Question Paper Code : X10242

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020 AND
APRIL/MAY 2021
Fourth Semester
Civil Engineering
CE 8403 – APPLIED HYDRAULIC ENGINEERING
(Regulations 2017)

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions

PART – A   **(10×2=20 Marks)**

1. Differentiate open channel flow from pipe flow.

2. What is meant by most economical section ?

3. Distinguish between draw down and back water curves.

4. What is break in grade in gradually varied flow ?

5. What are the location of hydraulic jump and why it is being done ?

6. What is mean by energy dissipation ?

7. A jet of water 40 mm diameter with a velocity 30 m/s, strikes a stationary plate at its normal direction. Determine the force exerted by the jet.

8. Define specific speed of a turbine.

9. Define mechanical efficiency of the pump.

10. What is meant by NPSH ?

PART – B   **(5×13=65 Marks)**

11.a) i) The depth of water in a circular brick lined conduit 1.8 m in diameter is to be 1.5 m and its capacity is 2.5m^3/sec. Find the bed slope of the conduit. Take C = 67. **(5)**

   ii) A 3m wide rectangular channel conveys 12m^3/s of water at a depth of 2 m. Calculate. 1. Specific energy of flowing fluid 2. Critical depth, critical velocity and the minimum specific energy 3. Froude number and state whether flow is subcritical or supercritical. **(8)**

(OR)

b) i) Show that the hydraulic radius is half the flow depth for the most economical trapezoidal channel section. **(5)**

ii) Determine the size of most economical rectangular channel which is carrying water at the rate of 0.6 m^3/s. The bed slope of the channel is 1 in 2000. Assume Chezy's constant C = 50. **(8)**

12. a) A wide channel laid to a slope of 1 in 1000 carries a discharge of 3.5m^3/sec per m of width at a depth of 1, 6m. Find out the value of Chezy's constant C. Consider the flow to be uniform. If the actual depth varies from 1.5m at an upstream location to 1.7 m at a location 300 m downstream or in other word the flow is gradually varied, what will be the value of Chezy's constant C. **(13)**

(OR)

b) i) Explain the computation of the water profiles is the direct step method. **(8)**

ii) Explain the classification of flow profiles. **(5)**

13. a) i) Derive an expression for depth of Hydraulic Jump. **(5)**

ii) The depth of flow of water, at a certain section of a rectangular channel of 2 m wide, is 0.3 m. The discharge through the channel is 1.5 m^3/sec. Determine whether a hydraulic jump will occur, and if so, find its height and loss of energy per kg of water. **(8)**

(OR)

b) i) Explain the term 'Hydraulic Jump'. Explain the classification of hydraulic jumps. **(5)**

ii) A rectangular channel 2m wide has a flow with a velocity of 2 m/s and a depth of flow of 1.25 m. The rate of flow at the downstream end is suddenly decrease such that the depth of flow is increased to 2m. Find the absolute velocity of the resulting surges and corresponding new discharge. **(8)**

14. a) Explain the characteristic curve of the turbine. State its application. **(13)**

(OR)

b) The following data is given for a Franci's turbine. Net head = 60 m; speed N = 70 rpm ; Shaft power = 294.3kW ; Overall efficiency = 84% ; Hydraulic efficiency = 93% ; breadth ratio = 0.1 ; Outer diameter of the runner = 2x inner diameter of the runner. The thickness of the vanes occupies 5% circumferential area of the runner, velocity of flow is constant at the inlet and discharge is radial at outlet. Determine : **(13)**
i) Guide blade angle
ii) Runner vane angle at inlet and outlet
iii) Diameters of runner at inlet and outlet

iv) Width of the wheel

15. a) i) What is minimum starting speed of the centrifugal pump ? Derive the expression for equation of minimum starting speed of the centrifugal pump. **(5)**

ii) A three stage centrifugal pump has impellers 40 cm in diameter and 2 cm wide at outlet. The vane are curved back at the outlet at 45° and reduce the circumferential area by 10%. The manometric efficiency is 90% and the overall efficiency 80%. Determine the head generated by the pump when running at 1000 rpm delivering 50 lit/sec. What should be the shaft power ? **(8)**

(OR)

b) i) A double acting reciprocating pump has a bore of 150 mm and stroke of 250 mm and runs at 35 rpm. The piston rod diameter is 20 mm. The suction head is 6.5 m and the delivery head is 14.5 m. The discharge of water was 4.7l/s. Determine the slip and the power required. **(5)**

ii) What is indicator diagram in reciprocating pumps ? Explain the effect of acceleration in suction and delivery strokes using indicator diagram. **(8)**

PART – C　　　　　　　**(1×15=15 Marks)**

16. a) The head at the base of the nozzle of a Pelton wheel is 640 m. The outlet vane angle of the bucket is 15°. The relative velocity at the outlet is reduced by 15% due to friction along the vanes. If the discharge at outlet is without whirl find the ratio of bucket speed to the jet speed. If the jet diameter is 100 mm while the wheel diameter is 1.2 m, find the speed of the turbine in rpm, the force exerted by the jet on the wheel, the power developed and the hydraulic efficiency. Take Cv = 0. 97. **(15)**

(OR)

b) The loss of energy head in a hydraulic jump formed in a rectangular channel is 4.25m. The Froude number just before the jump is 7.50. Find : **(15)**

a) The discharge per meter width of the channel

b) The depths before and after the hydraulic jump

c) Froude number after the jump

d) Percentage loss of energy head due to jump

e) Length of the jump.