Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: CE206

Course Name: FLUID MECHANICS II (CE)

Max. Marks: 100 Duration: 3 Hours

Assume any missing data suitably.

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Show that the maximum efficiency of a jet striking normally on a series of flat plates arranged over the periphery of a runner is 50 %. (5)

b) A Kaplan turbine develops 15000 kW power at a head of 30 m. The diameter of the boss is 0.35 times the diameter of the runner. Assuming a speed ratio of 2, a flow ratio of 0.65 and an overall efficiency of 90 % calculate the diameter of the runner and the rotational speed. (7)

c) Why the suction lift of a centrifugal pump cannot exceed a certain limit? (3)

2 a) A jet of water having a velocity of 35 m/s impinges without shock on a series of vanes moving at 20 m/s. The jet angle at inlet is 30^0 and jet angle at exit is 60^0. Find: (a) vane angles at entrance and exit (b) work done on vanes per unit weight of water supplied by the jet; and (c) the hydraulic efficiency. (10)

b) A Pelton turbine is to operate under a net head of 500 m at 420 rpm. If a single jet with diameter 18 cm is used, find the specific speed of the machine. Take C_v as 0.98 and overall efficiency as 0.85. (5)

3 a) Derive an expression for the specific speed of a centrifugal pump. (5)

b) A centrifugal pump discharges 0.2 m^3/s of water at a head of 25 m when running at a speed of 1400 rpm. The manometric efficiency is 80%. If the impeller has an outer diameter of 30 cm and width of 5 cm, determine the vane angle at the outlet. (7)

c) Define the term, Net Positive Suction Head. (3)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Define the terms: i) wetted Perimeter, ii) Hydraulic depth and iii) Hydraulic radius. (5)

b) A trapezoidal channel discharging water at the rate of 150 m^3/s is to be designed for most economical section. Find the bottom width of the channel and depth of (10)

water. The side slope is 45^0. Take bed slope is 1 in 1000 and Chezy's constant as 50.

5 a) Derive the condition for maximum discharge for a given value of specific energy. (7)

b) In a hydraulic jump on a horizontal rectangular channel the Froude number before the jump is 10 and energy loss during the jump is 4 m. Find i) depths before and after the jump, ii) the discharge per unit width and iii) Froude no after the jump. (8)

6 a) Define the terms: i) conveyance of a channel section ii) normal depth. (5)

b) A rectangular channel has a width of 1.8 m and carries a discharge of 1.8 m^3/s at a depth of 0.2 m. Calculate i) specific energy ii) depth alternate to the existing depth and iii) Froude numbers at the alternate depths. (10)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Derive the dynamic equation for gradually varied flow, stating the assumptions involved. (8)

b) A trapezoidal channel with 6 m bottom width and side slope 2 horizontal to 1 vertical having a bed slope of 0.0016 carries 10 m^3/s of water. The dam along the way of the channel rises the water depth by 2 m behind the dam. Decide the nature of channel and type of profile of water. Take Manning's coefficient as 0.025 (12)

8 a) The resistance force F of a ship is a function of length L, velocity V, gravitational acceleration g, density ρ and viscosity μ. Develop a functional relationship in terms of non-dimensional numbers using Buckingham π theorem. (10)

b) Explain the different types of similarities to be ensured between the model and prototype. (6)

c) Explain the Froude model law. (4)

9 a) Find the slope of free water surface of a rectangular stream 20 m wide at a section 3 m deep. The slope of the bed of stream is 1 in 5000. Total discharge is 25 m^3/s. Assume Chezy's constant C as 55. State whether water surface will fall or rise. (10)

b) A 1 : 5 scale model of a car is tested in wind tunnel. The velocity of prototype is 75 km/h. The model drag is 300 N. Find out the drag and power required for the prototype. The air used is same in model and prototype. (7)

c) Differentiate between backwater curve and drawdown curve. (3)

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