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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JUNE 2017

Course Code: **CE206**

Course Name: **FLUID MECHANICS II (CE)**

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any 2 questions. Each question carries 15 marks.

1. A Kaplan turbine working under a head of 20 m develops 11772 kW shaft power. The outer diameter of the runner is 3.5 m and hub diameter 1.75 m. The guide blade angle at the inlet at the extreme edge of the runner is 35°. The hydraulic and the overall efficiencies of the turbines are 88% and 84% respectively. If the velocity of whirl is zero at the outlet, determine:

   a) Runner vane angles at the inlet and outlet at the extreme edge of the runner.

   b) Speed of the turbine.

2. a. Show that the force exerted by a fluid jet in its direction of flow on a semicircular vane is twice that exerted on a flat vertical plate, both plates being fixed in position. (9)

   b. What are the different types of draft tubes? (6)

3. A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 35 m. The velocity of flow through the impeller is constant and equal to 2.4 m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500 mm and width at outlet is 50 mm, determine:

   i) Vane angle at inlet

   ii) Work done by impeller on water per second, and

   iii) Manometric efficiency.

PART B

Answer any 2 questions. Each question carries 15 marks.

4. a. Derive Chezy's equation for uniform flow in a channel section. (8)

   b. For a constant specific energy of 2.4 N.m/N, calculate the maximum discharge that may occur in a rectangular channel of 4.0 m wide. (7)

5. a. Explain the velocity distribution in an open channel. (5)

b. A trapezoidal irrigation channel, having side slopes 3 horizontal to 2 vertical, is to carry a flow of 10 cumecs on a longitudinal slope of 1 in 5000. The channel is to be lined for which the value of Manning's coefficient is 0.012. Find the dimensions of the most economic section of the channel. (10)

6. Derive the expression for conjugate depths and energy loss associated with hydraulic jump in rectangular channels.

PART C

Answer any 2 questions. Each question carries 20 marks.

7. a. Derive the dynamic equation of gradually varied flow in a channel, stating the assumptions involved. (10)

   b. A rectangular channel of 8.0 m wide has a uniform depth of flow of 2.0 m and has a bed slope of 1 in 3000. If due to weir constructed at the downstream end of the channel, water surface at a section is raised by 0.5m, determine the water surface slope with respect to horizontal at this section. Assume Manning's n= 0.02. (10)

8. a. Explain, with sketches, the various surface profiles that are possible in an open channel. (12)

   b. Derive the equation for the computation of length of backwater curve by step method. (8)

9. For laminar flow in a pipe, the pressure drop ΔP in pipe of diameter D and length L depends on the density ρ and viscosity μ of the flowing fluid, mean velocity of flow V and the average height of surface roughness of pipe (t). Show by Rayleigh's method, the p ressure drop ΔP is given by

$$\Delta P = \rho V^2 f[(L/D)\,(t/D)\,(\mu/\rho V D)] \quad (20)$$

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