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



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

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| **Code :** | **17CE2005** | **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. | | List out the differences between pipeflow and open channel flow | CO1 | 2 |
| b. | | Describe on most economical section. | CO1 | 2 |
| c. | | Define hydraulic radius and hydraulic depth. | CO1 | 2 |
| d. | | A trapezoidal channel has a side slope of 2 horizontal to 3 vertical . The bed slope is 1 in 1000 . If the channel has to carry a discharge of 1 m3/s, determine the dimensions of the most economical channel. Chezy’s constant is 70. | CO1 | 14 |
| **(OR)** | | | | | |
| 2. | a. | | Derive the condition for a circular channel to carry maximum discharge. | CO1 | 12 |
| b. | | Determine the dimensions of the most economical trapezoidal channel section with 1:1 side slope to carry a discharge of 10 m3/ s .The bed slope is 1 in 1600 and Chezy’s constant is 60. | CO1 | 08 |
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| 3. | a. | | Sketch the water surface profile in zone 2 of steep channel. | CO2 | 3 |
| b. | | Draw the specific energy diagram and mark the salient points . | CO2 | 3 |
| c. | | Determine the length of backwater curve caused by an affix of 0.2 in a rectenagular channel of width 20m and 1.2 m. The bed slope is 1in 1000 . Assume Chezy ‘ s constant as 50. | CO2 | 14 |
| **(OR)** | | | | | |
| 4. | a. | | Describe on backwater curve. | CO2 | 4 |
| b. | | Define the height and length of hydraulic jump. | CO3 | 4 |
| c. | | Obtain the relationship between the initial and sequent depth of a hydraulic jump. | CO3 | 12 |
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| 5. | a. | | List out the advantages of distorted models. | CO4 | 3 |
| b. | | The period of a simple pendulum depends on the length and accumulation due to gravity. Derive the expression for the time period using dimensional analysis. | CO4 | 5 |
| c. | | A fluid of density ρ and viscosity μ flow at an average velocity of v through a circular pipe of diameter D , Show by dimensional analysis that shear stress in the pipe is given by τ0 = ρ v2φ (ρVD / μ) | CO4 | 12 |
| **(OR)** | | | | | |
| 6. | a. | | Define derived quantities. Give two examples for derived quantities along with their dimensions in MLT system. | CO4 | 6 |
|  | b. | | In order to estimate the energy loss in pipe of diameter 1 m , a 1: 10 model was created. The discharge in the prototype is 2 m3/s . Determine the head lost in the prototype if the head lost in the model is 4m. Also determine the discharge in the model. | CO4 | 14 |
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| 7. | a. | | Define speed ratio and flow ratio. | CO6 | 4 |
| b. | | Define hydraulic efficiency and write the expression for the hydraulic efficiency of Francis turbine . | CO6 | 4 |
| c. | | A Francis turbine has to be designed to develop 370 kW under a head of 70 m while running at a speed of 750 rpm.  Ratio of width of runner to outer diameter of the runner = 0.1  Ratio of inner diameter to outer diameter = 0.5  Flow ratio = 0.15  Hydraulic efficiency = 0.95  Mechanical efficiency = 0.87  Area occupied by blades is 5%. Assuming velocity of flow as constant, determine the guide blade angle at inlet and vane angles at inlet and outlet. | CO6 | 12 |
| **(OR)** | | | | | |
| 8. | a. | | A jet of water strikes a flat plate inclined at an angle of 300 to the direction of jet. If the velocity of the jet is 15 m/s and the diameter of the jet is 10 cm, determine the forces in the normal, along the x and y directions. | CO5 | 6 |
| b. | | A Kaplan turbine produces 44000 kW under a head of 25 m. The overall efficiency of the turbine is 90% . If speed ratio is 1.6 and flow ratio is 0.5 , determine the diameter and speed of the turbine. The hub diameter is 0.35 times the outer diameter. | CO6 | 14 |
|  | | | **Compulsory**: |  |  |
| 9. | | a. | Write an expression for the minimum starting speed of a centrifugal pump. | CO6 | 4 |
| b. | Make a comparison between centrifugal and reciprocating pumps. | CO6 | 6 |
| c. | A single acting reciprocating pump has a bore diameter of 20 cm and a stroke of 30 cm. The speed of the pump m is 50 rpm. The pump is raising 0.0078 m3/ s of water through a height of 20 m. The efficeiency of the pump is 75 %. Determine the theoretical discharge, percentage slip, theoretical power required and the actual power required to drive the pump. | CO6 | 10 |