

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

**GUJARAT TECHNOLOGICAL UNIVERSITY**

**BE - SEMESTER-V(New) • EXAMINATION – WINTER 2016**

**Subject Code:2152003**

**Date:19/11/2016**

**Subject Name:Fluid Mechanics & Machines**

**Time:10:30 AM to 01:00 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 Short Questions**

**14**

- 1 The fluid property, due to which, mercury does not wet the glass is  
(A) surface tension (B) viscosity  
(C) cohesion (D) adhesion
- 2 Laminar flow of a Newtonian fluid ceases to exist, when the Reynolds number exceeds  
(A)2000 (B)2800  
(C)4000 (D)3000
- 3 The normal stress is the same in all directions at a point in a fluid, when the fluid is  
(A) non-viscous. (B) incompressible  
(C) Both (a) and (b). (D)having no motion of one fluid layer relative to the other
- 4 Head developed by a centrifugal pump depends on its  
(A)speed (B)impeller diameter  
(C) Both (a) and (b). (D) neither (a) nor (b)
- 5 In order to measure the flow with a venturimeter, it is installed in  
(A) horizontal line (B) inclined line with flow  
(C) inclined line with flow downwards (D) any direction and in any location
- 6 Which of the following is an example of laminar flow?  
(A) Under ground flow (B) Flow past tiny bodies  
(C) Flow of oil in measuring (D) all of these
- 7 The total energy line lies over the hydraulic gradient line by an amount equal to the  
(A) pressure head (B) velocity head  
(C) pressure head + velocity head (D) pressure head - velocity head
- 8 The coefficient of viscosity may be determined by  
(A) capillary tube method (B) orifice type viscometer  
(C) rotating cylinder method (D) all of these
- 9 The stability of a dam is checked for  
(A) tension at the base (B) overturning of the wall or

- (C) sliding of the wall or dam      (D) all of these
- 10** The center of gravity of the volume of the liquid displaced is called  
 (A) center of pressure      (B) center of buoyancy  
 (C) metacenter      (D) none of these
- 11** The body will sink down if the force of buoyancy is \_\_\_\_\_ the weight of the liquid displaced.  
 (A) equal to      (B) less than  
 (C) more than
- 12** The pressure measured with the help of a piezometer tube is in  
 (A)  $\text{N/mm}^2$       (B)  $\text{kg/m}^2$   
 (C) head of liquid      (D) all of these
- 13** The pressure of the liquid flowing through the divergent portion of a venturimeter  
 (A) remains constant      (B) increases  
 (C) decreases      (D) depends upon mass of liquid
- 14** Bulk modulus of a fluid is the ratio of  
 (A) shear stress to shear strain      (B) increase in volume to the viscosity of fluid  
 (C) increase in pressure to the volumetric strain      (D) critical velocity to the viscosity of fluid
- Q.2** (a) What is capillarity? Derive expression for height of capillary rise. **03**  
 (b) Define and distinguish between following fluid properties **04**  
       (1) Cohesion and Adhesion  
       (2) Surface tension and Capillarity  
 (c) A solid cylinder 2 m in diameter and 2 m high is floating in water with its axis vertical. If the specific gravity of the material of cylinder is 0.65 find its metacentric height. State also whether the equilibrium is stable or unstable. **07**
- OR**
- (c) State and explain the Newton's law of viscosity. **07**  
 When a pressure of  $20.07 \text{ MN/m}^2$  is applied to 100 liters of a liquid its volume decreases by 1 liter. Find the bulk modulus of the liquid and identify this liquid.
- Q.3** (a) Define and distinguish between following fluid properties **03**  
       (1) Dynamic Viscosity and Kinematic viscosity  
 (b) Describe backward, radial and forward curved blades of pump impeller. **04**  
 (c) Measurement of pressure at the base and the top of mountain are 74 cm and 60 cm of mercury respectively. Workout the height of mountain if air has a specific weight of  $11.97 \text{ N/m}^3$ . **07**
- OR**
- Q.3** (a) Describe different shape and type of centrifugal pump impeller. **03**  
 (b) Draw theoretical indicator diagram of reciprocating pump and explain function of air vessel. **04**  
 (c) Obtain the equation to the stream lines for the velocity field given as: **07**  

$$V = 2x^3 i - 6x^2 y j$$

- Q.4 (a)** Differentiate clearly between Impulse turbine and Reaction turbine. **03**
- (b)** Sketch a hydro-power plant and explain its different elements. **04**
- (c)** A centrifugal pump is to discharge  $0.118 \text{ m}^3/\text{s}$  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.4 (a)** What is three flow pump? **03**
- (b)** Explain following terms: Net positive suction head, Priming. **04**
- (c)** Give detailed classification of Francis turbine and explain function of Wicket gate. Compare Francis turbine with Kaplan turbine also. **07**
- Q.5 (a)** Compare multistage pump impellers in series and parallel. **03**
- (b)** Discuss the various characteristic curves of a centrifugal pump. **04**
- (c)** Define displacement thickness. Derive an expression for the displacement thickness. **07**

**OR**

- Q.5 (a)** Find the smallest diameter of a manometer tube such that error due to capillary action in the measured gauge pressure of  $100 \text{ N/m}^2$  is less than 5 percent. The manometric liquid is water. **03**
- (b)** Compare Reciprocating pump with Centrifugal pump. **04**
- (c)** The following data refers to the runner of Kaplan turbine which yields 8850 kw at the turbine shaft – net available head 5.5 m, speed ratio 2.1,flow ratio 0.67 and overall efficiency 85%.presuming the hub diameter of the wheel is 0.35 times the outside diameter, work out the runner diameter and its rotational speed. **07**

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