

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2022**

**Subject Code:3141906**

**Date:27-06-2022**

**Subject Name:Fluid Mechanics and Hydraulics 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.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
<b>Q.1</b>	(a) Define Following Fluid Properties: (i) Specific Gravity (ii) Compressibility (iii) Vapour Pressure	<b>03</b>
	(b) Classify fluids on the basis of general equation of Viscosity. Plot Shear stress versus deformation rate curve for each type of fluid.	<b>04</b>
	(c) Differentiate between following fluid flows with examples: (i) Uniform and Non Uniform flow (ii) Steady and Unsteady flow (iii) Compressible and Incompressible flow (iv) Laminar and Turbulent flow (v) Rotational and Irrotational flow	<b>07</b>
<b>Q.2</b>	(a) Define Metacentric height. List the Equilibrium conditions for a floating body.	<b>03</b>
	(b) Explain streamline, Pathline and Streakline with the help of neat diagrams. What is a streamtube?	<b>04</b>
	(c) A 120 mm diameter disc rotates on a table separated by an oil film of 1.8 mm thickness. Find the viscosity of oil if the torque required to rotate the disc at 60 rpm is 0.00072 Nm. Assume the velocity gradient in the oil film to be linear.	<b>07</b>
	<b>OR</b>	
	(c) An isosceles triangular plate of base 5 mm and height 5 mm is immersed vertically in an oil of specific gravity 0.8. The base of the plate is 1 m below the free liquid surface, determine: (i) The total pressure (ii) The centre of Pressure.	<b>07</b>
<b>Q.3</b>	(a) List the assumptions in Bernoulli's theorem. List different forces that act on a fluid during flow.	<b>03</b>
	(b) Explain : (i) Hydraulic Gradient line (ii) Total energy line (iii) Geometric similarity (iv) Water hammer	<b>04</b>
	(c) A pipe of 150 mm diameter is attached to a 100 mm diameter pipe by means of a flange in such a way that they are in same horizontal axis. If rate of flow is 2 m <sup>3</sup> /min and manometer shows the pressure difference reading as 80 mm, then find: (i) The loss of head due to contraction (ii) The coefficient of contraction	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) Define Velocity potential function and stream function. Explain the relation between Potential line and stream line.	<b>03</b>
	(b) Describe the steps involved in Buckingham $\pi$ -theorem with the help of an example.	<b>04</b>
	(c) Glycerine of specific gravity 1.28 and viscosity 8.07 poise flows between two large parallel flat plates 1.5 cm apart. The rate of flow	<b>07</b>

is  $4.4 \text{ m}^3$  per hour per metre width of the plates. Determine: (i) Maximum velocity (ii) Maximum shear stress (iii) Pressure gradient (iv) Reynolds number.

- Q.4** (a) Classify Hydraulic turbines on the basis of various criteria. **03**  
(b) Explain the application and working of “Draft tube”. **04**  
(c) Determine the output power, speed, specific head and vane angle at exit of a Francis turbine using the following data: Head = 75 m, Hydraulic efficiency = 92 %, Overall efficiency = 86 %, runner diameters = 1 m and 0.5 m, runner width = 15 cm and guide blade angle =  $18^\circ$ . Assume that the runner vanes are set normal to the periphery at the inlet. **07**
- OR**
- Q.4** (a) With the help of neat diagram, Explain the working of Kaplan turbine. **03**  
(b) Explain Cavitation in Hydraulic turbines. List the steps to protect the turbines against cavitation. **04**  
(c) Describe the requirements of a good Governor. Explain Governing of Impulse turbine in detail. **07**
- Q.5** (a) Explain priming in centrifugal pumps. **03**  
(b) Describe following with respect to a centrifugal pump : (i) Manometric efficiency (ii) Mechanical efficiency (iii) Volumetric efficiency (iv) Overall efficiency **04**  
(c) Estimate the maximum height at which a centrifugal pump with following data can be located above the sump water level: Capacity =  $0.08 \text{ m}^3/\text{s}$ , diameter of suction pipe = 20 cm, loss of head in suction pipe = 12 times the velocity head in pipe, manometric head = 15 m, vapor pressure of water = 80 kPa (vac). **07**
- OR**
- Q.5** (a) List the selection criteria for pump. **03**  
(b) Plot and explain the characteristic curves for centrifugal pump. **04**  
(c) With the help of neat diagram, explain the construction and working of Hydraulic accumulator. **07**

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