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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**Supplementary Examination – June – 2017**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **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 expression for a trapezoidal section for a most economical condition. | CO1 | 14 |
| b. | Find the discharge of water through the channel shown in fig. Take the value of Chezy’s constant = 60 and slope of the bed as 1 in 950. | CO1 | 6 |
| (OR) | | | | |
| 2. | a. | A weir is installed across a rectangular open channel thereby raising the flow depth from 1.5m in a normal flow to 2.5m at the weir. The width of th channel is 10m and it is laid to a slope of 1 in 1000. Find an approximate length of the backwater curve considering the average velocity, average depth and average slope midway between the two sections. Take the value of Manning’s co-efficient = 0.02. | CO1 | 14 |
| b. | List out the differences between open channel flow and pipe flow. | CO1 | 6 |
| 3. | a. | Obtain the expression for Momentum thickness and Energy thickness for a boundary layer flows. | CO2 | 14 |
|  | b. | Define Boundary layer with neat sketch. | CO2 | 6 |
| (OR) | | | | |
| 4. | a. | For the velocity profile, determine the Displacement thickness, Momentum thickness, Energy thickness. | CO2 | 10 |
|  | b. | The velocity distribution in the boundary layer is given by  Calculate (i) Displacement thickness (ii) Momentum thickness | CO2 | 10 |
| 5. | 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 having a velocity of 45m/s impinges without shock on a series of vanes moving at 15m/s. The direction of motion of the vanes is inclined at 200 to that of jet. The relative velocity at outlet is 0.9 of that at inlet and absolute velocity of water at exit is to be normal to the motion of vanes. Find: (i) vane angles at inlet and outlet (ii) workdone on vanes per N (newton) of water supplied by the jet (iii) Hydraulic efficiency. | CO4 | 10 |
|  |  | (OR) |  |  |
| 6. | a. | A Francis turbine with an overall efficiency of 76% is required to produce 150kW. It is working under head of 8m. The peripheral velocity = 0.25 and the radial velocity of flow at inlet is 0.95. The wheel runs at 150rpm and the hydraulic losses in the turbine are 20% of the available energy. Assuming radial discharge, Determine: (i) Guide blade angle (ii) Wheel vane angle at inlet (iii) Diameter of the wheel at inlet and (iv) Width of the wheel at inlet. | CO5 | 14 |
|  | b. | Define Specific Speed and write down its expression. | CO5 | 3 |
|  | c. | Define Negative slip. | CO5 | 3 |
| 7. | a. | A Pelton wheel is to be designed for the following soecifications:  a. Power = 9560kW b. Head = 350m  c. Speed = 750 rpm d. Overall efficiency = 85%  e. Jet diameter = not to exceed 1/6th of the wheel diameter  Determine the following: (i) The wheel diameter (ii) Diameter of the jet (iii) No. of jets required. Take Cv= 0.985, Speed ratio = 0.45 | CO5 | 14 |
|  | b. | Define Specific Speed. | CO5 | 3 |
|  | c. | Define Minimum speed for starting a centrifugal pump. | CO5 | 3 |
| (OR) | | | | |
| 8. | a. | The diameter and stroke of a single acting reciprocating pump are 250mm and 450mm respectively. The pump takes in supply of water from sump 2.9m below the pump and through a pipe 8m long and 100mm diameter. If seperatiom occurs at 2.4m of water absolute, determine: (i) The speed at which separation may take place at the beginning of suction of stroke and (ii) The speed of the pump if an air vessel is fitted on the suction side very close to the cylinder. Take atmospheric pressue head = 10.3m of water and friction factor as 0.02 | CO5 | 14 |
|  | b. | A single acting reciprocating pump, running at 50rpm delivers 0.00736m3/s of water. The diameter of the piston is 200mm and stroke length 300mm. The suction and delivery heads are 3.5m and 11.5m respectively. Detremine: (i) Theoretical discharge, (ii) Co – efficient of discharge (iii)Percentage slip of the pump (iv) Power required to run the pump. | CO5 | 6 |
|  | | **Compulsory**: |  |  |
| 9. |  | 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. | CO5 | 20 |