29. a.i.	Write about classification of flows in open channel.	4	2	2	2
ii.	Find the bed slope of trapezoidal channel of bed width 4 m, design of water 3 m and side slope of 2 horizontal to 3 vertical, when the discharge through the channel is 20 m^3/sec.	8	3	2	3
	(OR)				
b.i.	Write the conditions to be satisfied for most economical rectangular and trapezoidal sections.	4	2	2	2
ii.	A trapezoidal channel has side slopes of 3 horizontal to 4 vertical and slope of its bed is 1 in 2000. Determine the optimum dimensions of the channel if it is to carry water of 0.5 m^3/sec. Take Chezy's constant 'C' as 80.	8	3	2	3
30. a.i.	Describe the classification of notches and weirs.	4	2	3	2
ii.	Water flows over a rectangular weir 1 m wide at depth of 150 mm and after water passes through triangular right angled weir. Taking C_d for rectangular and triangular weight as 0.62 and 0.59. Find the depth over the triangular weir.	8	3	3	3
	(OR)				
b.i.	A cippoletti weir of crest length 60 cm discharge water. The head of water over the weir is 360 mm. Find the discharge over the weir if the channel is 80 cm, wide, 50 cm deep. Take $C_d = 0.60$.	6	3	3	3
ii.	The height of water on U/S and D/S side of submerged weir of 3 m length are 20 cm and 10 cm, respectively. If C_d for free and drowned portions are 0.6 and 0.8, find the discharge over the weir.	6	3	3	3
31. a.	Draw a neat sketch of cross section of centrifugal pump and describe in detail about various components of pump.	12	2	4	2
	(OR)				
b.	A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40 m. The velocity of flow through impeller is constant and equal to 2.5 m/sec. The vanes are set back at an angle of 40° at outlet. If the outer diameter of impeller is 500 mm and width at outlet is 50 mm. determine (i) Vane angle of inlet (ii) Work done by impeller on water / second (iii) Manometric efficiency	12	3	4	3
32. a.i.	Write about efficiencies of turbine.	4	2	5	2
ii.	Define draft tube and purpose of it in turbines and describe in detail with neat sketches about various types of draft tubes.	8	2	5	2
	(OR)				
b.	A Kaplan turbine develops 24647.67 kW power at an average head of 39 metres. Assuming speed ratio of 2, flow ratio of 0.6, diameter of boss equal to 0.35 times, the diameter of runner and overall efficiency of 90%. Calculate diameter, speed and specific speed of turbine.	12	3	5	3

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Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2023

Fourth Semester

18CEC206T – HYDRAULIC ENGINEERING AND DESIGN

(For the candidates admitted during the academic year 2018-2019 to 2021-2022)

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 & Part - C** should be answered in answer booklet.

Time: 3 hours Max. Marks: 100

		Marks	BL	CO	PO

PART – A (20 × 1 = 20 Marks)

Answer **ALL** Questions

1. The scale effect in models can be — 1 1 1 1
   (A) Positive only (B) Negative only
   (C) Both positive and negative (D) Zero

2. _____ is important in compressible fluid flow problems at high velocity. — 1 1 1 1
   (A) Euler number (B) Mach number
   (C) Reynolds number (D) Fourier number

3. In dimensional analysis, the Buckingham's π-theorem in widely used and express the reporting equation interms of — 1 1 1 1
   (A) The reporting variables (B) Geometric, kinematic and dynamic variables
   (C) (n–m) dimensionless parameter (D) n dimensionless parameter

4. _____ is equal to the product of shear stress due to viscosity and surface area of flow. — 1 1 1 1
   (A) Viscous force (B) Inertia force
   (C) Pressure force (D) Gravity force

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

6. The channel flow is subcritical when — 1 1 2 1
   (A) $Fr < 1$ (B) $Fr = 1$
   (C) $Fr > 1$ (D) $Fr = 0$

7. The equation of gradually varied flow is — 1 1 2 2
   (A) $\frac{dy}{dx} = \frac{s_b - s_e}{1 - Fr^2}$ (B) $\frac{dy}{dx} = \frac{s_b - s_e}{1 + Fr^2}$
   (C) $\frac{dy}{dx} = \frac{s_b - s_e}{1 - Fr^3}$ (D) $\frac{dy}{dx} = \frac{s_b - s_e}{1 - \sqrt{Fr}}$

8.	The water surfaces slope $\frac{dy}{dx}$, in case of uniform flow in the channel is equal to	1	1	2	2
	(A) 0 (B) 1 (C) 1000 (D) ∞				
9.	Maximum discharge over a broad crafted weir is given by	1	1	3	1
	(A) $Q = Cd.L.H^{3/2}$ (B) $Q = 0.5Cd.L.H^{5/2}$ (C) $Q = 1.705Cd.L.H^{3/2}$ (D) $Q = 1.705Cd.L.H^{5/2}$				
10.	An error of 1% in measuring it will produce error in discharge over a rectangular notch (or) weir	1	1	3	2
	(A) 1% (B) 1.5% (C) 2% (D) 2.5%				
11.	The error in discharge due to the error in the measurement of head over a triangular notch (or) weir is given by	1	1	3	2
	(A) $\frac{dQ}{Q} = \frac{1}{2}\frac{dH}{H}$ (B) $\frac{dQ}{Q} = \frac{dH}{H}$ (C) $\frac{dQ}{Q} = \frac{3}{2}\frac{dH}{H}$ (D) $\frac{dQ}{Q} = \frac{5}{2}\frac{dH}{H}$				
12.	Discharge (Q) over a triangular notch (or) weir is given by	1	1	3	2
	(A) $\frac{2}{3}Cd.\sqrt{2g}\tan\frac{\theta}{2}.H^{3/2}$ (B) $Cd.\sqrt{2g}\tan\frac{\theta}{2}.H^{5/2}$ (C) $\frac{1}{2}Cd.\sqrt{2g}\tan\frac{\theta}{2}.H^{5/2}$ (D) $\frac{8}{15}Cd.\sqrt{2g}\tan\frac{\theta}{2}.H^{5/2}$				
13.	The flow ratio in case of a centrifugal pump varies from	1	1	4	1
	(A) 0.1 to 0.25 (B) 0.25 to 0.40 (C) 0.40 to 0.50 (D) 0.50 to 0.65				
14.	The ratio of power outlet of the pump to the power input to the pump is known as	1	1	4	1
	(A) Mechanical efficiency (B) Overall efficiency (C) Manometric efficiency (D) Hydraulic efficiency				
15.	In centrifugal pumps, cavitation is reduced by	1	2	4	1
	(A) Inversion the flow velocity (B) Reducing the discharge (C) Throttling the discharge (D) Reducing the suction head				
16.	In a reciprocating pump, the air vessels are used for which of the following purposes?	1	2	4	1
	(A) To set continuous supply of liquid at a uniform rate (B) To save power required to drive the pump (C) To run the pump at much higher speed (D) All of the above				
17.	The difference between the power obtained from turbine shaft and power supplied by water at its entry to the turbine is equal to	1	2	5	2
	(A) Sum of hydraulic and mechanical losses (B) Sum of mechanical and volumetric losses (C) Mechanical losses (D) Hydraulic losses				

18.	In a reaction turbine, the function of a draft tube is to	1	2	5	1
	(A) Provide safety to turbine (B) Prevent air from entering (C) Reconvert the kinetic energy to flow energy (D) Increase the rate of flow				
19.	The value of speed ratio (Ku) in case of Francis turbine ranges from	1	2	5	1
	(A) 0.2 to 0.3 (B) 0.4 to 0.5 (C) 0.6 to 0.9 (D) 0.7 to 0.8				
20.	A Kaplan turbine is	1	2	5	1
	(A) An inward flow impulse turbine (B) Low head axial flow turbine (C) High head axial flow turbine (D) High head mixed flow turbine				

PART – B (5 × 4 = 20 Marks) Marks BL CO PO

Answer **ANY FIVE** Questions

21.	Determine the dimensions of (i) Angular velocity (ii) Angular acceleration (iii) Discharge (iv) Kinematic viscosity	4	2	1	2
22.	Explain the term, 'dimensionality homogeneous equation, with example.	4	2	1	2
23.	Find the critical depth and critical velocity of the water flowing through a rectangular channel of width 5 m, when discharge is 15 m^3/sec.	4	2	2	2
24.	How are the weirs and notches classified?	4	2	3	1
25.	Find the discharge through a trapezoidal notch which is 1 m wide at the top and 0.40 m at the bottom and 30 cm in height. The head of water on the notch is 20 cm. C_d = 0.62 for rectangular section C_d = 0.60 for triangular section	4	3	3	2
26.	Define slip, percentage slip and negative slip of a reciprocating pump.	4	2	4	1
27.	Differentiate between turbines and pumps.	4	2	5	2

PART – C (5 × 12 = 60 Marks) Marks BL CO PO

Answer **ALL** Questions

28. a.i.	State Buckingham's π-theorem.	2	2	1	2
ii.	The efficiency η of a ten depends on density ρ, dynamic viscosity μ, angular velocity ω, diameter D of the rotor and the discharge Q. Express η interms of dimensionless parameter.	10	3	1	2
	(OR)				
b.i.	Write mathematical expression for Reynolds number, Froude number, Euler's number, Weber number and Mach number.	4	3	1	2
ii.	A pipe of diameter 1.5 m is required to transport an oil of specific gravity 0.90 and viscosity 3×10^{-2} poise at the rate of 3000 lit/sec. Tests wave conducted on a 15 cm diameter pipe using water at 20°C. Find the velocity and rate of flow in the model. Viscosity is given as 0.01 poise.	8	3	1	2