D

02000CE206052001

Pages: 3

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth semester B.Tech examinations (S), September 2020

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) Find the type of the turbine which should be used under a head of 150 m to develop 1500 KW while running at 300 rpm, based on specific speed criteria. (3)

b) A jet of water strikes on a smooth stationary curved plate at the centre. Derive an equation for force exerted in the direction of the jet. (3)

c) A Kaplan turbine, operating under a head of 20 m develops 20000 KW with an overall efficiency of 66%. The speed ratio is 2 and flow ratio is 0.6. The hub diameter of the wheel is 0.35 times the outer diameter of the wheel. Find the diameter and speed of the turbine. (9)

2 a) How priming is carried out in small and large centrifugal pumps? What is self-priming pump? (3)

b) A centrifugal pump delivers 0.04 m^3/s of water to a height of 20 m through a 15 cm diameter pipe which is 100 m long. Calculate the manometric head if the coefficient of friction is 0.15. (3)

c) Derive an expression for specific speed of a centrifugal pump. (9)

3 a) Find the ratio of forces exerted by a jet of water in the direction of jet when it strikes normally (4)

i) a smooth stationary flat plate

ii) a smooth flat plate moving in the direction of the jet at one half of the velocity of the jet.

b) Compare Kaplan turbine and Francis turbine. (4)

c) A centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 45^0 and velocity of flow at outlet is 2.5 m/s. The discharge through the pump is 200 litres/s when the pump is working against a total head of 20m. (7)

If the manometric efficiency of the pump is 80%, determine the diameter of the impeller and the width of the impeller at the outlet.

PART B

Answer any two full questions, each carries 15 marks.

4 a) Differentiate between hydraulic radius and hydraulic depth. (3)

b) A triangular channel has a side slope of 1.5 horizontal to 1 vertical and is laid on a longitudinal slope of 1 in 1650. Assuming Manning's coefficient as 0.013, estimate the normal depth required to pass a discharge of 0.3 m^3/s. (3)

c) A trapezoidal section has side slopes of 1 vertical to 1 horizontal and has to carry a discharge of 14 m^3/s. The bed slope of the channel is 1 in 1000. Chezy's constant is 45 if the channel is unlined and is 70 if the channel is lined with concrete. The cost per cubic meter of excavation is 3 times the cost per square metre of lining. The channel is to be the most efficient one. Find whether the lined canal or unlined canal will be cheaper. (9)

5 a) List out any three practical cases in which a hydraulic jump may occur. (3)

b) Explain specific force curve. (3)

c) A discharge of 18m^3/s flows through a rectangular channel 6m wide at a depth of 1.6m. Find the specific energy and critical depth. State whether the flow is subcritical or supercritical. What is the alternate depth? (9)

6 a) Show that the head loss in a hydraulic jump formed in a rectangular channel may be expressed as $\Delta E = \frac{(V_1 - V_2)^3}{2g(V_1 + V_2)}$ (8)

b) For maximum discharge in a circular channel section, prove that the depth of flow is 0.95 times the diameter of the channel. (7)

PART C

Answer any two full questions, each carries 20 marks.

7 a) What are the assumptions made for deriving dynamic equation for gradually varied flow? (5)

b) A rectangular channel 10 m wide carries a discharge of 10 m^3/s. It is laid at a slope of 0.0001. If the depth of flow at a section is 1.6 m, how far (upstream or downstream) will be the depth be 2 m? Manning's coefficient N = 0.015. (15)

8 a) Distinguish between Reynolds number and Froude number. (5)

b) What is distorted model? What are the merits and demerits? (5)

c) The efficiency η of a fan depends upon the kinematic viscosity of the fluid μ, the angular velocity ω, diameter D of the rotor and the discharge Q. Express η (10)

in terms of dimensionless parameters using Buckingham π- theorem as $\eta = \varphi\left[\frac{v}{\omega D^2}, \frac{Q}{\omega D^3}\right]$.

9 a) Find the slope of free water surface in a rectangular channel of width 3 m and depth of flow 0.75 m. The discharge through the channel is 0.84 m^3/s. The bed of the channel is having a slope of 0.15 m per km. Assume Chezy's constant, C as 55. (5)

b) With a neat sketch explain the characteristics of water surface profile in critical sloped channels. (5)

c) A 1: 50 spillway model has a discharge of 1.25 m^3/s. What is the corresponding prototype discharge? If a flood phenomenon takes 12 hours to occur in the prototype, how long should it take in the model? (10)

****