DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – May 2019

Course: B. Tech in -Civil Engineering **Sem: IV**

Subject Name: Hydraulic II **Subject Code: BTCVC401**

Max Marks: 60 **Date:- 14/05/19** **Duration:- 3 Hr.**

Instructions to the Students:
1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

Marks

Q. 1 Attempt following Questions

(A) Enlist flow measuring devices and explain pitot tube. **4**

(B) Differentiate Between open channel and pipe flow.

(C) Determine the height of rectangular weir of length 6m to be built across a rectangular channel. The maximum depth of water on the upstream side of the weir is 1.8 m and discharge is 2000 liters/s. Take C_d =0.6 and neglect end contraction. **4** **4**

Q.2 Attempt following Questions

(A) Define Critical depth, critical velocity, and alternate depth. **3**

(B) Explain Specific energy and Specific energy curve. **4**

(C) A trapezoidal channel has side slopes of 1 horizontal to 2 vertical and the slope of the bed is 1 in 1500. The area of the section is 40 m^2. Find the dimensions of the section if it is most economical. Determine the discharge of the most economical section if C=50 **5**

Q. 3 Attempt following Questions

(A) Define and explain **6**

i) Hydraulic jump in short ii) GVF with assumptions

(B) Give classification of channels according to flow (only table) and derive expression for the length of back water curve / Direct step method.

Q.4 Attempt any two of following Questions

(A) Derive the expression for force exerted by stationary curved plate when i)jet strikes at centre ii)jet strikes at one end tangentially on symmetrical plate **6**

(B) Explain velocity triangles at outlet and inlet of unsymmetrical moving curved plate when jet strikes tangentially at one of the tips. Derive the expression for **6**

1) The force exerted by jet of water on same plate
2) Work done per second per unit weight of fluid striking per second
3) Work done per second per unit mass of fluid striking per second.

(C) A jet of water of diameter 7.5 cm strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of jet. The jet is deflected through an angle of 165^0. Find: **6**

i) The force on the plate i) Power of the jet iii)The efficiency of the jet.

Q.5 Attempt any two of following Questions

(A) Write a note on classification of hydraulic turbines **6**

(B) A pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 lit/sec under a head of 30m. The bucket deflects the jet through an angle of 160^0, Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98. **6**

(C) Explain: 1) Classification of pumps 2) Selection of pumps. **6**

Q.6 Attempt following Questions

(A) Explain – Laminar boundary layer, Turbulent boundary layer, Laminar sub layer and Separation of boundary layer. **6**

(B) Find The Displacement thickness, Momentum Thickness and energy thickness for the velocity distribution in boundary layer given by u/U=y/■ where u is the velocity at a distance y from the plate and u = U at y = ■ where ■ = boundary layer thickness. Also calculate the ratio Displacement thickness to Momentum Thickness. **6**

***** End of paper *****

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Winter Examination – Nov. 2019

Course: B. Tech in -Civil Engineering **Sem: IV**

Subject Name: Hydraulic Engg. II **Subject Code: BTCVC401**

Max Marks: 60 **Date:- 26/11/19** **Duration:- 3 Hr.**

Instructions to the Students:

1. Each question carries 12 marks.
2. Attempt **any five** questions of the following.
3. Illustrate your answers with neat sketches, diagram etc., wherever necessary.
4. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly

Marks

Q. 1 Attempt any two of following Questions

(A) Explain classification of flow in open channel **and** Types of channels. **6**

(B) Water flows over a rectangular weir 1.5m wide at a depth of 160mm and afterwards passes through a triangular right-angled weir. Taking Cd for the rectangular and triangular weir as 0.62 and 0.59 respectively. Find the depth over the triangular weir. **6**

(C) Define most economical section of channel. Derive condition for most economical rectangular channel. **6**

Q.2 Attempt following Questions

(A) Calculate the quantity of water that will be discharged at a uniform depth of 0.9m in a 1.2m diameter pipe which is laid at a slope 1 in 1000. Take C=55 **4**

(B) Explain Specific energy and Specific energy curve. **4**

(C) The specific energy for a 4 m wide rectangular channel is to be 3 Nm/m. If the rate of flow of water through the channel is 18 m^3/s. Determine the alternate depths of flow. **4**

Q. 3 Attempt following Questions

(A) Derive the expression of depth of hydraulic jump. **6**

(B) Give classification of channels according to flow (only table) and derive expression for the length of back water curve / Direct step method. 6

Q.4 Attempt following Questions

(A) Explain velocity triangles at outlet and inlet of unsymmetrical moving curved **8**

plate when jet strikes tangentially at one of the tips. Derive the expression for

1) The force exerted by jet of water on same plate
2) Work done per second per unit weight of fluid striking per second
3) Work done per second per unit mass of fluid striking per second.
4) Efficiency of jet

(B) A nozzle of 50mm dia. delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find **4**

1) The force on the plate
2) The efficiency of the jet.

Q.5 Attempt following Questions

(A) Elaborate major component parts of pelton wheel, Francis and Kaplan Turbine with neat sketch. **4**

(B) A pelton wheel has a mean bucket speed of 10 m/s with a jet of water flowing at the rate of 700 lit/sec under a head of 30m. The bucket deflects the jet through an angle of 160^0, Calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98. **4**

(C) Explain **4**

1) Efficiencies of a Centrifugal pump
2) Airlift pump and submersible pump.

Q.6 Attempt following Questions

(A) Explain – Laminar boundary layer, Turbulent boundary layer, Laminar sub layer, Boundary layer thickness, Displacement thickness, Momentum thickness, Energy thickness and coefficient of Drag. **8**

(B) Determine the thickness of a boundary layer at the trailing edge of smooth plate of length 4m and of width 1.5m, when the plate is moving with a velocity of 4 m/s in stationary air. Take kinematic viscosity of air as 1.5×10^{-5} m^2/s. **4**

***** End of paper *****

Dr. Babasaheb Ambedkar Technological University Lonere

SUMMER SEMESTER EXAMINATION - May 2018

IV Semester B. Tech. Civil Engineering

CV 401 Hydraulic Engineering II

Time: 03 Hours **Max. Marks: 60**

Instructions to the Students

1. *Attempt any five questions from Q. 1. To Q. 6.*
2. *Illustrate your answers with neat sketches, diagrams etc. where ever necessary. Data required for solving the question, but not mentioned therein, is part of examination. Therefore, Students shall make suitable assumptions.*
3. *Figure in parenthesis, on the right hand side of a question indicates marks of that question.*

Q. 1 Solve :

a) Show that the discharge formula for a trapezoidal channel having Manning's coefficient N = 0.0126 and carrying maximum flow is given by

$$Q = 100\, y^{8/3} \left(\sqrt{1+z^2} - \frac{z}{2}\right) S_b^{1/2}$$

Where Q is discharge in m^3/s; y is depth of flow in meter in the channel of side slopes 1 vertical to z horizontal and S_b is the bed slope of the channel. (5)

b) What size of circular drainage pipe is needed to carry 1.10 m^3/s of discharge when flowing half full? The pipe is laid at a slope of 1 in 2500 and Manning's N for the pipe is 0.018 . (4)

c) Calculate the specific energy E in a critical flow at depth y_c occurring in a triangular channel. (Calculate 'E' in terms of critical depth 'y_c') (3)

Q. 2 Solve :

a) Water flows in a triangular channel of side slope 1 horizontal to 1 vertical and longitudinal slope of 0.001. Determine the type of channel bottom slope (whether the channel has mild, steep or critical slope etc.) The discharge flows through it is 0.2 m^3/s. Assume Manning's N is 0.015. For what range of depths will the flow be on a type 1, 2 and 3 curve ? (Means determine the ranges of depths for zone 1, zone 2 and zone 3 for the given GVF profile) (5)

b) A hydraulic jump is formed in a 2m wide rectangular open channel which is horizontal and frictionless. The post jump depth and velocity are 0.8m and 1m/s respectively. The pre-jump velocity is? (3)

c) Explain the term 'Specific Force'. Show that the 'Specific Forces' at two different sections in a short horizontal reach of prismatic channel (in an open channel flow) are equal. (4)

Q. 3 Solve :

a) Calculate the friction drag force on a plate 0.15 m wide & 0.45 m long placed longitudinally in a stream of oil having a free stream velocity of 6 m/s .Specific gravity of oil is 0.925. Total drag coefficient $C_D = 0.0153$ (3)

b) The velocity distribution in the boundary layer is given by : $\frac{u}{U} = \frac{y}{\delta}$ where u is the velocity at a distance y from the plate and u = U at y = δ, δ being boundary layer thickness. Find the value of energy thickness. (3)

c) Explain the term hydraulic jump. Derive an expression for the depth of hydraulic jump in terms of the upstream Froude number. (6)

OR

A Pelton wheel has a mean bucket speed 10 m/s with a jet of water flowing at the rate of 700 litres/s under a head of 30 meters. The bucket deflects the jet through an angle of 160^0. Calculate the power given by water to the runner and hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98. (6)

Q. 4 Solve :

a) A stream has a width of 25 m and depth of flow 2.5 m. The mean velocity of the flow is 1.10 m/s. Find the height of a weir to be built in the stream to raise the water level by 1.2 m. Assume coefficient of discharge as 0.90. (4)

b) A right angled triangular notch is provided in the vertical side of a tank having plan area of 0.93 sq.m. uniform at all levels. When the head over the notch is 75 mm, it is found that the water surface in the tank is falling down at a rate of 2.54 mm per second. Calculate the coefficient of discharge of the notch. (4)

c) If 'H' is the height of water above crest level and 'h' is the head of head of water at the middle of the weir, Derive the relation between H and h for the condition of maximum discharge over a broad crested weir. (4)

Q. 5 Solve :

a) With the help of neat diagram explain the construction, components and working of a Francis turbine. (4)

b) A turbine develops 8000 kW power under a head of 30 m when revolving at a speed of 100 rpm. Find its specific speed. If the head on the same turbine falls during the summer season to 18 m, find the power and speed developed by the turbine. (4)

c) A pump can deliver discharge of 0.10 m^3/s to a head of 30 m. The critical cavitation number for the pump is found to be 0.12. The pump is to be installed at a location where the barometric pressure is 96 kPa (abs) and the vapour pressure 3kPa (abs). Assuming an intake pipe friction head of 0.3 m. Determine the minimum value of Net Positive Suction

Head (NPSH). What would be the maximum allowable elevation above the sump water surface at which the pump can be located? (4)

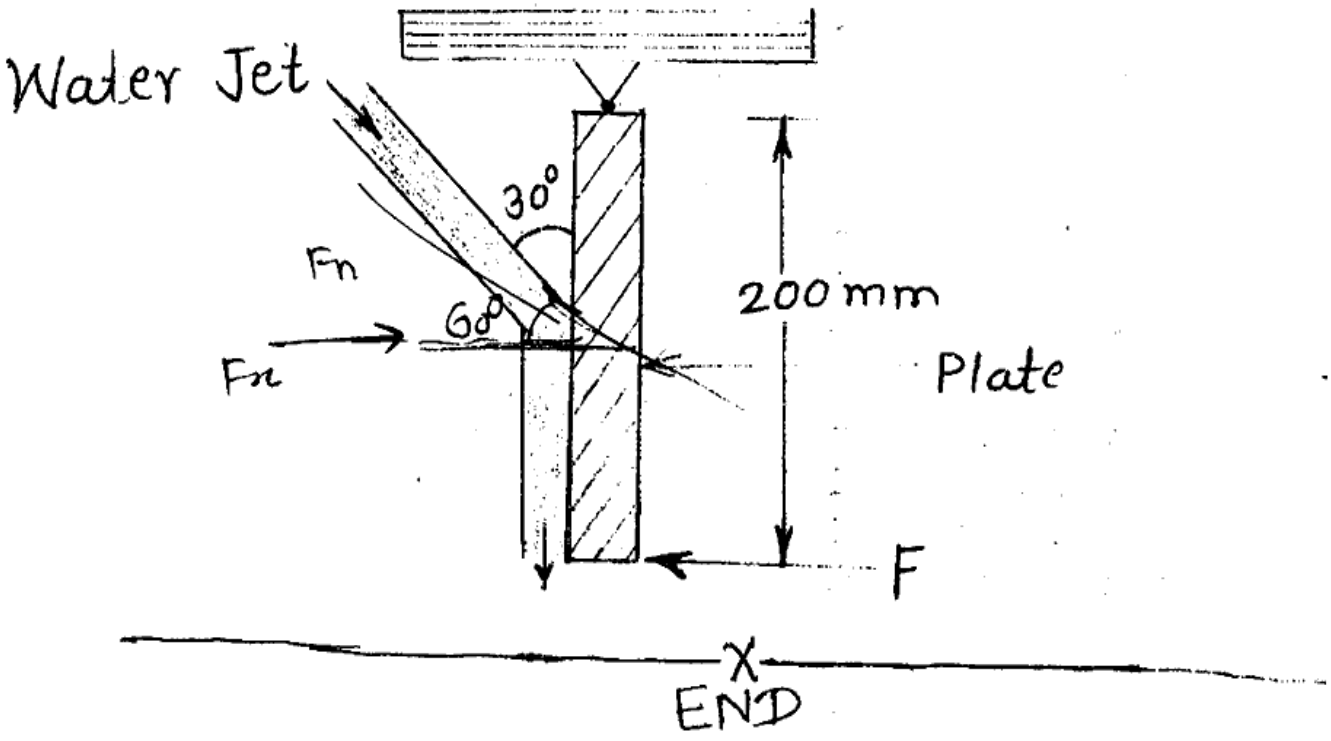
Q. 6 Solve :

a) Derive the following expression for force F exerted by a jet of area 'A' which strikes a flat plate at an angel θ to the normal to the plate with velocity V. The plate itself is moving with velocity u in the direction of normal to the plate surface.

$$F = \rho A \frac{(V \cos\theta - u)^2}{\cos\theta}$$ (4)

b) A jet of water of diameter 40 mm moving with a velocity of 30 m/s, strikes a curved fixed symmetrical plate at the centre. Find the force exerted by the jet water in the direction of the jet if the jet is deflected through an angle of 120^0 at the outlet of the curved plate. (4)

c) A square plate of height 200 mm is suspended vertically from one of its edges using a hinge support as shown in figure. A water jet of 20 mm diameter having a velocity of 10 m/s strikes the plate at its midpoint, at an angle 30^0 with the vertical. Consider g = 9.81 m/s^2 and neglect the self weight of the plate. Calculate the force required at the bottom of the plate to keep it in its vertical position? (4)



DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Regular End Semester Examination – Summer 2022

Course: B. Tech. (S.Y.) **Branch : CIVIL** **Semester :IV**

Subject Code & Name: BTCVC405 HYDRAULICS II

Max Marks: 60 **Date: 27/08/2022** **Duration: 3.45 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(CO)	Marks
Q. 1	**Solve Any Two of the following.**		
A)	Define open channel flow and differentiate pipe flow from channel flow	**(1)**	**6**
B)	Derive an expression for discharge through triangular notch	**(1)**	**6**
C)	Find the time required to lower down water level from 3 m to 2 m in a reservoir of 80 m x80 m by i) a rectangular notch of length 1.5 m . ii) a right angled V notch. Take Cd = 0.62 & other data same for both.	**(1)**	**6**
Q.2	**Solve Any Two of the following.**		
A)	Derive an expression for most efficient trapezoidal section of a channel.	**(1)**	**6**
B)	Explain with neat diagram ;-- specific energy curve.	**(1)**	**6**
C)	The discharge of water through a rectangular channel of width 8 m , discharge 15 m3/s when depth of flow of water is 1.2 m. Calculate :- i) specific energy. ii) critical depth . iii) minimum specific energy	**(1)**	**6**
Q. 3	**Solve Any Two of the following.**		
A)	Derive the dynamic equation gradually varied flow.	**(2)**	**6**
B)	A sluice gate discharges water into a horizontal rectangular channel with a discharge 19.20 m3/s ,width of channel 8 m and depth of flow 0.40 m. Determine whether a jump will occur, if so find its height & loss of energy Per kg of water.	**(2)**	**6**
C)	A jet of diameter 7.5 cm strikes a curved plate at its centre with a velocity 20 m/s. The curved plate is also moving with a velocity of 8 m/s in the direction of jet. The jet is deflected through an angle of 165 0 assuming the plate smooth find:-- i) force exerted by jet ii) work done by the jet.	**(3)**	**6**
Q.4	**Solve Any Two of the following.**		
A)	Classify different types of turbines. Also differentiate impulse and reaction turbine.	**(3)**	**6**
B)	Describe draft tube stating its need and performance ,also state different shapes of it.	**(3)**	**6**

C) A pelton wheel turbine has mean bucket speed of 10 m/s with a jet of water flowing at a rate of 700 lit/s under a head of 30 m. The bucket deflects the jet through an angle of 160 ^{0} Calculate horse power and hydraulic efficiency of turbine , assuming co-efficient of velocity 0.98. **(3) 6**

Q. 5 Solve Any Two of the following.

A) How pumps are generally classified, Explain in detail working of a **ce**ntrifugal pump. **(3) 6**

B) Write a detail**e**d note on :---- **(3) 6**
i) Efficiencies of pump. ii) Multistage pump arrangements.

C) A centrifugal pump delivers water against a net head of 14.5 m and at a speed of 1000 r.p.m. The vanes are curved at an angle of 30 ^{0} with the periphery. The impeller diameter is 300 m m and the outlet width 50 mm. Determine the discharge of pump if manometric efficiency is 95%. **(3) 6**

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DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Bachelor of Technology (Civil Engineering) SEMESTER - 4 Summer 2025 (Regular)

Course :Bachelor of Technology (Civil Engineering) Branch : Engineering and Technology

Semester : SEMESTER - 4

Subject Code & Name: BTCVC405 - HYDRAULICS - II

Time : 3 Hours] **[Total Marks : 60**

Instructions to the Students:

1.Each question carries 12 marks.

2.Question No. 1 will be compulsory and include objective-type questions.

3.Candidates are required to attempt any four questions from Question No. 2 to Question No.6

4.Use of non-programmable scientific calculators is allowed.

5.Assume suitable data wherever necessary and mention it clearly.

Q1. Objective type questions. (Compulsory Question) 12

1 Velocity in an open channel is maximum at:
a) Top surface b) Near bottom c) Below the surface d) Side wall

2 A channel has a hydraulic radius of 0.5 m and slope of 0.001. If Chezy's C = 50, velocity is:
a) 1 m/s b) 2.5 m/s c) 3.5 m/s d) 4 m/s

3 Hydraulically efficient section minimizes:
a) Velocity b) Flow area c) Wetted perimeter d) Flow depth

4 For a most economical rectangular channel section, depth is 2 m. What is bottom width?
a) 2 m b) 3 m c) 4 m d) 5 m

5 The hydraulic radius is defined as:
a) Wetted perimeter / Area b) Area / Wetted perimeter c) Depth / Width d) Width / Depth

6 Specific force is used in:
a) Flow resistance b) Uniform flow c) Hydraulic jump analysis d) Turbine design

7 A gradually varied flow is one in which:
a) Flow depth changes abruptly b) Flow depth remains constant c) Flow depth changes gradually along the length d) Flow is uniform

8 A hydraulic jump is an example of:
a) Gradually varied flow b) Supercritical flow c) Rapidly varied flow d) Uniform flow

9 In subcritical flow, the Froude number is:
a) < 1 b) > 1 c) = 1 d) = 0

10 The momentum of water jet striking a flat plate perpendicularly is converted into:
a) Only kinetic energy b) Heat and sound c) Force on the plate d) Torque

11 Which turbine is used for high heads?
a) Francis b) Kaplan c) Pelton d) Axial flow

12 Pump cavitation is caused due to:
a) Low flow velocity b) High NPSH c) Vapor formation at low pressure
d) Sudden expansion

Q2. Solve the following.

A) Explain in detail momentum equation applied to open channel flow. 6

B) Determine the height of a rectangular weir of length 6 m to be built across a rectangular channel. The maximum depth of water on the upstream side of the weir is 1.8 m and discharge is 2000 liters/s. Take Cd = 0.6 and neglect end contraction. 6

Q3. Solve the following.

A) What do you understand by 'Economical section' or 'Hydraulically most efficient section'? Derive condition for hydraulically most efficient rectangular section. 6

B) What is specific energy? Describe Specific energy curve with neat diagram. 6

Q4. Solve Any Two of the following.

A) Derive the following dynamic equation for gradually varied flow. 6

$$\frac{dy}{dx} = \frac{S_0 - S_f}{1 - \frac{Q^2 T}{gA^3}}$$

B) Derive an expression for impact of jet of water on stationary flat plate. 6

C) A sluice gate discharges water into a horizontal rectangular channel with velocity of 5 m/s and depth of flow 0.35 m, width of channel is 7 m. Determine whether hydraulic jump will occur and if so, determine its height and loss of energy per newton of water. 6

Q5. Solve Any Two of the following.

A) Distinguish between impulse turbine and reaction turbine. 6

B) Explain the following terms: 6
(i) Hydraulic efficiency; (ii) Mechanical efficiency; (iii)Overall efficiency

C) Enlist types of turbines. Explain with neat sketch Pelton wheel turbine. 6

Q6. Solve Any Two of the following.

A) Explain in detail component parts of centrifugal pumps with neat diagram. 6

B) The internal and external diameters of the impeller of a centrifugal pump are 200 mm and 400 mm respectively. The pump is running at 1200 rpm. The vane angles of the impeller at inlet and outlet are 20° and 30° respectively. The water enters the impeller radially, and the velocity of flow is constant. Determine the work done by the impeller per unit weight of water. 6

C) Define priming. Why it is necessary for a centrifugal pump? 6

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