(Pages : 4) **G – 3590**

Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, June 2019

(2013 Scheme)

13.404 : FLUID MECHANICS – II (C)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. Each question carries 4 marks.

1. (a) What do you mean by 'hydraulically best section'? State the conditions for maximum velocity and maximum discharge in circular section.

   (b) Explain gradually varied flow and the assumptions made.

   (c) What do you mean by separation of boundary layer? What is the effect of pressure gradient on boundary layer separation?

   (d) What are the different laws on which models are designed for dynamic similarity?

   (e) Write short notes on types of surge tanks.

(5 × 4 = 20 Marks)

P.T.O.

PART – B

Answer **any one full** question from **each** Module. Each full question carries 20 marks.

Module – I

2. (a) A 4m diameter circular channel is laid at a bed slope of 1 in 800. Find the depth, velocity and discharge for maximum velocity condition. Take C = 60. **8**

(b) What are the applications of specific energy in open channel flow? **4**

(c) Derive the Chezy's equation for an open channel flow. **8**

OR

3. (a) A 8m wide rectangular channel conveys 15 cumecs of water at a depth of 1.2m Determine:

(i) Specific energy of the flowing water,

(ii) Critical depth, critical velocity and minimum specific energy,

(iii) Froude number and state whether the flow is sub-critical or super critical. **10**

(b) Find the dimensions of an economical trapezoidal section of an open channel with side slope 2H to 1V, laid at a slope of 1 in 1600 to carry a discharge of $36m^3/s$. Take C = 60. **10**

Module – II

4. (a) Find the slope of the free water surface in a rectangular channel of width 20m, having depth of flow 5m. The discharge through the channel is $50m^3/s$. The bed of the channel is having a slope of 1 in 4000. Take C = 60. **12**

(b) Find the rate of change of depth of water in a rectangular channel of 10m wide and 1.5m deep, when the water is flowing with a velocity of 1 m/s. The flow of water through the channel of bed slope 1 in 4000 is regulated in such a way that energy line is having a slope of 0.00004. **8**

OR

5. (a) A 3m wide rectangular channel discharges 5.1m^3/s, the depth of flow being 0.75m. If due to a sudden release of flow, the upstream discharge rate is doubled, find the velocity of the consequent surge. Find also the new depth of flow. **10**

(b) A rectangular channel 2m wide conveys water at a velocity of 2m/s, the depth of flow being 1.25m. The rate of flow at the downstream end is suddenly decreased such that the depth of flow is increased to 2m. Find the absolute velocity of the resulting surge and the corresponding new discharge. **10**

Module – III

6. (a) Define displacement thickness. Derive an expression for the displacement thickness. **10**

(b) A plate 450mm x 150mm has been placed longitudinally in a stream of a crude oil of specific gravity *0.925* and kinematic viscosity of 0.9 stoke which flows with velocity of 6m/s calculate

(i) The friction drag on the plate

(ii) Thickness of the boundary layer at the trailing edge and

(iii) Shear stress at the trailing edge. **10**

OR

7. (a) Using Buckingham's π-theorem, show that the discharge Q consumed by an oil ring is given by,

$$Q = Nd^3\,\varphi[\mu / \rho N d^2, \sigma / \rho N^2 d^3, w / \rho N^2 d]$$

Where d is the internal diameter of the ring, N is rotational speed, ρ is density, μ is viscosity, σ is surface tension and w is the specific weight of oil. **12**

(b) A spillway 7m high and 150m long discharge 2000m^3/s under a head of 4m. If a 1:16 model of the spillway is to be constructed find the dimensions of the model and discharge in the model. **8**

Module – IV

8. (a) A pelton wheel is to be designed for the following specifications: shaft power = 11,772kW; Head = 380m; Speed =750rpm; Overall Efficiency = 86%; Jet diameter is not to exceed one-sixth of the wheel diameter. Determine: (i) the wheel diameter (ii) number of jet required and (iii) Diameter of jet. Take co efficient of velocity 'C_v' = 0.985 and speed ratio=0.45. **12**

(b) A turbine develops 9000kW when running at 10rpm. The head on the turbine is 30m. If the head on the turbine is reduced to 18m, determine the speed and power developed by the turbine. **8**

OR

9. (a) Derive the expression for minimum starting speed of a centrifugal pump. **10**

(b) A Centrifugal pump while running at a net head of 1000 rpm discharges 80 L/sec against a net head of 16m. The manometric efficiency of the pump is 0.85. If the vane angle at the outlet is 35° and Velocity of flow is 1.5 m/sec, estimate the outer diameter of the Impeller and its width at that diameter. **10**