Total No. of Questions – [8]

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G.R. No.	

Paper Code - U228-154 (ESE)

MAY 2019/ENDSEM

S. Y. B. TECH. (MECHANICAL) (SEMESTER - II)

COURSE NAME: FLUID MECHANICS

COURSE CODE: MEUA22174

(PATTERN 2017)

Time: [**2 Hours**]

[Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data whereever required**

Q.1) a) Determine the torque and power required to rotate a 10 cm long, 5 cm diameter shaft at 500 rpm in a 5.1 cm diameter concentric bearing flooded with a lubricating oil of viscosity 100 centipoises. [6]

OR

b) A rectangular plane surface 3 m wide and 4 m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water. Determine the total pressure and position of center of pressure when the upper edge is 2 m below the free surface. [6]

Q.2) a) Explain the velocity potential function and stream function with mathematical equation and properties. [6]

OR

b) Differentiate the following : [6]
   i) Laminar and turbulent flow
   ii) Compressible and incompressible flow
   iii) One and two dimensional flow

Q.3) a) Explain with the help of neat sketch the working of Venturimeter and also derive an expression of discharge for it. [6]

OR

b) At a section in a horizontal pipe the diameter is 6 cm and the pressure is 80 kN/m^2, At a another section, the diameter is 10 cm and pressure is 120 kN/m^2. If the flow rate is 0.09 m^3/s , Determine the direction of flow. [6]

Q.4) a) Crude oil of relative density 0.9 is pumped through a smooth horizontal pipe 400 m long and 100 mm diameter. The kinematic viscosity of oil is 2.5 stokes. Differential pressure heads between two of the pipe is 16.31 m of oil. Assuming the flow of oil is to be laminar, Find the rate of flow of oil through pipe. [4]

OR

b) Explain the following dimensionless numbers [4]
i) Euler's number
ii) Froude's number

Q.5) a) Derive Dupuit's equation for equivalent pipe. [6]

b) The diameter of the pipe suddenly changes from 15 cm to 30 cm. The loss of head due to expansion is measured as 1.3 m of water. Estimate the flow rate through pipe. [4]

c) Write a short-note on compound pipe. [4]

OR

Q.6) a) A syphon of diameter 200 mm connects two reservoirs having a difference in elevation of 20 m. The length of the syphon is 500 m and summit is 3 m above water level in the upper reservoir. The length of the syphon from upper reservoir to the summit is 100 m. Determine the flow rate through syphon and pressure at the summit. Neglect minor losses. Take coefficient of friction = 0.005. [6]

b) Differentiate between major losses and minor losses. [4]

c) Three pipes of lengths 800 m, 500 m and 400 m and of diameters 500 mm, 400 mm and 300 mm respectively are connected in series. These pipes are to be replaced by a single pipe of length 1700 m. Estimate the diameter of the single pipe. [4]

Q.7) a) Explain the following : [6]
a) Boundary layer thickness
b) Displacement thickness
c) Momentum thickness

b) Oil with a free stream velocity of 2 m/s flows over a thin plate 2 m wide and 2 m long. Calculate the boundary layer thickness and the Drag force on one side of the plate. Take specific gravity as 0.86 and kinematic viscosity as 10^{-5} m^2/s. [4]

c) Differentiate between streamlined body and bluff body. [4]

OR

Q.8) a) A kite 0.8 m × 0.8 m weighing 3.924 N assumes an angle of 12° to the horizontal. The string attached to the kite makes an angle of 45° to the horizontal. The pull on the string is 24.525 N when the wind is flowing at a speed of 30 km/hr. Find the corresponding coefficient of drag and lift. Take density of air = 1.25 kg/m^3. [6]

b) Differentiate between pressure drag and skin friction drag [4]

c) Explain any four methods of controlling separation of boundary layer . [4]