Reg. No.________________ Name:________________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CE206

Course Name: FLUID MECHANICS -II.

Max. Marks: 100 Duration: 3 Hours

Answer any two Questions from each part.

PART A

1. a) Derive an expression for maximum hydraulic efficiency of a Pelton wheel. (5)

   b) A jet of water having a velocity of 45m/s impinges without shock a series of vanes moving at 15m/s, the direction of motion of the vanes being inclined at 20^0 to that of the jet. The relative velocity at outlet is 0.9 of that at inlet, and the absolute velocity of the water at exit is to be normal to the motion of the vanes. 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)

2. a)Explain with figure the function of a surge tank in a hydroelectric plant. (5)

   b)Determine the overall efficiency of a Kaplan turbine developing 3000kW under a net head of 5m.It is provided with a draft tube with its inlet diameter 3m set 1.6m above the tail race level. A vacuum gauge connected to the draft tube indicates a reading of 5m of water. Assume draft tube efficiency as 78%.Neglect losses in the draft tube. (10)

3. a) Define the terms (i) Specific speed of a centrifugal pump and (ii) Net Positive Suction Head. (5)

   b)The diameter of an impeller of a centrifugal pump at the inlet and outlet are 36cm and 72cm respectively. The velocity of flow at outlet is 2.4m/s and the vanes are set back at angle of 45^0 at outlet. Determine the minimum starting speed if the manometric efficiency is 70%. (10)

PART B

4. a) Differentiate between (i) Gradually varied flow and rapidly varied flow, (ii)subcritical and supercritical flow. (6)

   b) A trapezoidal channel with side slopes of 2 horizontal : 1 vertical has to be designed to carry 15 m^3/s at a slope of 1/5000. Determine the dimensions of the efficient section.Manning's coefficient is 0.014. (9)

5. a) A rectangular channel 3.5m wide is laid on a slope of 0.0005. Calculate the normal depth of flow for a discharge of $5m^3/s$ in this channel. The Manning's coefficient can be taken as 0.02. (7)

b)On what slope should one construct a 3m wide rectangular channel (Manning's coefficient is 0.014) so that critical flow will occur at a normal depth of 1.2m? (8)

6. a) Differentiate between alternate depths and conjugate depths. (5)
   b) In a hydraulic jump on a horizontal rectangular channel the depth and Froude number before the jump are 0.2 m and 9 respectively. Estimate the energy loss and specific energy head at the end of the jump. (10)

PART C

7. a) Sketch the water surface profiles that can occur in a steep slope channel. (7)
   b) In a rectangular channel 12 m wide and 3.6 m deep water is flowing with a velocity of 1.2 m/s. The bed slope of the channel is 1 in 4000. If flow of water through the channel is regulated in such a way that energy line is having a slope of 0.00004, find the rate of change of depth of water in the channel. (8)
   c) Differentiate between backwater curve and drawdown curve. (5)
8. a) The resisting force F of a plane during flight can be considered as dependent upon the length of aircraft L, velocity V, air viscosity μ, air density ρ and bulk modulus of air K. Express the functional relationship between these variables and the resisting force using dimensional analysis. (8)
   b) The normal depth of flow of water, in a rectangular channel 1.5 m wide, is one metre. The bed slope of the channel is 0.0006 and Manning's roughness co-efficient is 0.012. Find the critical depth. At a certain section of the same channel the depth is 0.92 m while at a second section the depth is 0.86 m. Find the distance between the two sections. (12)
9. a) Explain the different types of similarities to be ensured between the model and prototype. (5)
   b) Explain the Froude model law and Reynolds model law. (5)
   c) A model of rectangular pier 1.5m wide and 4.5m long in a river is built to a scale of 1: 25.The average depth of water in the river is 3m. The model was tested in a laboratory, where the velocity of flow was maintained constant at 1.65m/s.It was observed that the force acting on the model was 3.92 N and the height of the standing wave was 3.5cm. Determine for the prototype a) the corresponding speed, b) the force acting, c) the height of the standing wave at nose. (10)

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