

[06 – 3114]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Electrical and Electronics Engineering

*Elective II* — FLUID MECHANICS AND HYDRAULIC  
MACHINERY

(Effective from the admitted batch of 2004–2005)

Time : Three hours

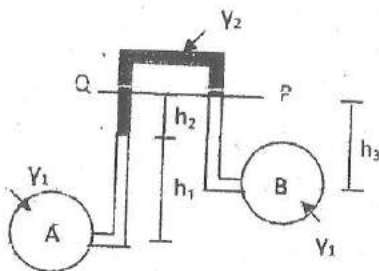
Maximum : 70 marks

First question is compulsory and its answers must be  
answer at one place. Answer any FOUR from the  
remaining.

All questions carry equal marks.

1. (a) Define stream line, path line and streak line.  
When they coincide?
- (b) What are the limitations of the Bernoulli's  
equation?
- (c) Define compressibility.
- (d) Under what conditions would a reaction  
turbine work as a pump?

- (e) A hydraulic turbine develops 800 kW under a head of 12 m at a speed of 90 r.p.m. Its efficiency is 0.93. Calculate the discharge and the specific speed of the turbine.
- (f) What are the hydraulic functions of spiral casing guide vanes and the draft tube?
- (g) Explain the terms "slip" and "cavitation" with reference to reciprocating pumps.
2. (a) Explain about different types of manometers with neat sketches.
- (b) Using an inverted U tube manometer, find the intensity of the pressure at B for the given condition shown in figure. Carbon tetrachloride of relative density 1.6 is flowing through the pipes A and B. Water is used as manometric fluid. The pressure at A is  $294.33 \text{ kN/m}^2$ .



$$h_1 = 1.0 \text{ m}, h_2 = 0.5 \text{ m}, h_3 = 0.8 \text{ m}$$

Figure

3. (a) Derive impulse momentum equation.
- (b) A 200 mm dia pipe, 4000 m long connects two reservoirs whose surface levels differ by 40 m. At a distance of 400 m from the upper reservoir, the pipe crosses a ridge the summit of which is 9 m above the level of water in the upper reservoir. Determine the minimum depth of the pipe below the summit of the ridge, if the absolute pressure head of at the summit of siphon is not to fall below 3 m of water (absolute). Take coefficient of friction  $f = 0.024$  and atmospheric head = 10.3 m of water. Neglect minor losses.
4. (a) What is Flownet? Explain its uses and limitations.
- (b) If for two dimensional the stream function is given by  $\psi = 2xy$ , calculate the velocity at a point (2, 4). Show that the velocity potential exists for this case and deduce it. Draw a rough sketch to indicate the flow pattern, taking  $\psi = 100$  and  $\psi = 300$  and corresponding  $\phi = 100$  and  $\phi = 300$ .

5. (a) Explain about component parts and working principles of Francis turbine.
- (b) A pelton wheel develops 5520 kW under a head of 240 m at an overall efficiency of 80% when revolving at a speed of 200 r.p.m. Find the unit discharge, unit power and unit speed. Assume peripheral coefficient = 0.46. If the head on the same turbine falls during the summer season to 150 m, find the discharge, power and speed for this head.
6. (a) Derive an equation for head loss due to friction in pipes.
- (b) A pipeline 0.225 m in diameter and 1580 m long has a slope of 1 in 200 for the first 790 m and 1 in 100 for the next 790 m. The pressure at the upper end of the pipeline is 107.91 kPa. Taking  $f = 0.032$  determine the discharge through the pipe.

7. (a) Draw a neat sketch showing the main component parts of a centrifugal pump.
- (b) For a single acting reciprocating pump, piston diameter is 150 mm, stroke length is 300 mm, rotational speed is 50 r.p.m. The pump is required to lift water to the height of 18 m. Determine the theoretical discharge. If the actual discharge is 4.0 lit/sec, and the mechanical efficiency 80%, determine the volumetric efficiency, slip, theoretical power and the actual power required.
8. A centrifugal pump lifts water against a static head of 32.067 m of which 3.054m is suction lift. The suction and delivery pipes are both 12.7 cm in diameter. The loss of head in suction pipe is 1.07 m of water and in delivery pipe is 5.955 m of water. The impeller is 30.54 cm in diameter and 2.54 cm wide at the outer diameter. It revolves at 1450 r.p.m. and the blade angle at exit is  $35^\circ$ . The manometric efficiency of the pump is 80% and its overall efficiency is 68%. Determine.