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SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR  
(AUTONOMOUS)

B. Tech II Year I Semester Supplementary Examinations August-2021

FLUID MECHANICS &amp; FLUID MACHINES

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 60

**PART-A**

(Answer all the Questions 5 x 2 = 10 Marks)

- |   |   |  |    |
|---|---|--|----|
| 1 | a | What is surface tension?   | 2M |
|   | b | What is free vortex and forced vortex flow.                            | 2M |
|   | c | What is the expression for head loss due to friction in Darcy formula? | 2M |
|   | d | State Froude's dimensionless number.                                   | 2M |
|   | e | How are hydraulic turbines classified?                                 | 2M |

**PART-B**

(Answer all Five Units 5 x 10 = 50 Marks)

**UNIT-I**

- |   |   |  |    |
|---|---|--|----|
| 2 | a | Differentiate kinematic viscosity and dynamic viscosity. Give their dimensions.  | 5M |
|   | b | A plate 0.025mm at a distance from a fixed plate moves at 60 cm/sec and requires a force of 2 N/m <sup>2</sup> . Determine the dynamic and kinematic viscosity between the plates. | 5M |

**OR**

- |   |   |   |    |
|---|---|---|----|
| 3 | a | Explain the phenomenon of capillarity. Obtain an expression for capillary rise of a liquid.   | 5M |
|   | b | Calculate the capillary raise in a glass tube of 2.5 mm diameter when immersed vertically water & mercury. Take surface tension is 0.0725 N/m for water and 0.52 N/m for mercury. The specific gravity of mercury is given 13.6 and angle of contact is 130°. | 5M |

**UNIT-II**

- |   |   |  |    |
|---|---|--|----|
| 4 | a | Obtain an expression for continuity equation for three - dimensional flow.   | 5M |
|   | b | A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/s. Find the discharge in the pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s. | 5M |

**OR**

- |   |   |     |
|---|---|-----|
| 5 |   | 10M |
|   | A vertical wall is of 8 m height. A jet of water is coming out from a nozzle with a velocity of 20 m/s. The nozzle is situated at a distance of 20 m from the vertical wall. Find the angle of projection of the nozzle to the horizontal so that the jet of water just clears the top of the wall. |     |

**UNIT-III**

- |   |   |  |    |
|---|---|--|----|
| 6 | a | A horizontal venturi meter with 30 cm diameter inlet and 10 cm throat is used for measuring the flow of water through a pipeline. If pressure in pipe is 1.5 kpa and the vacuum pressure at the throat is 40 cm of mercury, calculate the rate of flow. It may be presumed that 5% of differential head is lost between the pipe main and the throat section. Also make calculations for the discharge co-efficient take specific weight of water = 10 kN/m <sup>3</sup> . | 5M |
|   | b | In a 100 mm diameter horizontal pipe a venturi meter of 0.5 contraction ratio has been fixed. The head of water on the meter when there is no flow in 3m (gauge). Find the rate of flow for which the throat pressure will be 2 m of water is 0.97 take atmospheric pressure head = 10.3 m of water.   | 5M |

**OR**

- 7 An external cylindrical mouth piece of diameter 150 mm is discharging water under a constant head of 6 m. Determine the discharge and absolute pressure head of water at vena – contracta. Take  $C_d=0.855$  and  $C_c$  for vena contracta = 0.62 and atmospheric pressure head = 10.3 of water. **10M**

**UNIT-IV**

- 8 a Write a short note on dimensional homogeneity. **6M**  
b Describe Rayleigh’s method. **4M**

**OR**

- 9 a In 1 in 40 model of a spill way, the velocity and discharge are 2 m/s and 2.5 m<sup>3</sup>/s. Find the Corresponding velocity and discharge in the prototype. **5M**  
b In a model test of a spill way the discharge and velocity of flow over the model were 2 m<sup>3</sup>/s and 1.5 m/s respectively. Calculate the velocity and discharge over the 5 m prototype, which is 36 times the model size. **5M**

**UNIT-V**

- 10 a What is Pelton turbine? Discuss the parts of Pelton turbine. **5M**  
b Derive the expression for velocity triangles and work done for Pelton wheel. **5M**

**OR**

- 11 A centrifugal pump delivers water against a net head of 14.5 m and a design speed of 1000 r.p.m. The vanes of curved back to an angle of 30° with the periphery. The impeller diameter is 300mm and outlet width is 50mm. Determine the discharge of the pump if manometric efficiency is 95%. **10M**

**\*\*\*END\*\*\***