BTS – III– 11.13 – 1184

B.Tech. Degree III Semester Examination November 2013

EE 1303 FLUID MECHANICS AND HEAT ENGINES

(2012 Scheme)

Time : 3 Hours | Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 x 5 = 40)

I. (a) Explain how fluids are classified. Using stress-strain diagram explain the behaviour of fluids.

(b) Differentiate the following:
(i) steady and unsteady flow (ii) uniform and non uniform flow.

(c) What are the minor losses occurring in pipes? Discuss how they are determined.

(d) Write notes on kinematic similarity and dynamic similarity.

(e) Differentiate between impulse and reaction turbines.

(f) What is a draft tube? Why is it used in a reaction turbine?

(g) What is meant by priming? Explain its significance.

(h) Explain the multistage centrifugal pumps with the help of a diagram.

PART B

(4 x 15 = 60)

II. (a) Explain a U-tube differential manometer with the help of a diagram. (5)

(b) If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y-1)$ determine the velocity at the point P(4, 5). Determine also the value of stream function ψ at the point P also. (10)

OR

III. (a) Explain the principle of venturimeter with a neat sketch. Derive the expression for the rate of flow of fluid through it. (10)

(b) A horizontal venturimeter with inlet diameter 20cm and throat diameter 10cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60 litres/sec. Find the reading of the oil mercury differential manometer. (5)

IV. (a) Derive Darcy-Weisbach equation for friction losses in pipes. State clearly the assumptions. (7)

(b) An oil of viscosity 0.1 Ns/m^2 and relative density 0.9 is flowing through a circular pipe of diameter 5cm and length 300m. The rate of flow of fluid through the pipe is 3.5 litres/sec. Find the pressure drop in a length of 300m and also the shear stress at the pipe wall. (8)

OR

V. (a) Define Reynolds number. Explain its significance. (5)

(b) The resisting force R of a supersonic plane during flight can be considered as dependent upon the length of the aircraft ℓ, velocity v, air viscosity μ, air density ρ and bulk modulus of air K. Using Buckingham's π-theorem, express the functional relationship between these variables and the resisting force. (10)

(P.T.O.)

VI. The penstock supplies water from a reservoir to the pelton wheel with a gross head of 500m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is $2.0m^3$/sec. The angle of deflection of the jet is 165°. Determine the power given by the water in the runner and also hydraulic efficiency of the pelton wheel. Take speed ratio = 0.45 and $C_v = 1.0$. (15)

OR

VII. A Francis turbine with an overall efficiency of 75% is required to produce a power of 15KW. It is working under a head of 7.62m. The peripheral velocity $= 0.26\sqrt{2gH}$ and the radial velocity of flow and inlet is $= 0.96\sqrt{2gH}$. The wheel runs at 150 rpm, and the hydraulic losses in the turbine are 22% of the available energy. Assuming radial discharge, determine: (15)

(i) The guide blade angle
(ii) The wheel vane angle at inlet
(iii) Diameter of the wheel at inlet
(iv) Width of the wheel at inlet

VIII. (a) Explain the use of air vessels in reciprocating pumps. (8)

(b) Explain the phenomenon of cavitation in pumps. How is it regulated? (7)

OR

IX. (a) A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 rpm works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 50cm and width at outlet is 5cm, determine: (12)

(i) vane angle at inlet
(ii) work done by impeller on water per second
(iii) manometer efficiency

(b) Define an indicator diagram. (3)

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