to friction in pipes. | 07 |
| Q.3 (a) Find the displacement thickness for the velocity distribution in the boundary layer is given by $\frac{u}{U} = \frac{y}{\delta}$, where u is the velocity at a distance y from the plate and $u = U$ at $y = \delta$, where δ = boundary layer thickness. | 03 |
| (b) State and prove Pascal's law. | 04 |
| (c) What is Continuity Equation? Derive Continuity Equation for three dimensions. | 07 |
| OR | |
| Q.3 (a) Enlist different forces present in a fluid flow. For the Euler's equation of motion which forces are taken into consideration? | 03 |
| (b) Explain following terms: Net positive suction head, Priming. | 04 |
| (c) Describe the types of fluid flow. Explain Stream-lines, Path-lines and Streak- lines. | 07 |
| Q.4 (a) Define the following terms: | 03 |

- Boundary layer thickness, Laminar sub-layer, Drag
- (b) State and derive moment of momentum equation. **04**
- (c) State and derive Bernoulli's theorem, state its application and assumptions made. **07**

OR

- Q.4** (a) Explain Archimedes's principle **03**
- (b) Compare Reciprocating pump and Centrifugal pump. **04**
- (c) A Pelton wheel is to be designed for the following specifications: **07**
 Shaft power = 11,772 kW, Head = 380 m, Speed = 750 r.p.m.,
 Overall efficiency = 86%, Jet diameter is not to exceed one-sixth of
 the wheel diameter. Determine: (i) The wheel diameter, (ii) The
 number of jets required, and (iii) Diameter of the jet. Take $K_{v1} = 0.985$ and $K_{u1} = 0.45$
- Q.5** (a) How hydraulic turbines are classified? **03**
- (b) What is the function of air vessels in Reciprocating pump? **04**
- (c) A centrifugal pump is to discharge 0.118 m³/s at a speed of 1450 r.p.m against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75%. determine the vane angle at the outer periphery of the impeller. **07**

OR

- Q.5** (a) Differentiate clearly between Impulse turbine and Reaction turbine. **03**
- (b) State function of draft tube and explain with neat sketch any two type of draft tubes. **04**
- (c) Define Specific speed of a centrifugal pump & derive the expression for the same. **07**
