**Code: 13A01307** R13

B.Tech II Year I Semester (R13) Supplementary Examinations June 2015

**FLUID MECHANICS AND HYDRAULIC MACHINERY**

(Electrical & Electronics Engineering)

Time: 3 hours Max. Marks: 70

**PART - A**

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define surface tension. How it various with temperature?
(b) Write about velocity potential and steam function.
(c) Differentiate between convective acceleration and local acceleration.
(d) What is hydraulic gradient line and total energy line?
(e) Explain the principle of angular momentum.
(f) Define and differentiate streak line and path line.
(g) Explain about various types of efficiencies in turbines.
(h) What is meant by cavitation in turbine?
(i) Explain about Net positive suction head (NPSH).
(j) What do you know about multistage centrifugal pump?

**PART - B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT - I**

2 (a) State and prove the Hydrostatic law.
(b) What is Vapor pressure? How it varies with respect to temperature?

OR

3 (a) Derive the continuity equation in three dimensional flow.
(b) Explain about different types of flows with examples.

**UNIT - II**

4 (a) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state the assumptions made for such a derivation.
(b) A pipe line carrying oil of specific gravity 0.87, changes in diameter from 200 mm diameter at a position A to 500 mm diameter at a position B which is 4 meters at a higher level. If the pressures at A and B are 9.81 $N/cm^2$ and 5.886 $N/cm^2$ respectively and the discharge is 200 litres/s, determine the loss of head and direction of flow.

OR

5 (a) Derive an expression for finding the major loss when the fluid flows through a pipe. Also give the formulae for various minor losses.
(b) A pipe 50 mm in diameter is 6 m long and the velocity of flow of water in the pipe is 2.4 m/s. What loss of head and the corresponding power would be saved if the central 2 m length of pipe was replaced by 75 mm diameter pipe, the change of section being sudden? Take f = 0.04 for the pipes of both the diameters.

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**UNIT - III**

6 (a) Write a brief note on classification of turbines.

(b) A pelton wheel has to be designed for the following data: power to be developed = 6000 kW, Net head available = 400 m, speed = 550 rpm, Ratio of jet diameter to the wheel diameter = 1/10 and overall efficiency = 85%. Find the number of jets, diameter of jet, diameter of the wheel and quantity of water required.

OR

7 (a) What is cavitation? How can it be avoided in reaction turbine?

(b) A turbine develops 9000 kW when running at 10 rpm. The head on the turbine is 30 m. If the head on the turbine is reduced to 18 m, determine the speed and power developed by the turbine.

**UNIT - IV**

8 (a) Define centrifugal pump and explain the working of a single – stage centrifugal pump with neat sketch.

(b) A centrifugal pump is to discharge 0.118 $m^3/s$ at a speed of 1450 rpm against a head of 25 m. The impeller diameter is 250 mm, its width at outlet is 50 mm and manometer efficiency is 75%. Determine the vane angle at the outer periphery of the impeller.

OR

9 (a) With a neat sketch, explain the principle and working of a centrifugal pump.

(b) A centrifugal pump rotating at 1000 rpm delivers 160 liters/s of water against a head of 30 m. The pump is installed at a place where atmospheric pressure is 1 x $10^5$ $P_a$ (abs) and vapour pressure of water is 2 $kP_a$ (abs). The head loss is suction pipe is equivalent to 0.2 m of water. Calculate minimum NPSH.

**UNIT - V**

10 (a) Show that the capacity factor is equal to the product of the load factor and utilization factor.

(b) A run – of – river hydroelectric power plant is installed on a river having a minimum flow of 12 $m^3/s$. If the plant is used as peak load plant operating only for 5 hours a day, determine the firm capacity of the plant (i) without pondage (ii) with pondage but allowing 10% of the water to be lost in evaporation and other losses. Head at the plant is 16 m and plant efficiency may be assumed as 75%.

OR

11 (a) Briefly explain the classification of power plants based on the storage characteristics.

(b) Two turbo- generators each of capacity 20,000 kW have been installed at a hydel power station. During a certain period the load on the hydel plant varies from 15000 to 35000 kW. Calculate total installed capacity, load factor, utilization factor and plant factor.

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