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

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

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| **Code :** | **17AE2002** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FUNDAMENTALS OF FLUID FLOW** | **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. | State Newton’s law of viscosity. | CO1 | 3 |
| b. | 150mm diameter shaft rotates at 1500 rpm in a 200mm long journal bearing with 150.5 mm   internal diameter. The uniform annular space between the shaft and the bearing is filled with oil of dynamic viscosity 0.8 poise.Calculate the power dissipated as heat. | CO1 | 8 |
| c. | An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5m and it rotates at 200rpm. Calculate the power lost in oil for a sleeve length of 100mm. The thickness of oil film is 0.7mm. | CO1 | 9 |
| (OR) | | | | |
| 2. | a. | Define doublet flow and circulation. | CO3 | 4 |
| b. | Draw and predict the stagnation point in the Rankine’s oval body. | CO3 | 4 |
| c. | Obtain the expressions for stream and velocity potential functions for uniform flow with source and sink. | CO3 | 12 |
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| 3. | a. | Consider a convergent duct with an inlet area A1=5m2, Air enters this duct with a velocity V1=10m/s and leaves the duct with a velocity V2= 30m/s. Find the area of the duct exit. | CO4 | 4 |
| b. | A pipe, through which water is flowing, is having diameters, 20 cm and 10 cm at the cross section 1 and 2 respectively. The velocity of water at section 1 is given 4 m/s. determine the velocity head at section 1 and 2 and also rate of discharge. | CO4 | 8 |
| c. | The following case represent the two velocity components. Determine third velocity component such that they satisfy the continuity equation.  u = 2y2 v = 2xyz | CO4 | 8 |
| (OR) | | | | |
| 4. | a. | State the Bernoulli’s theorem and its application. | CO2 | 6 |
| b. | What are the assumptions involved in Bernoulli’s equation. | CO2 | 4 |
| c. | Derive the Bernoulli’s equation for steady flow of an incompressible flow. | CO2 | 10 |
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| 5. | a. | Find the loss of head due to friction in a pipe is 1.2 m diameter and 20 km long. The velocity of water in the pipe is 1.2 m/s. Take coefficient of friction as 0.005. | CO5 | 4 |
| b. | An oil of density 1000kg/m3 and viscosity 0.08 Ns/m2 flows through a pipe of diameter 0.4 m with a velocity of 2.91m/s. Find friction factor ‘f’? | CO5 | 4 |
| c. | The rate of flow of water through a horizontal pipe is 0.25m3/s. The diameter of the pipe which is 20 cm is suddenly enlarged to 40 cm. The pressure intensity in the smaller pipe is 11.772 N/cm2. Determine: i) Loss of head due to sudden enlargement, ii) Pressure intensity in larger pipe and Power loss due to enlargement. | CO5 | 12 |
| (OR) | | | | |
| 6. | a. | In a two dimensional incompressible flow, the fluid velocity components are given by u = x -4y and v = -y-4x .Show that velocity potential exists and determine its form. Find also its the stream function. | CO3 | 10 |
| b. | Show that the maximum velocity in a circular pipe for viscous flow is equal to two times the average of the flow. | CO3 | 10 |
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| 7. | a. | State Hydrostatic law. | CO1 | 4 |
| b. | List the four types of manometer | CO2 | 4 |
| c. | A U-Tube Manometer is used to measure the pressure of oil of specific gravity 0.85 is flowing in a pipe line. Its left end is connected to the pipe and the right limb is connected to the open atmosphere. The centre of the pipe is 100mm below the level of mercury (specific gravity 13.6) in the right limb. If the difference of mercury level in the two limbs is 160mm determine the absolute pressure of the oil in the pipe. | CO2 | 12 |
| (OR) | | | | |
| 8. | a. | List the forces are taken into consideration for Euler’s equation of motion. | CO4 | 4 |
| b. | Derive Euler's equation of motion for flow along a stream line. What are the assumptions involved. | CO4 | 8 |
| c. | A horizontal Venturimeter with inlet diameter 100 mm and throat diameter 50 mm is employed to measure the flow of water. The reading of the differential manometer connected to the inlet is 100 mm of mercury.  If Cd = 0.95, determine the rate of flow. | CO4 | 8 |
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|  | | **Compulsory**: |  |  |
| 9. | a. | State the Buckingham’s π-theorem and also explain various types of similarities. | CO6 | 6 |
| b. | List the significance of Reynolds number and in what flow situations Reynolds number is used? | CO6 | 4 |
| c. | The resisting force (R) of a supersonic flight can be considered as dependent upon length of aircraft (l), velocity (V), air viscosity ‘μ’, air density ‘ρ’, and bulk modulus of air ‘ k’. Express the functional relationship between these variables and the resisting force. | CO6 | 10 |