

**Government College of Engineering, Amravati**  
(An Autonomous Institute of Government of Maharashtra)

**Fourth Semester B.Tech. (Civil Engineering)**

**Summer - 2017**

**Course Code: CEU 405**

**Course Name: Open Channel Flow and Hydraulic Machine**

**Time: 2 Hrs. 30 Min.**

**Max. Marks: 60**

**Instructions to Candidate**

- 1) All questions are compulsory.
- 2) Assume suitable data wherever necessary and clearly state the assumptions made.
- 3) Diagrams/sketches should be given wherever necessary.
- 4) Use of logarithmic table, drawing instruments and non-programmable calculators is permitted.
- 5) Figures to the right indicate full marks.

1. A Differentiate between Gradually varied flow and Rapidly varied flow. 2

B Find the rate of flow for a rectangular channel of 7.5 m wide for uniform flow at a depth of 2.25 m. The channel is having bed slope as 1 in 1000. Take Chezy's constant  $C = 55$ . Also state whether flow is tranquil or rapid. 4

~~OR~~

Derive expression for critical depth and critical velocity.

C A trapezoidal channel has a side slopes of 3

*Contd..*

horizontal to 4 vertical and the slope of its bed is 6  
1 in 2000. Determine the optimum dimensions  
of the channel, if it is to carry water at  $5 \text{ m}^3/\text{s}$ .  
Take Chezy's constant 80.

2. A Explain the meaning and types of floats? 3

B ✓ A discharge of  $0.06 \text{ m}^3/\text{s}$  was measured over a  
right angled notch. While measuring the head 4  
over the notch, an error of 1.5mm was made.  
Determine the percentage error in the discharge,  
if the coefficient of discharge for the notch is  
0.6.

OR

In a rectangular channel of 0.5 m width, a  
hydraulic jump occurs at a point where depth of  
water flow is 0.15 m and Froude number is 2.5.  
Determine:

- i) The specific energy
- ii) The critical depth and subsequent depth
- iii) Loss of head, and
- iv) Energy dissipated.

C A 40 m long weir is divided into 12 equal bays 5  
by vertical posts, each 0.6 m wide. Using Francis  
formula, calculate the discharge over the weir if  
the head over the crest is 1.20 m and velocity of  
approach is 2 m/s.

3. A Explain working of venturiflume with suitable 3  
sketch.

OR

Explain with sketches various Gradually Varied  
Flow surface profiles.



B In a rectangular channel of width 24 m and depth of flow 6 m, the rate of flow of water is  $86.4 \text{ m}^3/\text{s}$ . If the bed slope of the channel is 1 in 4000, Find the slope of free surface of water. Take Chezy's Contant  $C = 60$  4

C Enumerate different dimensionless number and state their significance. 5

4. A Define Hydraulic jump? What are its practical applications? 3

B The characteristics of the spillway are to be studied by means of a geometrically similar model constructed to the scale ration of 1: 10. 4

- i) If the maximum rate of flow in the prototype is 28.3 cumecs, what will be the corresponding flow in model?
- ii) If the measured velocity in the model at a point on the spillway is 2.4 m/s, what will be the corresponding velocity in the prototype?
- iii) If the hydraulic jump at the foot of model is 50 mm high, what will be the height of jump in prototype?
- iv) If the energy dissipated per second in the model is 3.5 Nm, what energy is dissipated per second in the prototype?

OR

Explain the working of Pelton wheel turbine with suitable sketch.

C A jet of water having velocity of 45 m/s impinges without shock on a series of vanes moving at 15 m/s. The direction of motion of 5

Contd..

vanes is inclined at  $20^\circ$  to that of the jet, the relative velocity at outlet is 0.9 of that inlet, and absolute velocity of water at exist is to be normal to the motion of vanes. Find

- i) Vane angles at inlet and outlet
- ii) Workdone per second per newton of water supplied by the jet, and
- iii) Hydraulic efficiency

5. A

A turbine is to operate under a head of 25 m at 200 rpm. The discharge is  $9 \text{ m}^3/\text{s}$ . If the overall efficiency is 90 per cent, determine:

- i) Power generated
- ii) Specific speed of turbine
- (iii) Type of turbine

OR

Define the following terms related with centrifugal pump

- i) Static head
- ii) Manometric head and
- iii) Total head

B Explain the working of submersible pump with sketch 4

C A single acting reciprocating pump, running at 50 rpm delivers  $0.00736 \text{ m}^3/\text{s}$  of water. The diameter of the piston is 200 mm and stroke length 300 mm. The suction and delivery heads are 3.5 m and 11.5 m respectively, Determine: 5

- i) Theoretical discharge
- ii) Coefficient of discharge
- iii) Percentage slip of the pump and
- iv) Power required

\*\*\*\*\*