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

G:\logo and QP Template\logo 3 Feb 2018 final.tif

**End Semester Examination – Nov/Dec– 2018**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **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. | Calculate the bed slope of trapezoidal channel of bed width 4m, depth 3m and side slope of 2 horizontal to 3 vertical when the discharge through the channel is 20m3/s. Take manning’s formula C=1/N*m*1/6. | CO1 | 8 |
| b. | Derive the expression for a trapezoidal section for a most economical condition. | CO1 | 12 |
| (OR) | | | | |
| 2. | a. | List out the differences between open channel flow and pipe flow. | CO1 | 6 |
| b. | Calculate the quantity of water that will be discharged at a uniform depth of 0.9 m in a 1.2 m diameter pipe which is laid at a slope 1 in 1000. Assume Chezy’s C=58. | CO1 | 10 |
| c. | A rectangular channel carries water at the rate of 400 litres/s when bed slope is 1 in 2000. Find the most economical dimensions of the channel if C=50. | CO1 | 4 |
|  | | | | |
| 3. | a. | A sluice gate discharges water into a horizontal rectangular channel with a velocity of 6 m/s and depth of flow is 0.4 m. The width of the channel is 8 m. Determine whether a hydraulic jump will occur, and if so, find its height and loss of energy per kg of water. Also determine the power lost in the hydraulic jump. | CO1 | 12 |
| 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 | 8 |
| (OR) | | | | |
| 4. | a. | Determine the length of the back water curve caused by an afflux of 2.0 m in a rectangular channel of width 40 m and depth 2.5 m. The slope of the bed is given as 1 in 11000. Take Manning’s N=0.03. | CO1 | 15 |
| b. | State specific energy curve. Draw the specific energy curve. | CO1 | 5 |
|  |  |  |  |  |
| 5. | a. | The velocity distribution in the boundary layer is given by 1/7Calculate (i) Displacement thickness (ii) Momentum thickness. | CO2 | 10 |
| b. | For the velocity profile , determine the Displacement thickness, Momentum thickness, Energy thickness. | CO2 | 10 |
| (OR) | | | | |
| 6. | a. | The velocity distribution in the boundary layer is given by 2, being boundary layer thickness. Calculate the following: (i) Displacement thickness (ii) Momentum thickness  (iii) Energy thickness. | CO2 | 12 |
| b. | Define Energy thickness and derive the formula. | CO2 | 8 |
|  | | | | |
| 7. | a. | A jet of water of diameter 25mm strikes a 20cm x 20cm 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 98.1N. The jet strikes normal to the plate. What force must be applied at the lower edge of the plate so that the plate is vertical? If the plate is allowed to deflect freely, what will be the inclination of the plate with vertical due to the force exerted by jet of water? | CO3 | 14 |
| b. | Derive the force on the curved plate when the plate is moving in the direction of the jet. | CO3 | 6 |
| (OR) | | | | |
| 8. | a. | A Pelton wheel is to be designed for a head of 60 m when running at 200 r.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 is equal to 0.98. | CO5 | 15 |
| b. | List the classifications of hydraulic turbines. | CO3 | 5 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. |  | 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%; η*h*=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 circumferential 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 |