Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **14CE2005** | Duration : | **3hrs** |
| **Sub. Name :** | **APPLIED HYDRAULICS AND HYDRAULIC MACHINERY** | Max. marks : | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Derive the discharge through open channel by chezy’s formula. | CO1 | 14 |
| b. | List out the differences between open channel flow and pipe flow. | CO1 | 6 |
| (OR) | | | | |
| 2. | a. | A trapezoidal channel is required to carry 8m3/s of water at a velocity of 2m/s. Calculate the most economical cross – section if the channel has side slopes 1 horizontal to 2 vertical. For the same discharge what saving in power would result if this trapezoidal section is replaced by a rectangular section 1.5m deep and 4m wide. Take C = 55 | CO1 | 14 |
| b. | Compute the rate of flow and conveyance for a rectangular channel 7.5m wide for uniform flow at a depth of 2.25m. The channel is having bed slope as 1 in 1000. Take C= 55 | CO1 | 6 |
|  |  |  |  |  |
| 3. | a. | A 5.1 m wide rectangular channel conveys 120m3/s of water with a velocity of 7m/s. Is there a condition for hydraulic jump to occur? If so, calculate the height and length of jump. Calculte the loss of energy/kg of water. | CO2 | 10 |
|  | b. | Draw specific energy curve and derive the expression for critical depth in a rectangular channel. | CO2 | 10 |
| (OR) | | | | |
| 4. | a. | Formulate the expression for the length of the back water curve. | CO2 | 10 |
|  | b. | Define the terms: (i) Afflux and (ii) Back water curve. Prove that the length of the back water curve is given by,  L=(E2 – E1)/ib-ie | CO1 | 10 |
|  |  |  |  |  |
| 5. | a. | Calculate the displacement thickness, the monentum thickness and energy thickness for the velocity distribution in the boundary layer given by u/U = 2 (y/) – (y/)2 | CO2 | 12 |
|  | b. | For the velocity profile , determine the Displacement thickness, Momentum thickness, Energy thickness. | CO2 | 8 |
| (OR) | | | | |
| 6. | a. | A rectangular plate, weighing 60N is suspended vertically by a hinge on the top horizontal edge. The centre of gravity of the plate is 100mm from the hinge. A horizontal jet of water 20mm diameter, whose axis is 150mm below the hinge impinges normally on the plate with a velocity of 5m/s. Determine : (i) The horizontal force applied at the centre of gravity to maintain the plate in its vertical portion.(ii) The corresponding velocity of the jet, if the plate is deflected through 300 and the same force continues to act at the center of gravity of the plate. | CO3 | 10 |
|  | b. | A jet of water of diameter 20mm strikes a 200mm×200mm square plate of uniform thickness with a velocity of 10m/s at the centre of the plate which is suspended vertically by a hinge on its top horizontal edge. The weight of the plate is 98N. The jet strikes normal to the plate. (i) Compute the force that must be applied at the lower edge of the plate so that plate is kept vertical (ii) If the plate is allowed to deflect freely, what will be inclination of the plate with vertical due to the force exerted by jet water? | CO3 | 10 |
|  |  |  |  |  |
| 7. | a. | Compile the differences between Centrifugal pump and reciprocating pump. | CO2 | 6 |
|  | b. | A Kaplan turbine runner is to be designed to develop 93000KW. The net available head is 5.6m. If the speed ratio = 0.68, overall efficiency = 86% and the diameter of the bossis 1/3 the diameter of runner. Calculate the diameter of the runner, its speed and the specific speed of the turbine. | CO3 | 14 |
| (OR) | | | | |
| 8. | a. | The following data is given for a Francis turbine. Net head H=60 m; speed N=700 r.p.m.; shaft power=294.3kW; ηo=84%; ηh=93%; flow ratio=0.20; breadth ratio n=0.1; Outer diameter of the runner=2 x inner diameter of the runner.The thickness of vanes occupy 5% of circumfrential area of the runner, velocity of flow is constant at inlet and outlet and discharge is radial at outlet. Calculate i) Guide blade angle ii) Runner vane angles at inlet and outlet iii) Diameter of runner at inlet and outlet iv) Width of wheel at inlet. | CO3 | 20 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. | a. | The following data refer to a radial, single stage centrifugal pump: Discharge at the pump = 90 l/s; Diameter at inlet = 100mm; Diameter at outlet = 290mm; Head = 36m; Speed of impeller = 1750rpm; Width at inlet = 25mm per side; width at outlet = 23mm in total; Overall efficiency = 60%; Leakage losses = 2.7l/s; Mechanical losses = 1.5kW; Contraction factor due to vane thickness = 0.87; Outlet vane angle = 270. Assuming that water enters the impeller at inlet radially, Determine : (i) Inlet vane angle (ii) Angle at which water leaves the wheel (iii) Speed ratio (v) Absolute velocity of water leaving the impeller (vi) Volumetric efficiency (vii) Mechanical efficiency | CO3 | 20 |