

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV • EXAMINATION – SUMMER • 2014****Subject Code: 143403****Date: 23-06-2014****Subject Name: Fluid Mechanics and Machinery****Time: 10:30 am - 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.

- Q.1 (a)** Define the following fluid properties: **07**
1. Density
 2. Weight density
 3. Specific volume
 4. Specific gravity
 5. Viscosity
 6. Vapour pressure
 7. Compressibility
- (b)** Discuss in details about capillarity and surface tension in fluid mechanics. **07**
- Q.2 (a)** Derive the momentum equation and moment of momentum equation. **07**
- (b)** Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumption. **07**
- OR**
- (b)** Calculate the capillary rise in a glass tube of 2.5 mm diameter when immersed Vertically in (a) water and (b) mercury. Take surface tensions $\sigma = 0.0725 \text{ N/m}$ For water and $\sigma = 0.25 \text{ N/m}$ for mercury in contact with air. The specific gravity For mercury is given as 13.6 and angle of contact $= 130^\circ$. **07**
- Q.3 (a)** Discuss the performance curves for centrifugal pumps. **07**
- (b)** Differentiate between: **07**
1. Kaplan and propeller turbines
 2. Impulse and reaction turbines
 3. Radial and axial flow turbines
- OR**
- Q.3 (a)** Discuss the performance curves for hydraulic turbines. **07**
- (b)** Calculate the capillary effect in millimeter in a glass tube of 4mm diameter, when immersed in (1) water and (2) mercury. The temperature of the liquid is 20°C and the values of the surface tension of water and mercury at 20°C in contact with air are 0.073575 N/m and 0.51 N/m respectively. The angle of contact for water is zero and that for mercury is 130° . take density of water at 20°C as equate to 998 kg/m^3 . **07**
- Q.4 (a)** A 7.2 m height and 15 m long spillway discharges $94 \text{ m}^3/\text{s}$ discharge under a head of 2.0 m. If a 1:9 scale model of this spillway is to be constructed, determine model dimensions, head over spillway model and the model discharge. If model experiences a force of 7500 N (764.53 kgf), determine force on the prototype. **07**

- (b) Water is flowing through a pipe of diameter 30 cm at a velocity of 4 m/s. Find the velocity of oil flowing in another pipe of diameter 10 cm, if the condition of dynamic similarity is satisfied between the two pipes. The viscosity of water and oil is given as 0.01 poise and 0.025 poise. The Sp. Gravity of oil = 0.8. **07**

OR

- Q.4 (a)** Define the specific speed of a turbine. Derive expression for the Specific speed. **07**
(b) Define and explain the terms: **07**
a. Hydraulic gradient.
b. Total energy line.

- Q.5 (a)** What do you mean by “equivalent pipe” and “flow through parallel pipes”? **07**
(b) Define indicator diagram. How will you prove that area of indicator diagram is proportional to the work done by the reciprocating pump? **07**

OR

- Q.5 (a)** State the Buckingham’s π theorem. What do you mean by repeating variables? **07**
(b) What do you mean by Dimensionless number? Explain any four dimensionless numbers. **07**
