C 15218 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2010

ME/AM 04 406—FLUID MACHINERY

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

1. (a) Define dimensional homogenity.

   (b) State Buckingham's π-theorem.

   (c) Define Cavitation.

   (d) Differentiate between the Turbines and Pumps.

   (e) What factors decide wheather Kaplan, Francis, or a Pelton type turbine would be used in a hydroelectric project ?

   (f) List the main parts of a centrifugal pump.

   (g) Differentiate between Volute casing and Vortex casing for the centrifugal pump.

   (h) What are the Cavitation causes ?

Part B

2. (a) A turbine is to operate under a head of 30 m. 250 r.p.m. The discharge is 10.5 m^3/s. If the efficiency is 85 % find out (i) power generated ; (ii) specific speed of the turbine ; (iii) performance under the head of 20 m.

(15 marks)

Or

(b) A model $\frac{1}{5}$ of an actual turbine develops 2 kW at 400 r.p.m. under a head of 3 m. Find the specific speed of the runner. Also calculate the speed, power and discharge of prototype when working under a head of 20 m. Assume $\eta_0 = 0.85$ for both model and prototype.

(15 marks)

3. (a) Show that the resistance "F" to the motion of a sphere of diameter "D" moving with a uniform velocity "V" through a real fluid of density "ρ" and viscosity "μ" is given by $F = \rho D^2V^2 f\left(\frac{\mu}{VD\rho}\right)$.

Use this result to explain how dimensional analysis results in the simplification of experimental data.

(15 marks)

Or

(b) Show by dimensional analysis, that the power "P" developed by a hydraulic turbine is given by $P = \rho N^3 D^5 f\left(\frac{N^2D^2}{gH}\right)$, where ρ is the mass density, "N" is the rotational speed, "D" is the diameter of runner, "H" is the working head and "g" is the gravitational acceleration.

(15 marks)

4. (a) A centrifugal pump running at 1440 r.p.m. delivers water against total head uf 30 m. The outlet vane angle is 45°. The outer diameter of the impeller is 50 cm. and vane width is 5 cm. Find the discharge of the pump assuming manometric efficiency = 0.75.

(15 marks)

Or

(b) A model is designed whose power is 20 kW, total head is 10 m. when running at 1,000 r.p.m. for predicting the performance of a prototype. The size of the model is $\frac{1}{10}$ of prototype which is to work against 15 m. Find the speed and power of the prototype. Also find the flow rate in both.

(15 marks)

5. (a) Explain the working of a double acting pump with the help of a neat sketch. (15 marks)

Or

(b) What is air-vessel ? Describe the functions of air vessel with the help of neat diagram.

(15 marks)