[01 – 3214]

III/IV B.E. DEGREE EXAMINATION.

Second Semester

Civil Engineering

FLUID MECHANICS — III

(Common with Civil Environmental Engineering and Dual Degree in Civil Engineering)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) What do you understand by repeating variables in Dimensional analysis?

   (b) Why draft tubes are not used in Impulse turbines? Explain.

   (c) What are the different types of characteristics curves of turbines?

   (d) What is slip of reciprocating pump? Why does it occur?

6. (a) Define the Indicator diagram. Prove that work done by the reciprocating pump is proportional to the area of indicator diagram. (7)

(b) A single stage centrifugal pump with impeller of diameter of 30 cm rotates at 1800 rpm and lifts 2.8 m/s to a height of 26 m with an efficiency of 75%. Find the number of stages and diameter of each impeller of a similar multi-stage pump to lift 5 m^3/s water to a height of 150 m, when rotating at 1300 rpm. (7)

7. (a) Discuss the different types of flood routing methods. (8)

(b) A rectangular channel 3 m wide and 1.25 deep discharges 10 m^3/s of water suddenly has the discharge reduced to 7 m^3/s at the downstream end. Determine the height and velocity of the surge wave. (6)

8. Write short notes on the following : $(4 \times 3\frac{1}{2} = 14)$

(a) Omitted and superfluous variables

(b) Velocity Triangles

(c) NPSH

(d) Pulsating flows

(e) What is priming? Why it is necessary?

(f) Define Froude number and Mach number.

(g) What do you meant by hydraulic jump?

2. (a) Why it is necessary to use the distorted models? List out the merits and limitations of distorted models. (7)

(b) The lift force F, on a rocket is known to be a function of its dimensions L and D, the angle of attack α, the rocket velocity v, and the fluid properties density ρ, viscosity μ, and sound speed C. Determine the Pi groups that can be formed from these eight parameters. (7)

3. (a) Discuss in detail the classification of turbines with examples for each classification. (7)

(b) What power in kilowatts can be developed by the impulse turbine if the turbine efficiency as 85%. Assume the resistance coefficient f of the penstock is 0.015 and the head loss in the nozzle is negligible. What will be angular speed of the wheel, assuming ideal conditions ($V_j = 2V_{bucket}$), and what torque will be exerted on the turbine shaft? (7)

4. (a) What do you understand by the specific speed of turbine? Derive the expression for specific speed of turbine. (7)

(b) A runner of a Pelton wheel turbine has tangential velocity of 22 m/s and works under a head of 62 m. The jet is turned through 165°. The discharge through the nozzle is 100 liters per second. Determine the power developed by the runner and the efficiency. Take C_V as 0.97. (7)

5. For each of the statement about the Centrifugal Pumps (CP) choose whether the statement is true or false and discuss your answer briefly.

(a) A CP with radial blades has higher efficiency than the same pump with backward inclined blades. ($3\frac{1}{2}$)

(b) A CP with radial blades produces a larger pressure rise than the same pump with backward or forward inclined blades over wide range of volume rates. ($3\frac{1}{2}$)

(c) A CP with forward inclined blades is good choice when one needs to provide a larger pressure rise over a wide range of volume flow rates. ($3\frac{1}{2}$)

(d) A CP with forward inclined blades would most likely have less blades than a pump of the same size with backward inclined or radial blades. ($3\frac{1}{2}$)