JYOTHI ENGG. COLLEGE THRISSUR EDUCATIONAL TRUST CHERUTHURUTHY 13/6/25

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (S,FE) (FT/WP) (S1 PT) Examination May 2025 (2019 Scheme)

Course Code: CET203

Course Name: Fluid Mechanics and Hydraulics

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions. Each question carries 3 marks Marks

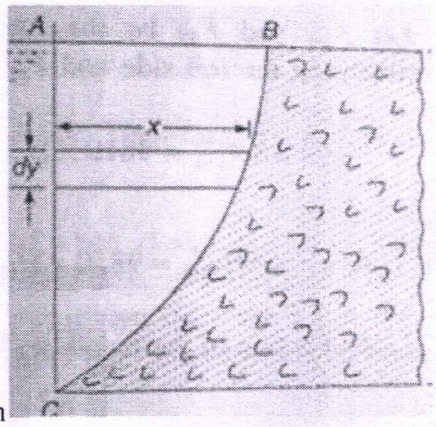
1	State and prove hydrostatic law and justify that it is adaptable for compressible and incompressible fluid?	(3)
2	Derive the expression for total pressure and centre of pressure for a plane immersed vertically in static mass of fluid	(3)
3	Explain the conditions of stability in floating and submerged condition	(3)
4	Classify and brief different type of fluid flow?	(3)
5	Derive the expression for kinetic energy factor? State its values in laminar flow and turbulent flow condition	(3)
6	Explain the determination of coefficient of velocity by conducting experiment?	(3)
7	Derive the condition of uniform flow in prismatic channels?	(3)
8	Derive the condition of economic section for a triangular channel?	(3)
9	Define sp.energy? State its variation w r to critical flow?	(3)
10	State the assumptions supporting the derivation of dynamic equation of gradually varied flow?	(3)

PART B

Answer any one full question from each module. Each question carries 14 marks

Module 1

11	a. Derive the expression for total pressure and centre of pressure on a plane immersed under water, have an angle with horizontal	(6)
	b. Find the magnitude and direction of resultant water pressure acting on the curved face of the dam. The surface is shaped according to the relation $y = x^2/3$. The height of water retained by the dam is 7m. Take length of dam as	(8)

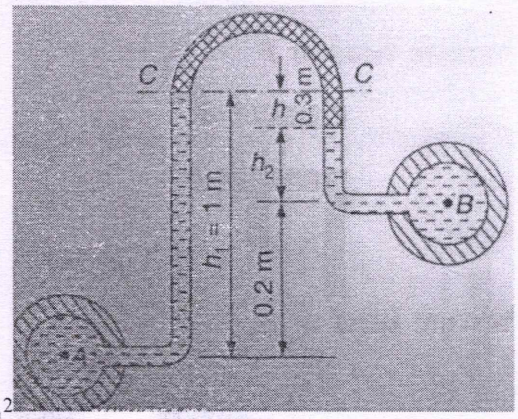


30m

OR

12 a.With a figure explain the difference between absolute pressure,gauge pressure and atmospheric pressure. Also state the rules of preparing pressure balance equation? (7)

b.An inverted U tube manometer is connected between two pipe lines. Pipe A carrying water and pipe B carrying oil of sp wt 7.85kN/m^3.A special liquid of sp.gravity 0.7 is used as manometric liquid. Find the difference in pressure between two pipes in N/m^2 (7)



Module 2

13 a. A hollow wooden cylinder of sp gravity 0.56 has an outer diameter of 60cm and an inner diameter of 30 cm. It is required to float in oil of sp gravity 0.85. Calculate the maximum height of the cylinder so that it shall be stable when floating with its axis vertical. Also calculate the depth to which it will sink? (8)

b. Derive continuity equation for unsteady, three dimensional, compressible fluid. Modify it by releasing the assumptions (6)

OR

14 a. Determine metacentric height by experimental method (6)

b. An idealised flow is represented by $V = 2x^3 i - 3x^2y j$. Is the flow steady or unsteady? Is it two or three dimensional? Calculate velocity, local acceleration, and convective acceleration of a fluid particle in this flow field at point P(x,y,z)=(2,1,3) (8)

Module 3

15 a. Establish the Bernoulli's theorem from the Euler's equation of motion along a stream line. Mention the assumptions made. (5)

b. Explain the principle of venturimeter with a neat sketch and establish an expression for the rate of flow? A 30 cm x 15 cm venturimeter is provided in a vertical pipeline carrying oil of sp.gravity 0.9, the flow being upwards? The difference in elevations of the throat section and entrance section of the venturimeter is 30cm. The differential U tube mercury manometer shows a gauge deflection of 25cm. Calculate (i)the discharge (ii)the pressure difference between the entrance and the throat section. Take Cd 0.98 and sp gravity of mercury as 13.6 (9)

OR

16 a. Derive Darcy-Weisbach equation for loss of head in a pipe due to friction (6)

b. A 5cm diameter pipe takes off abruptly from a large tank and runs 8m, then expands abruptly to 10 cm diameter and runs 45m, and next discharge directly into open air with a velocity of 1.5m/s. Compute necessary height of water surface above the point discharge and draw the Hydraulic Grade Line. Take friction coefficient as f=0.0065 (8)

Module 4

17 a. Derive the economic section for a circular channel (i) maximum discharge condition (ii) maximum velocity condition (6)

b. A trapezoidal channel is required to carry $6m^3/s$ of water at a velocity of 1.5m/s. Find the most economic cross section if the channel has side slopes 2V to 1H. For the same discharge what saving in power would result if this trapezoidal section is replaced by a rectangular 1.5m deep and 3m wide? C =$55m^{1/2}/s$ (8)

OR

18 a. Derive an expression for the discharge through a rectangular notch for a (7)

given head of water over the sill and modify the expression for accounting velocity of approach and end contraction?

b. A stream approaching a waterfall of 18.5m is gauged by a weir. The measured head over the weir is 0.3m and the length of weir crest is 3m.The velocity of approach is 1.2m/s and due to this the head may be supposed to be increased by 1.5 $Va^2/2g$. Determine the power available from the fall if 75% energy can be utilised (7)

Module 5

19 a. Explain the features of the specific energy curve with a diagram with respect to super critical and sub critical flow condition and also show the alternate depth and critical depths. (6)

b. A weir is installed across a rectangular open channel thereby raising the flow depth from 1.5m in a normal flow to 2.5m at the weir. The width of the channel is 10m and its laid to a slope of 1 in 10000.Find the approximate length of the backwater curve considering average velocity, average depth and average slope midway between the two sections. Take Manning's rugosity coefficient is 0.02. (8)

OR

20 a. What is meant by hydraulic jump? List the conditions necessary for the derivation of dynamic equation of hydraulic jump occurring in a rectangular channel? What are the uses of hydraulic jump? (6)

b. A 3m wide rectangular channel conveys $7.5m^3/s$ of water with a velocity of 5m/s. Is there a condition for hydraulic jump to occur? If so calculate the height, length and strength of the jump. Also determine the loss of energy per kg of water (8)

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