Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree Examination December 2020 (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	Differentiate atmospheric pressure, gauge pressure and absolute pressure.	(3)
2	Explain pressure diagram and its use.	(3)
3	State the stability conditions of floating bodies.	(3)
4	Differentiate streamline, streakline and pathline.	(3)
5	Explain the use and principle of Pitot tube.	(3)
6	Explain hydraulic gradient line and total energy line with a sketch.	(3)
7	Obtain hydraulic depth and hydraulic mean depth of a triangular channel.	(3)
8	State the characteristics of velocity distribution in open channels.	(3)
9	Explain the characteristics of S-type water profile with examples.	(3)
10	Explain the classification of hydraulic jump based on Froude number.	(3)

PART B

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

Module 1

11.a	An inverted differential manometer is connected to two pipes A and B which convey water. The centreline of pipe B is 50 cm below the centreline of pipe A. Pipe B is to the right side of pipe A. The oil level in the left limb is 40 cm above the centreline of pipe A and that in the right limb is 60 cm above the centreline of pipe B. The fluid in the manometer is oil of specific gravity 0.85. Find the pressure difference between A and B.	(6)
11.b	A square aperture in the vertical side of a tank has one diagonal vertical and is completely covered by a plane plate hinged along one side of the upper side of the aperture. The diagonals of the aperture are 2.4 m long and the tank contains a liquid of specific gravity 1.2. The centre of the aperture is 1.8 m below the free surface. Calculate the thrust exerted on the plate by the liquid and the position of centre of pressure.	(8)

12 A cylinder of 3 m diameter is placed across a channel of 5 m width. Water is retained on one side of the cylinder for a depth of 3 m and on the other side, it retains oil (SG=0.8) for a depth of 1.5 m. Determine the resultant force acting on the cylinder. (14)

Module 2

13.a The velocity component in a 2D incompressible flow field are $u = \frac{y^3}{3} + 2x - x^2 y$ and $v = xy^2 - 2y - \frac{x^3}{3}$. Determine and acceleration at P(1,3). (5)

13.b Derive the continuity equation in 3D Cartesian coordinates. (9)

14 A buoy carrying a beam-light has the upper portion cylindrical, 2 m diameter and 1.25 m deep. The lower portion, which is curved one displaces a volume of 400 litres and its centre of buoyancy is located 1.3 m below the top of the cylinder. The centre of gravity of the whole buoy is 0.95 m below the top of the cylinder and the total displacement is 25.5 kN. Find the metacentric height of the body. (14)

Module 3

15.a An orifice meter consisting of 100 mm diameter orifice in a 250 mm diameter pipe has C_d=0.65. The pipe delivers oil of specific gravity 0.8. The pressure difference in the two sides of the orifice plate is measured by mercury-oil differential manometer. If the differential gauge reading is 800 mm of mercury, find the rate of flow of oil through the pipe in litres/s. (6)

15.b A partially submerged rectangular orifice is 1 m wide and 0.8 m deep. Calculate the discharge through the orifice, if the water level on the upstream is 4 m above the upper edge of the orifice and that at the downstream is 0.3 above the lower edge of the orifice. Take C_d=0.62. (8)

16 A pipeline with diameter 80 cm and length 3000 m connects two open reservoirs of water which have their surface elevations of 100 m and 70 m above a datum. In order to increase the flow rate between the reservoirs by 20 %, it is decided to lay an additional pipe of same diameter in parallel to the first one. The second pipeline is to be originated from the upper reservoir and is to be connected at some suitable point. Determine the point of connection, assuming the friction factor as 0.04 for both the lines. Neglect minor losses. (14)

Module 4

17.a Obtain the condition for maximum velocity of flow through circular channels (7)

17.b Determine the dimensions of a most efficient trapezoidal section to convey 10 m^3/sec at a velocity of 1.25 m/s. (7)

18.a Obtain the discharge equation of a Cipoletti weir. State its advantages. (5)

18.b A weir of 25 m long is divided into 10 equal bays by vertical posts which of 50 cm width. Find the discharge over the weir, if the head over the crest is 1.5 m and the velocity of approach is 2 m/s. (9)

Module 5

19.a Stating the assumptions underlying it, derive the dynamic equation gradually varied flow. (10)

19.b A rectangular channel 2 m wide carries a discharge of 6 m^3/s. Calculate the critical depth and specific energy at critical depth. (4)

20.a A very wide rectangular channel carries a discharge of 8 cumecs per m width. The channel has a bed slope of 0.004 and Manning's roughness coefficient 0.015. Find the distance to a section were water depth is 0.9 m using direct step method employing single step. (8)

20.b A hydraulic jump occurs in a rectangular channel and depths of flow before and after the jump are 0.5 m and 3. Calculate the critical depth and energy lost in the hydraulic jump. (6)

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