

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Backlog), April-May 2017
B. Tech in Civil Engineering, Semester IV

Roll No.....

CE406 : Fluid Mechanics-II

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

- Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10
- i. A draft tube is not required for a
 - (a) Francis turbine
 - (b) Kaplan turbine
 - (c) Pelton wheel turbine
 - (d) None of the above
 - ii. The dimension of the Manning's coefficient N are
 - iii. A sluice gate discharges water into a horizontal rectangular channel with a velocity of 12 m/s and depth of flow of 1 m. What is the depth of flow after the hydraulic jump?
 - (a) 6.42 m
 - (b) 5.84 m
 - (c) 4.94 m
 - (d) 2.21 m
 - iv. For hypersonic flow, the Mach number is
 - (a) Unity
 - (b) Greater than unity
 - (c) Greater than 2
 - (d) Greater than 4
 - v. shooting flow can never occur
 - (a) Directly after a hydraulic jump
 - (b) In a horizontal channel
 - (c) In a mild slope channel
 - (d) In a steep slope channel
 - vi. A 1:256 scale model of a reservoir is drained in 4 minutes by opening the sluice gate. The time required to empty the prototype will be:.....
 - vii. Specific speed of turbomachine
 - (a) is the speed of a machine having unit dimensions
 - (b) relates the shape rather than size of machine
 - (c) remains the same under different conditions of operations
 - (d) depends only upon the head under which the machine operates
 - viii. Francis turbine is
 - (a) A reaction radial flow turbine
 - (b) An axial flow turbine
 - (c) A radial flow turbine
 - (d) An impulse turbine
 - ix. Coefficient of contraction is the ratio of
 - (a) actual velocity of jet at vena contracta to the theoretical velocity

- (b) loss of head in the orifice to the head of water available at the exit of the orifice
- (c) actual discharge through an orifice to the theoretical discharge
- (d) area of jet at vena contracta to the area of orifice
- x. Steady flow in a open channel exists when the
 - (a) flow is uniform
 - (b) channel is frictionless
 - (c) depth does not change with time
 - (d) channel bed is not curved

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

Derive the expression for Most Economical section of channels-

- i. Rectangular channel
- ii. Trapezoidal channel

Write a short note on :

- iii. Steep slope profile & horizontal slope profile.
- iv. Hydraulic similarities between model and its prototype.

Q.3A The time period π of a simple pendulum depends on its effective length l and the local acceleration due to gravity g . Using both Buckingham's pi theorem and Rayleigh's method, find the functional relationship between the variable involved. 05

Q.3B A model test is to be conducted in a water tunnel using a 1: 20 model of a submarine, which is to travel at a speed of 12 km/h deep under sea surface. The water temperature in the tunnel is maintained, so that its kinematic viscosity is half that of sea water. At what speed is the model test to be conducted to produce useful data for the prototype? 05

Q.4A Discuss the salient features of stromcad software . How will you design a drainage of a city using stromcad. 05

Q.4B Design a most economical channel for a part of area in JKLU campus. 05
Assume land area = 15000 m²
Of which 50% area is built-up area.
Assume any other parameter if required.

Q.5A A trapezoidal channel made out of brick with bottom width 2 m ,bottom slope 0.001 is to carry 17 m³/s. calculate the dimension of channel such that least number of brick are required . $n=0.0125$. 05

Q.5B Draw and explain the specific energy diagram for various constant and show the alternate and critical depth. 05

Q.6A An orifice meter having orifice diameter of 10cm is fitted in a 200 mm dia. pipe which is laid horizontally. The manometer reads 30cm of height of mercury. Determine the discharge of oil flow of sp.gr. 0.8 .consider coeff. of discharge 0.6. 05

- Q.6B Show that in a triangular channel, the Froude number F_1 and F_2 corresponding to alternate depths Y_1 and Y_2 respectively are related as : 05

$$\frac{F_1}{F_2} = \left(\frac{(4 + F_1^2)}{(4 + F_2^2)} \right)^{5/2}$$

OR

- Q.6B A closed tank partially filled with water discharges through an orifice of 12.5 mm diameter and has a coefficient of discharge of 0.65. If air is pumped into the upper part of the tank, Determine the pressure required to produce a discharge of 36.6 liters/ minute when the water surface is 1 m above the outlet. 05

- Q.7A State the difference between an impulse turbine and a reaction turbine. Define and explain hydraulic efficiency, mechanical efficiency and overall efficiency of a turbine. 05

- Q.7B How are weir classified? Define velocity of approach .Derive an equation for discharge over a rectangular weir taking velocity of approach. 05

OR

- Q.7B State the chezy's, kutter and manning formulas for uniform flow through a channel .Differentiate between open channel flow and pipe flow. Why is bed slope provided in channels? 05

- Q.8A A triangular channel of apex angle 90° and a rectangular channel of the same material have the same bed slope. If the rectangular channel has the depth of flow equal to width of channel and flow areas in both channels are the same, find the ratio of discharges in rectangular and triangular channels respectively. Use Manning's Roughness equation for estimation of velocity. 10

- Q.9A A wind-tunnel test is performed on a 1/20 scale model of a supersonic aircraft. The prototype aircraft flies at 480 m/s in conditions where the speed of sound is 300 m/s and the air density is 1.0 kg/m³. The model aircraft is tested in a wind tunnel in which the speed of sound is 279 m/s and the air density is 0.43 kg/m³. The drag force on the model is 100 N. What speed must the flow in the wind tunnel be for dynamic similitude, and what is the drag force on the prototype? 10

- Q.9B A trapezoidal channel of bed width $B=10.0$ m, side slope 2 H:1V, bed slope= 0.0005, Manning's $n = 0.015$ carries water in a region. For the given flow ,the uniform depth in the channel was observed as 2.0 m .A small dam is constructed across the channel that raises the water height at dam portion to 3.50m. whether the GVF will be M curve or S curve . For how long does the GVF curve exist. Use 4th order R-K method. 10

OR

- Q.9B A 4 m wide rectangular channel conveys 12 cumec of water a depth of 2.5 m. calculate (a) Specific energy and conjugate depth.
(b) Critical depth, critical velocity & minimum specific energy.
(c) compute the Froude number and discuss the nature of flow .
(d) at what depth specific energy will be 1.8 m. 10