

Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2024

Subject Code:3152003

Date:23-05-2024

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.
4. Simple and non-programmable scientific calculators are allowed.

	Marks
Q.1 (a) Explain Hydrostatic law.	03
(b) Derive an expression for capillary rise $h = 4\sigma/\rho g d$. where, h = rise of water, σ = surface tension of liquid, ρ = density of liquid and d = diameter of droplet.	04
(c) Define the following terms: Ideal fluid, Weight density, Dynamic viscosity, Newtonian fluid, Surface tension, Adhesion, Cavitation.	07
Q.2 (a) Describe conditions of equilibrium for submerged bodies.	03
(b) A wooden block of specific gravity 0.7 floats in water. If the size of the block is 1 m X 1 m X 0.5 m, find its metacentric height.	04
(c) An isosceles triangular plate of base 4 m and altitude 4 m is immersed vertically in an oil of specific gravity 0.8. the base of plate coincides with the free surface of oil. Determine total pressure on the plate.	07
OR	
(c) For inclined immersed surface derive with usual notations, expression for total pressure and center of pressure.	07
Q.3 (a) Define Stream-lines, Path-lines and streak lines in a fluid flow.	03
(b) Obtain the equation to the stream lines for the velocity field given as: $V = 4x^3 i + 5x^2 y j$.	04
(c) Derive continuity equation in 3-dimensional co-ordinate system. and reduce it for steady, incompressible two-dimensional flow.	07
OR	
Q.3 (a) Explain Moment of momentum equation.	03
(b) Explain Control volume and control surface with fig.	04
(c) Derive Euler's equation of motion along a stream line for an ideal fluid and integrate it to get the Bernoulli's equation, hence obtain Bernoulli's equation.	07
Q.4 (a) Write the characteristics of Boundary layer.	03
(b) Explain Laminar boundary layer theory over a flat plate with fig.	04
(c) Derive the expression for the loss of head due to Friction in pipe flow.	07
OR	
Q.4 (a) List Major and Minor head losses in a pipe flow.	03
(b) Write the difference between Laminar and turbulent boundary layer.	04

- (c) What is an air vessel? Explain with a neat sketch the working of air vessels in a reciprocating pump. **07**
- Q.5** (a) Write classification of Centrifugal pump. **03**
- (b) State function of draft tube and explain with neat sketch different types of draft tubes. **04**
- (c) A centrifugal pump impeller has internal and external diameter 480 mm and 240 mm respectively. It is running at 1000 rpm. The rate of flow through the pump is $0.0576 \text{ m}^3/\text{s}$ and velocity of flow is constant and is equal to 2.4 m/s. The diameter of suction and delivery pipes are 180 mm and 120 mm respectively and suction and delivery heads are 6.2 m (abs) and 30.2 m of water respectively. If the power required to drive the pump is 23.3 KW and the outlet vane angle is 45° . Find (i) Inlet vane angle (ii) Overall efficiency (iii) Manometric efficiency. **07**
- OR**
- Q.5** (a) State advantages and disadvantages of Francis turbine over Pelton turbine. **03**
- (b) Discuss the various characteristic curves of a centrifugal pump. **04**
- (c) Explain construction and working of Pelton wheel turbine and derive expression for maximum hydraulic efficiency of Pelton wheel turbine. **07**