Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2023
CIVIL ENGINEERING
(2020 SCHEME)

Course Code : **20CET203**

Course Name: **Fluid Mechanics and Hydraulics**

Max. Marks: **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain the classification of fluids.
2. Describe the theory of Wetting and Non-wetting Fluids with examples for each.
3. With a neat sketch describe the principle of floatation of a solid body.
4. Explain the different types of fluid flow.
5. Describe Static, Dynamic and Stagnation Pressure.
6. Explain all the minor losses associated with the flow of a fluid through a closed conduit.
7. Explain the characteristics of velocity distribution in open channels.
8. With a neat sketch explain the terms Crest and Nappe of a notch.
9. How the channel bottom slopes are classified?
10. Explain Specific Energy Diagram with a neat sketch

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. a) Mathematically explain the pressure variation along the depth of liquid (7)

    b) Determine the differential reading 'h' of an inverted U-tube Manometer containing oil of specific gravity 0.8 as the manometric fluid when connected across pipe A and B conveying liquids of specific gravities 1.2 and 1.0 respectively and immiscible with the oil. Pressure at A and B are equal and pipes A and B are located at same datum level. The level of oil in the left limb is 20mm above the central line of pipe A. (7)

OR

12. a) Derive the expression of Total Pressure and depth of Centre of Pressure on a vertical submerged surface. (7)

b) A circular plate of 3 m diameter is immersed in water in such a way that it's greatest and least depths below the free surface are 4 m and 1.5 m respectively. Determine the total pressure on one face of the plate and position of centre of pressure. (7)

MODULE II

13. a) Using the analytical method determine the metacentric height of a rectangular solid body (7)

b) The velocity vector in a fluid is given by $V = 4 X^3 i - 10 X^2 j + 2 t k$. Find the velocity and acceleration of a fluid particle at (2,1,3) at time t = 1. (7)

OR

14. a) Derive Continuity equation for a 3- Dimensional Flow. (7)

b) A metallic body floats at the interface of mercury and water such that 30% of its volume is submerged in mercury and 70% in water. Estimate the density of the metal. (7)

MODULE III

15. a) Derive the expression for the discharge of Orifice Meter. (8)

b) An oil of specific gravity 0.85 and viscosity 0.05 poise flows through a 20 cm diameter pipe at a rate of 75 liters per second. Find the head lost due to friction for a 500 m length of pipe. Also calculate the power required to maintain the flow. (6)

OR

16. a) Differentiate between Laminar and Turbulent Flow (6)

b) A Pipe line is 15 cm in diameter and is at an elevation of 100 m at the section A. At section B it is at an elevation of 107 m and has a diameter 30 cm. When a discharge 0f 50 liters/sec of water is passed through this pipe, the pressure at section A is observed to be 30 kPa. The energy loss in the pipe is 2 m. Calculate the pressure at B when the flow is (8)

(i) From A to B

(ii) From B to A

MODULE IV

17. a) Derive an expression for the discharge over a rectangular notch. (7)

b) A sewer pipe is to be laid at a slope of 1 in 8,100 to carry a maximum discharge of 600 liters/sec, when the depth of water is 75% of the vertical diameter. Find the diameter of the pipe if manning's N is 0.025 (7)

OR

18. a) A rectangular weir of crest length 50 cm is used to measure the rate of flow of water in a rectangular channel of 80 cm wide and 70 cm deep. Determine the discharge in the channel if the water level is 80 mm above the crest of the weir. Take velocity of approach into consideration and value of C_d= 0.62 (5)

b) Obtain the conditions for the most economical trapezoidal sections for Open Channel Flow. (9)

MODULE V

19. a) Derive the condition for maximum discharge for a given value of specific energy. (5)

b) A rectangular channel 10 m wide carries a discharge of 30 m^3/sec. it is laid at the slope of 0.0001. If at section in this channel the depth is 1.6 m, how for (upstream and downstream) form the section will the depth be 2.0 m? Take Manning's n as 0.015 (9)

OR

20. a) The specific energy for a 5 m wide rectangular channel is to be 4 Nm/N. if the rate of flow of water through the channel is 20 m^3/s. determine the alternate depth of flow. (7)

b) A rectangular channel 7.5 m wide has a uniform depth of flow of 2.0 m and has a bed slope of 1 in 3000. If due to weir is constructed at the downstream end of the channel, water surface at a section is raised by 0.75 m, determine the water surface slope with respect to horizontal at this section. Assume manning's N = 0.02 (7)

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