ii. Explain the terms specific energy, critical depth, critical velocity as applied to non-uniform flow.   5   2   3   3

(OR)

b. Find the discharge through a trapezoidal notch which is 1m wide at the top and 0.4 m at the bottom and is 0.3 m in height. The head of water on the notch is 20 cm. Assume 'C$_d$' for rectangular portion = 0.62 while for triangular portion = 0.60.   10   2   3   3

29. a. A centrifugal pump is to discharge 0.118 m³/s at a speed of 1450 r.p.m against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometric efficiency is 75%. Determine the vane angle at the outer periphery of the impeller.   10   2   4   3

(OR)

b. A single acting reciprocating pump, running at 50 r.p.m delivers 0.01 m³/s of water. The diameter of the piston is 200 mm and stroke length 400 mm. Determine   10   2   4   3
   - (i) The theoretical discharge of the pump
   - (ii) Coefficient of discharge
   - (iii) Slip and percentage slip of the pump

30. a. A Kaplan turbine runner is to be designed to develop 9100 kW. The net available head is 5.6 m. If the speed ratio is 2.09, flow ratio = 0.68, overall efficiency = 86% and the diameter of the boss is 1/3 the diameter of the runner. Find the   10   2   5   3
   - (i) Diameter of the runner
   - (ii) Speed of turbine
   - (iii) Specific speed of the turbine

(OR)

b. A pelton wheel is to be designed for a head of 60 m when running at 200 r.p.m. The pelton wheel develops 95.6475 kW shaft power. The velocity of buckets = 0.45 times the velocity of the jet, overall efficiency = 0.85 and co-efficient of velocity is equal to 0.98. Determine   10   2   5   3
   - (i) Diameter of jet
   - (ii) Diameter of wheel
   - (iii) Width and depth of buckets
   - (iv) Number of buckets on the wheel

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B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

18CEC206T – HYDRAULIC ENGINEERING AND DESIGN

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

Note:
- (i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.
- (ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours   Max. Marks: 75

PART – A (25 × 1 = 25 Marks)   Marks   BL   CO   PO

Answer **ALL** Questions

1. Dimensional analysis is based on   1   1   1   3
   - (A) Newton's law of viscosity
   - (B) Fluid properties
   - (C) Flow properties
   - (D) The principle of dimensional homogeneity

2. The dimension of power is   1   1   1   3
   - (A) ML^2T^{-3}
   - (B) MLT^{-1}
   - (C) LT^{-1}
   - (D) $ML^{-1}T^{-1}$

3. The number of dimensionless term is determined by an equations   1   1   1   3
   - (A) $(m-n)$
   - (B) $(n-m)$
   - (C) $(l-m)$
   - (D) $(t-n)$

4. The square root of ratio of the inertia force to gravity force is called   1   1   1   3
   - (A) Froude's number
   - (B) Reynolds number
   - (C) Weber's number
   - (D) Mach's number

5. The actual structure of machine is called   1   1   1   3
   - (A) Prototype
   - (B) Similitude
   - (C) Mach's model law
   - (D) Model

6. A channel without any cover at the top is known as   1   1   2   3
   - (A) Natural channel
   - (B) Open channel
   - (C) Artificial channel
   - (D) Closed channel

7. The flow in the open channel is critical when Froude number is   1   2   2   3
   - (A) Less than 1
   - (B) Equal to 1
   - (C) More than 1
   - (D) Equal to zero

8. For the best rectangular channel section   1   2   2   3
   - (A) $y = \dfrac{b}{3}$
   - (B) $y = b$
   - (C) $y = \dfrac{b}{4}$
   - (D) $y = \dfrac{b}{2}$

9. The strength of jump is governed by the   1   1   2   3
   (A) Upstream velocity   (B) Downstream velocity
   (C) Upstream Froude number   (D) Bed slope

10. The curve for kinetic energy is a   1   1   2   3
   (A) Parabola   (B) Hyperbola
   (C) Ellipse   (D) Straight line

11. Gradually varied flow may be caused due to   1   2   3   3
   (A) Depth of flow changes abruptly in the channel   (B) Loss of energy in the channel
   (C) The change in slope of the channel   (D) Wetted perimeter of the channel

12. The depth of flow at which the specific energy is minimum is called   1   1   3   3
   (A) Critical flow   (B) Critical velocity
   (C) Critical area   (D) Critical depth

13. A notch is generally made of   1   1   3   3
   (A) Masonary   (B) Metallic plate
   (C) Concrete   (D) Plastic plate

14. Maximum discharge over a broad-crested weir is given by   1   2   3   3
   (A) $Q = 1.705\,Cd.L.H^{3/2}$ (B) $Q = Cd.L.H^{3/2}$
   (C) $Q = Cd.L.H^{5/2}$ (D) $Q = 0.5\,Cd.L.H^{5/2}$

15. The side slopes of a cippoletti weir is   1   2   3   3
   (A) 1 horizontal to 3 vertical   (B) 1 horizontal to 4 vertical
   (C) 1 horizontal to 2 vertical   (D) 1 horizontal to 1 vertical

16. A current meter is an instrument used to measure the   1   1   4   3
   (A) Rate of flow in a stream   (B) Pressure in a stream
   (C) Velocity of flow at a point in the flowing stream   (D) Temperature in a stream

17. The velocity of flow in streams can be measured by means of   1   1   4   3
   (A) Floats   (B) Manometer
   (C) Venturi meter   (D) Orifice meter

18. The delivery valve while starting centrifugal pump is kept   1   1   4   3
   (A) Fully open   (B) Half open
   (C) Fully closed   (D) In any position

19. The flow ratio in case of a centrifugal pump varies from   1   2   4   3
   (A) 0.10-0.25   (B) 0.25-0.40
   (C) 0.40-0.50   (D) 0.50-0.65

20. Discharge through a double acting reciprocating pump is given as   1   1   4   3
   (A) $\dfrac{ALN}{60}$ (B) $\dfrac{ALN}{120}$
   (C) $\dfrac{ALN}{30}$ (D) $\dfrac{2ALN}{60}$

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21. The specific speed of a turbine is expressed as   1   2   5   3
   (A) $\dfrac{N\sqrt{P}}{H^{5/4}}$ (B) $\dfrac{N\sqrt{P}}{H}$
   (C) $\dfrac{N\sqrt{P}}{H^{2}}$ (D) $\dfrac{N\sqrt{P}}{H^{3}}$

22. In a reaction turbine the function of a draft tube is to   1   1   5   3
   (A) Provide safety to turbine   (B) Prevent air from entering
   (C) Reconvert the kinetic energy to flow energy   (D) Increase the rate of flow

23. Which of the following turbines is least efficient under part load conditions   1   1   5   3
   (A) Propeller   (B) Francis
   (C) Kaplan   (D) Pelton

24. Overall efficiency of the turbine is defined as the ratio of   1   1   5   3
   (A) Power supplied by water jet to shaft power   (B) Shaft power to bucket power
   (C) Shaft power to volume of water striking the runner   (D) Shaft power to power supplied by water jet

25. For heads greater than _____ Pelton turbine is generally employed.   1   2   5   3
   (A) 350 m   (B) 150 m
   (C) 60 m   (D) 15 m

PART – B (5 × 10 = 50 Marks)   Marks   BL   CO   PO
Answer ALL Questions

26. a.i. What are the advantages of Model testing?   5   2   1   3

   ii. Find an expression for the drag force on smooth sphere of diameter 'D', moving with a uniform velocity 'V' in a fluid density 'ρ' and dynamic viscosity 'μ'.   5   2   1   3

(OR)

   b. Show that the lift F_L on airfoil can be expressed as $F_L = \rho V^2 d^2 \phi\left[\dfrac{\rho V d}{\mu}, \alpha\right]$.   10   2   1   3

27. a. Diameter the most economical section of a rectangular channel carrying water at the rate of 0.4 m³/s; the bed slope of the channel being 1 in 2000. Take Chezy's constant 'C' = 50.   10   2   2   3

(OR)

   b. Design a trapezoidal channel for carrying 30 m³/sec of water. The bed slope of the channel is 1:1800 and side slope of 1 horizontal to 1 vertical. Take 'C' = 50.   10   2   2   3

28. a.i. The depth of flow of water at a certain section of a rectangular channel of 4 m wide is 0.50 m. The discharge through the channel is 16 m³/s if a hydraulic jump takes place on the downstream side, find the depth of flow after the jump.   5   2   3   3