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

B.Tech III Year I Semester Regular Examinations Feb-2021

HYDRAULIC ENGINEERING

(Civil Engineering)

Time: 3 hours

Max. Marks: 60

**PART-A**

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

- |   |   |   |    |
|---|---|---|----|
| 1 | a | State the different types of channels.              | 2M |
|   | b | Write any four characteristics of surface profiles. | 2M |
|   | c | Define overall efficiency of turbine.               | 2M |
|   | d | What is meant by dimensional homogeneity?           | 2M |
|   | e | What is cavitation in case of turbines?             | 2M |

**PART-B**

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

**UNIT-I**

- |   |   |   |    |
|---|---|---|----|
| 2 | a | Derive the condition for a rectangular channel to be most efficient.                              | 5M |
|   | b | Explain the term specific energy of a flowing liquid and derive the condition for critical depth. | 5M |

**OR**

- |   |   |     |
|---|---|-----|
| 3 | In a rectangular channel 3.5m wide laid at a slope of 0.0036, uniform flow occurs at a depth of 2m. Find how high can the hump be raised without causing afflux? If the upstream depth of flow is to be raised to 2.5m. What should be the height of hump? Take $n = 0.015$ in manning's formula. | 10M |
|---|---|-----|

**UNIT-II**

- |   |   |   |    |
|---|---|---|----|
| 4 | a | Derive an expression for depth of hydraulic jump in terms of upstream Froude number.  | 5M |
|   | b | Find the rate of change of depth of water in a rectangular channel of 10m wide and 1.5m deep, when the water is flowing with a velocity of 1 m/s. The flow of water through the channel of bed slope 1 in 4000, is regulated in such a way that energy line is having a slope of 0.00004. | 5M |

**OR**

- |   |   |  |    |
|---|---|--|----|
| 5 | a | What is hydraulic jump and what are the assumptions of hydraulic jump.         | 5M |
|   | b | What are the different types of hydraulic jump and explain with neat sketches? | 5M |

**UNIT-III**

- |   |   |     |
|---|---|-----|
| 6 | A 7.5 cm diameter jet having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 45 degrees to the axis of the jet. Calculate the normal pressure on the plate when the plate is stationary. When the plate is moving with a velocity of 15 m/s and away from the jet. Also determine the power and efficiency of the jet when the plate is moving. | 10M |
|---|---|-----|

**OR**

- |   |   |   |    |
|---|---|---|----|
| 7 | a | Derive the equation for force exerted by a jet on stationary inclined flat plate.   | 5M |
|   | b | Find the force exerted by a jet of water of diameter 75mm on a stationary flat plate, when the jet strikes the plate normally with velocity of 20m/s. | 5M |

**UNIT-IV**

- 8 a What are different types of dimensionless numbers? Explain them. 5M  
b Define the terms: model, prototype, hydraulic similitude 5M

**OR**

- 9 a State the Buckingham – Pi theorem. 5M  
b The time period( $t$ ) of a pendulum depends upon the length( $L$ ) of the pendulum and acceleration due to gravity ( $g$ ). Derive an expression for time period. 5M

**UNIT-V**

- 10 a A Pelton wheel is to be designed for a head of 60m when running at 200r.p.m. The pelton wheel develops 95.6475 kW shaft power. The velocity of the buckets =0.45 times the velocity of the jet, overall efficiency=0.85 and co-efficient of the velocity=0.98. 5M  
b A jet strikes the buckets of Pelton wheel, which is having shaft power as 15450 kW. The diameter of each jet is given as 200mm. If the net head on the turbine is 400m. Find the overall efficiency of the turbine, take  $C_v=1.0$ . 5M

**OR**

- 11 a What are the uses of draft tube? Describe with neat sketches different types of draft tube. 5M  
b What is specific speed, derive the equation for specific speed. 5M

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