Reg. No. :

Question Paper Code: 53104

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Third Semester

Agricultural Engineering

15UAG304 - FLUID MECHANICS AND HYDRAULICS

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Fluid in a substance which offers no resistance to change of

    (a) Pressure   (b) Shape   (c) Volume   (d) Temperature

2. A pressure head of 25 m of water is equal to

    (a) 25 kN/m^2 (b) 12.5 kN/m^2 (c) 2500 kN/m^2 (d) 245 kN/m^2

3. An ideal flow of any fluid must satisfy

    (a) Pascal's law   (b) Newton's law of viscosity
    (c) Continuity equation   (d) Bernoulli's Theorem

4. Bernoulli's equation deals with the law of conservation of

    (a) Mass   (b) Energy   (c) Momentum   (d) Work

5. Rotameter is device used to measure

    (a) Velocity of fluid   (b) Flow
    (c) Rotation   (d) Velocity of flow

6. The maximum efficiency of transmission through a pipe is

    (a) 46.67 %   (b) 56.67 %   (c) 66.67 %   (d) 76.67 %

7. In open channels, the specific energy is the

   (a) Total energy per unit discharge
   (b) Total energy measured with respect to the datum passing through the bottom of the channel
   (c) Total energy measured above the horizontal datum
   (d) Kinetic energy plotted above the free water surface

8. The discharge through a V-notch varies as

   (a) $H^{1/2}$ (b) $H^{3/2}$ (c) $H^{5/2}$ (d) $H^{7/2}$

9. For a sphere of radius 15 cm moving with a uniform velocity of 2 m/sec through a liquid of specific gravity 0.9 and dynamic viscosity 0.8 poise, the Reynolds number will be

   (a) 300   (b) 600   (c) 337.5   (d) 675

10. Multistage centrifugal pumps are used to obtain

   (a) High head   (b) High discharge
   (c) Pumping of high viscous fluid   (d) High efficiency

PART - B (5 x 2 = 10 Marks)

11. State Pascal's law. Give at least two examples where this principle is applied.

12. What are the limitations of Bernoulli's theorem?

13. Define vena-contracta. Why is so much importance attached to it?

14. Define a weir and point out the difference between a notch and a weir with suitable diagram.

15. State the difference between a closed, semi-closed and open impeller with sketch.

PART - C (5 x 16 = 80 Marks)

16. (a) A U-tube differential manometer containing mercury is connected on one side to pipe A containing carbon tetrachloride (specific gravity 1.6) under a pressure of 120 kPa, and on the other side to pipe B containing oil (specific gravity 0.8) under a pressure of 200 kPa. The pipe A lies 2.5 m above pipe B and the mercury level in the limb communicating with pipe A lies 4 m below the pipe A. Determine the difference in the levels of mercury in the two limbs of the manometer. Take specific weight of water 9.81 kN/m³. (16)

Or

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(b) An isosceles triangular plate of base 4 m and altitude 6 m is immersed vertically in water. Its axis of symmetry is parallel to and at a depth of 6 m from the free water surface. Calculate the magnitude and location of total pressure force. (16)

17. (a) Water flows through a pipe AB 1.2 m diameter at 3 m/s and then passes through a pipe BC 1.5 m diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume flow rate in AB, the velocity in BC, the velocity in CD and the diameter of CE. (16)

Or

(b) A 2 m long pipeline tapers uniformly from 10 cm diameter to 20 cm diameter at its upper end. The pipe centre line slopes upwards at an angle of 30° to the horizontal and the flow direction is from smaller to bigger cross-section. If the pressure gauges installed at the lower and upper ends of the pipeline read 200 kPa and 230 kPa respectively, determine the flow rate and the fluid pressure at the mid-length of the pipeline. Assume no energy losses. (16)

18. (a) A venture meter with 200 mm diameter at inlet and 100 mm throat is laid with axis horizontal, and is used for measuring the flow of oil of specific gravity 0.8. The difference of levels in the U-tube differential manometer reads 180 mm of mercury whilst 11.52 X 103 kg of oil is collected in 4 minutes. Calculate the co-efficient of discharge for the meter. Take specific gravity of mercury as 13.6. (16)

Or

(b) Two reservoirs are connected by a pipeline which is 15 cm diameter for the first 5 m and 25 cm diameter for the remaining 15 m. Entry to and exit from the pipe is sharp, and the water surface in the upper reservoir is 7.5 m above that in the lower reservoir. Represent the layout and tabulate the head losses by assuming that friction co-efficient is 0.01 for both the pipes. Further, calculate flow rate through the arrangement and draw the hydraulic gradient lines. (16)

19. (a) Show that the most economical trapezoidal section for an open channel is one which has the three sides tangential to the semi-circle described on the water line. (16)

Or

(b) Water flows at a steady and uniform depth of 2 m in an open channel of rectangular cross section having base width equal to 5 m and laid at a slope of 1 in 1000. It is desired to obtain critical flow in the channel by providing a hump in the bed. Calculate height of hump and sketch the flow profile. Consider the value of Manning's rugosity co-efficient N = 0.02 for the channel surface. (16)

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20. (a) What are the dimensionless numbers in fluid mechanics? Define them. Under what circumstances in each of these important. (16)

Or

(b) Discuss in general the main and operating characteristics of a centrifugal pump. What is the importance of constant efficiency curves? (16)

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