

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  $30^\circ$  and jet angle at exit is  $60^\circ$ . 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  $0.2 \text{ m}^3/\text{s}$  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  $150 \text{ m}^3/\text{s}$  is to be designed for most economical section. Find the bottom width of the channel and depth of (10)

water. The side slope is  $45^\circ$ . 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  $1.8 \text{ m}^3/\text{s}$  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  $10 \text{ m}^3/\text{s}$  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  $\rho$  and viscosity  $\mu$ . Develop a functional relationship in terms of non-dimensional numbers using Buckingham  $\pi$  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  $25 \text{ m}^3/\text{s}$ . 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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