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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

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

**End Semester Examination – April/May– 2017**

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

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

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Design an earthen trapezoidal channel for water having a velocity of 0.6m/s. Side slope of the channel is 1:1.5 and quantity of water flowing is 3m3/s. Assuming C = 65. | CO1 | 14 |
| b. | Calculate 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 |
| (OR) | | | | |
| 2. | a. | A trapezoidal channel is required to carry 8m3/s of water at a velocity of 2m/s. Find 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 | 15 |
| b. | A canal of trapezoidal section has bed width of 8m and bed slope of 1 in 4000. If the depth of flow is 2.4m and side slopes of the channel are 1 horizontal to 3 vertical, determine the average velocity and discharge carried by the channel. | CO1 | 5 |
| 3. | a. | Derive a mathematical expression for critical depth and critical velocity. | CO1 | 10 |
|  | b. | Derive the condition for maximum discharge for a given value of specific energy with neat sketch. | CO2 | 10 |
| (OR) | | | | |
| 4. | 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. | The velocity distribution in the boundary layer is given by  being boundary layer thickness. Calculate the following: (i) Displacement thickness (ii) Momentum thickness (iii) Energy thickness | CO2 | 10 |
| 5. | a. | 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) What force 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 |
|  | b. | A jet of water moving at 12m/s impinges on a concave shaped vane to deflect the jet through 1200 when stationary. The vane is moving at 5m/s. Calculate (i) The angle of jet so that there is no shock at inlet (ii) The absolute velocity of the jet at exit both in magnitude and direction (iii) The work done per second per N of water. Assume vane is smooth. | CO4 | 10 |
|  |  | (OR) |  |  |
| 6. | a. | A pelton wheel turbine is to be designed for the following specifications, Power = 9500kW, Head = 350 m, speed = 750 rpm, overall efficiencies = 85%, jet diameter 1/6th of the wheel diameter. Take CN =0.987, speed ratio =0.45. Determine (i)Wheel diameter (ii) Diameter of the jet (iii) No of jets required. | CO5 | 15 |
|  | b. | Explain different types of efficiencies | CO5 | 5 |
| 7. | a. | A Kaplan turbine working under a head of 20m develops 11772kW shaft power. The outer diameter of the runner is 3.5m and hub diameter is 1.75m. The guide blade angle at the extreme edge of the runner is 350. The hydraulic and overall efficiencies of the turbines are 88% and 84% respectively. If the velocity of whirl is zero at outlet, determine: (i) Runner vane angles at inlet and outlet at the extreme edge of the runner (ii) Speed of the turbine. | CO5 | 15 |
|  | b. | Distinguish between an impulse turbine and a reaction turbine. | CO5 | 5 |
| (OR) | | | | |
| 8. | a. | The centrifugal pump has the following characteristics. Outer diameter of the impeller is 800 mm, width of the impeller vane at the outlet is 400 mm, angle of the impeller vane at the outlet is 40º, the impeller runs at a speed of 550 rpm and discharges 0.98 m3/s under an effective head of 35 m. A 500 kW motor is used to drive the pump. Determine manometric, mechanical and overall efficiency of the pump; assume water enters the impeller vanes radially at the inlet. | CO5 | 15 |
|  | b. | If the specific speed of a turbine is 700rpm, Calculte the normal speed when 3000kW power is developed at 15m head. | CO5 | 5 |
|  | | **Compulsory:** |  |  |
| 9. | a. | A single acting reciprocating pump has a diameter of 150mm and stroke length 350mm. The centre of the pump is 3.5m above the water surface in the sump and 22m below the delivery water level. Both the suction and delivery pipes have the same diameter of 100mm and are 5m and 30m long. If the pump is working at 30r.p.m. determine (i) The pressure heads on the piston at the beginning, middle and end of both suction and delivery strokes (ii) The power required to drive the pump. Take atmospheric pressure as 10.3m of water. Assume friction factor as 0.02 | CO5 | 15 |
|  | b. | Compare Centrifugal pumps and reciprocating pumps. | CO5 | 5 |

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