

Fifth Semester B. E. (Civil Engineering) Examination

FLUID MECHANICS-II

Paper - 5 CE 02

(USC - 10191)

P. Pages : 4

Time : Three Hours]

[Max. Marks : 80

- Note :** (1) Separate answer book must be used for each section in the subject Geology. Engineering material of civil branch and Separate answer book must be used for Section A and B in Pharmacy and Cosmetic Tech.
(2) Answer **Three** questions from Section A and **Three** questions from Section B.
(3) Assume suitable data wherever necessary.
(4) Illustrate your answer wherever necessary with the help of neat sketches.

SECTION A

1. (a) What is meant by smooth transition and rough boundary ? Give the corresponding criteria obtained by Nikuradse experiment. 6
(b) A pipe of 120 mm diameter is carrying water. The velocities at the pipe centre and 2cm from the pipe centre are 2.5 m/s and 1.8 m/s respectively and flow in the pipe is turbulent. Calculate the wall shear stress. 7

OR

2. (a) The water is flowing through a 10 cm diameter rough pipe. Measurement made by pitot tube indicates that the velocity at a point 3 cm from the pipe wall is 35% more than the velocity at a point 1 cm from pipe wall. Make calculations for avg. height of roughness projections. 7
(b) Derive the expression for velocity distribution for turbulent flow in smooth pipe. 6
3. (a) What is meant by most economical channel section ? Derive the conditions for most economical trapezoidal channel section. 6

- (b) A rectangular channel 4 m wide conveys 20 m³/s of water at a depth of 2.2 m

Calculate :

- (i) Specific energy of flowing fluid.
- (ii) Critical depth, critical velocity and minimum specific energy.
- (iii) State whether the flow is subcritical or supercritical. 7

OR

4. (a) Determine the dimensions of the most economical trapezoidal channel section to carry a discharges of 15 m³/s at a slope of 5 in 10000. Take Chezy's constant as 70. 7
- (b) Define specific energy. Draw and explain specific energy diagram. 6
5. (a) What is meant by hydraulic jump ? Derive an expression for loss of energy head for hydraulic jump. 7
- (b) A rectangular channel 8 m wide discharges 1000 lit/sec of water with mean velocity of 6.0 m/s. What is the height of jump ? Also determine efficiency of jump as well as energy loss in jump. 7

OR

6. (a) A rectangular channel 4 m broad has a bed slope of 1 in 1000 and under original condition depth is 1.5 m. The dam was placed across a channel increasing the depth at the dam to 2.1 m. Calculate the depth of flow at 100 m upstream, take Chezy's constant as 60. 7
- (b) Derive a dynamic equation for gradually varied flow. Also give the assumptions. 7

SECTION B

7. (a) State Buckingham's π theorem. Explain the rules for selection of repeating variables in dimensional analysis. 6

- (b) A spillway model is to be built to a geometrically similar scale of 1/100 across a flume of 500 mm width. The prototype is 20 m high and maximum head on it expected to be 1.8 m.
- (i) What height of model and what head in model should be used ?
- (ii) If flow over model at particular head is 20 lit/sec. What flow per meter length of prototype is expected ?
- (iii) If negative pressure in model is 0.3 m, what is the negative pressure in prototype ? Is it practicable ? 8

OR

8. (a) Show that resistance R to the motion of sphere is given by :

$$R = pV^2 D^2 \phi [\mu/VD, \rho],$$

where,

D = diameter of sphere

V = velocity

ρ = fluid density and μ = viscosity. 8

- (b) State the applications of model and dimensional analysis. 6

9. (a) Draw a neat sketch of Pelton wheel turbine and explain its components and working. 6

- (b) Define momentum principle applied to free jet striking a plate. A nozzle of 40 mm diameter delivers water at 30 m/s, perpendicular to a plate that moves away from jet 5 m/s.

Find :

(i) Force on plate,

(ii) Work done,

(iii) Efficiency of the jet. 7

OR

10. (a) Find the expression for work done and efficiency by the jet on moving curved plate. Assuming the jet is striking the plate at its centre. 6

- (b) A jet of water of diameter 50 mm moving with a velocity of 30 m/s strikes a fixed plate in such away that the angle between jet and the plate is 60° . Find force exerted by the jet on the plate.

(i) In the direction normal to the plate and.

(ii) In the direction of jet.

7

11. (a) Explain the working of double acting reciprocating pump with neat sketch.

6

- (b) A centrifugal pump delivers water against a head of 12 m and design speed of 950 r.p.m. The vanes are set back to an angle of 30° with periphery. The diameter of impeller is 350 mm and outlet width is 60 mm. Determine the discharge of the pump if manometric efficiency is 70%.

7

OR

12. (a) A single acting reciprocating pump has cylinder diameter 150 mm and stroke length 350 mm. The section and delivery heads are 3 m and 10 m respectively. The pump is running at 100 r.p.m. and delivers $0.008 \text{ m}^3/\text{s}$ of water. Determine:

(i) Theoretical discharge.

(ii) Co-efficient of discharge.

(iii) Percentage slip of pump.

(iv) Power required to run the pump.

7

- (b) Explain the working of hydraulic ram.

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