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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S, FE) / S2 (PT) (S, FE) Examination May 2023 (2015 Scheme)

Course Code: CE206

Course Name: FLUID MECHANICS II (CE)

Max. Marks: 100 Duration: 3 Hours

PART A

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

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

b) A Francis turbine with an overall efficiency of 70% is required to produce 147.15kw. It is working under a head of 8m. the peripheral velocity= 0.30 $\sqrt{2gH}$ and the radial velocity of flow at inlet is 0.96 $\sqrt{2gH}$. The wheel runs at 200 rpm and the hydraulic losses in the turbine are 20% of the available energy. Assume radial discharge determine : i) the guide blade angle, ii) the wheel vane angle at inlet, iii) diameter of the wheel at inlet, and iv) width of the wheel at inlet. (10)

2 a) i) What are the purposes of providing draft tube? (7)

ii) Derive the expression for minimum speed for starting a centrifugal pump

b) A jet of water of diameter 150mm moving with a velocity of 12m/s strikes a flat plate normally. The plate is moving with a velocity of 6m/s in the direction of the jet and away from the jet. Find the i) force exerted by the jet on the plate, ii) work done by the jet on the plate per second, iii) power of the jet, iv) efficiency of the jet. (8)

3 a) With a neat sketch explain the components and working of a centrifugal pump. (5)

b) A centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 30^0 and velocity of flow at outlet is 3m/s. The pump is working against a total head of 30m and the discharge through the pump is 0.3 m^3/s. if the manometric efficiency of the pump is 75%, determine i) diameter of the impeller at outlet, and ii)width of the impeller at outlet, iii) work done by the impeller per second. (10)

PART B

Answer any two full questions, each carries 15 marks.

4 a) i)Show that the three sides of the trapezoidal section of most economical section are tangential to the semicircle described on the water line (7)

ii) Show that for a most economical rectangular channel, width of channel equal to two times the depth

b) A rectangular channel 4m wide has depth of water 1.5m. The slope of the bed of the channel is 1 in 1000 and value of Chezy's constant C=55. It is desired to increase the discharge to a maximum by changing the dimensions of the section for constant area of cross section, slope of the bed and roughness of the channel. Find new dimensions of the channel and increase in discharge. (8)

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

ii)Explain normal depth, normal discharge, normal slope

b) A sluice gate discharges water into a horizontal rectangular channel with a velocity of 10m/s and depth of flow 1m. Determine the depth of flow after the jump and consequent loss in total head. (8)

6 a) What is specific force? Explain the characteristics of specific force curve? (6)

b) Applying the momentum equation to a rectangular open channel flow, show that the sequent depths and flow rate are related by $2q^2/g = y_1 y_2 (y_1 + y_2)$ (9)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Derive the dynamic equation for gradually varied flow (7)

b) Design a trapezoidal shaped concrete lined channel to carry a discharge of 100 cumec at a slope of 25cm/km. The side slope of the channel are 1.5:1, N=0.016, Assuming limiting velocity as 1.5 m/s (7)

c) Give a brief description on classification of surface profiles (6)

8 a) Find the rate of change of depth of water in a rectangular channel of 9m wide and 1.7m deep when the water is flowing with a velocity of 1m/s. The flow of water through the channel of bed slope 1 in 3000 is regulated in such a way that energy line is having a slope of 0.00004 (5)

b) A 7.2m height and 15m long spillway discharges $94 m^3/s$ discharge under a (8)

head of 2.0m. If a 1:9 scale model of this spillway is to be constructed, determine the model dimensions, head over spillway model and the model discharge. If model experiences a force of 7500N determine the force on the prototype.

c) Draw and explain the characteristics of surface profile of mild slope channel. (7)

9 a) Explain i) distorted and undistorted models (5)

ii) scale ratios

b) Find the scale ratio for i) acceleration ,ii)discharge, iii) force (7)

c) The discharge through an orifice depends on the diameter D of the orifice, head H over the orifice, density ρ of liquid, viscosity μ of the liquid and acceleration g due to gravity. Using dimensional analysis, find the expression for the discharge. Hence find the dimensionless parameters on which the discharge co-efficient of an orifice meter depends. (8)

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