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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S3 (R, S) / S1 (PT) (S, FE) Examination December 2023 (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	Define the terms gauge pressure and absolute pressure. Indicate their relative positions on a chart.	(3)
2	Determine the total pressure on a circular plate of diameter 1.5 m which is placed vertically in water such a way that centre of plate is 3m below the free surface. Find the centre of pressure also.	(3)
3	Explain on the stability conditions of submerged bodies	(3)
4	Define the terms stream line, pathline and streak line.	(3)
5	Explain the working and principle of Pitot tube.	(3)
6	Differentiate between Hydraulic gradient line and Energy gradient line.	(3)
7	Compare between open channel flow and pipe flow.	(3)
8	Differentiate between a notch and a weir.	(3)
9	Give the assumption of Dynamic equation for G.V.F.	(3)
10	Explain on the characteristics of M2 water surface profile.	(3)

PART B

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

Module 1

11a.	A simple U tube manometer is used to measure the vacuum pressure of a liquid of specific gravity 0.85 flowing through a pipe. One end of the manometer is connected to the centre of the pipe and other end is open to atmosphere. The difference in mercury level in the two limbs is 30 cm and height of the liquid in the limb connected to pipe is 20 cm from the centre of the pipe. Determine the pressure in the pipe.	(5)
11b.	A curved surface AB is in the form of a quadrant of a circle of radius 2m, compute the horizontal and vertical components of the total force acting on the curved surface AB. Take width of the gate as unity.	(9)

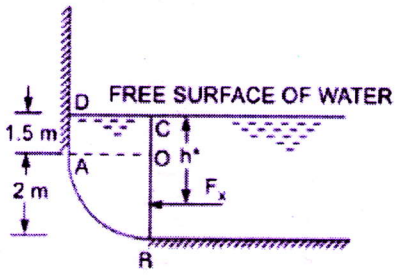

Fig. 1

12 A circular plate 3m diameter having a concentric circular hole of 1.5m diameter is immersed in water in such a way that its greatest and least depth below the free surface are 4m and 1.5m respectively. Determine the total pressure on one face of the plate and position of centre of pressure. (14)

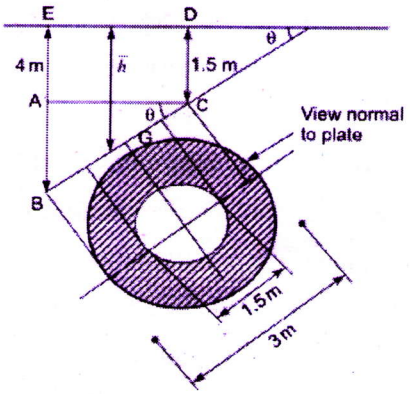

Fig. 2

Module 2

13 Show that a cylindrical buoy of 1m diameter and 2m height weighing 10kN will not float vertically in a sea water of density 1030kg/m^3. Find the force necessary in a vertical chain attached at the centre of base of the buoy that will keep it vertical. (14)

14 A fluid flow field is given by, (14)

$$\mathbf{V} = x^2y\mathbf{i} + y^2z\mathbf{j} - (2xyz + y^2z)\mathbf{k}$$

Prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity and acceleration at the point (2,1,3).

Module 3

15 Giving the assumptions arrive at Bernoulli's Equation form Euler's equation of motion. (14)

16 The rate of flow of water pumped into a pipe ABC, 200m long is 20litres/s. (14)

The pipe is laid on an upward slope of 1 in 40. The length of portion AB is 100m and its diameter 0.1m, while the length of portion BC is 100m and its diameter suddenly enlarges to 0.2m. The flow is taking place from A to C where pressure at A is $20N/cm^2$ and end C is connected to a tank. Find the pressure at C and draw the H.G.L and T.E.L. Take f = 0.008.

Module 4

17 A triangular gutter, whose sides include of 60^o, conveys water at a uniform depth of 250 mm. If the discharge is $0.05m^3/s$, determine the gradient of the trough. Use the Chezy's formula that the C= 52. Also find the roughness coefficient at the channel. (14)

18 A trapezoidal channel has side slopes 1 to1. It is required to discharge $15m^3/s$ of water with a bed gradient of 1 in 1000. If unlined the value of Chezy's C is 44. If lined with concrete its value is 60. The cost per m^3 of excavation is four times the cost per m^2 of lining. The channel is to be the most efficient one. Find whether the lined canal or the unlined canal will be cheaper. What will be the dimensions of that economical canal? (14)

Module 5

19a. Define gradually varied flow and derive Dynamic Equation for Gradually varied flow. (6)

19b. The depth of flow of water at a certain section of a rectangular channel of 2m wide is 0.3m. The discharge through the channel is 1.5 m^3/s. Determine whether a hydraulic jump will occur, and if so, find the height and loss of energy per kg of water. (8)

20a. Give the characteristics of Water surface profile in horizontal sloped channels. (5)

20b. A sluice gate discharges water into a horizontal rectangular channel with a velocity of 6m/s and depth of flow is 0.4m. The width of channel is 8m. Determine whether the jump will occur, and if so, find its height and loss of energy per kg of water. Also determine the power lost in the hydraulic jump. (9)

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