Exam.Code:0941
Sub. Code: 33867

2125

B. E. (Mechanical Engineering)
Fifth Semester
MEC-506: Fluid Machinery

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt <u>five</u> questions in all, including Question No. I (section-A) which is compulsory and selecting two questions each from Section B-C.

x-x-x

Section – A (2 marks each)

Q 1 **a)** What is the function of the Spear in the Pelton wheel turbine.

b) What methods can be used to prevent or minimize cavitation in reaction turbines

c) Identify the key differences between Indoor Propagation and Outdoor Propagation of sound.

d) What is Priming, and why is it necessary for a centrifugal pump.

e) What is slip in a reciprocating pump

Section – B (10 marks)

Q 2 For the Francis turbine, the following data is available: Shaft power = **140 kW**, Net head = **100 m**, Speed = **130 rpm**, Overall efficiency = **75%**, Hydraulic efficiency = **90%**, Velocity of flow at inlet = $\mathbf{1.18\sqrt{H}}$, Vane speed at inlet = $\mathbf{3.45\sqrt{H}}$. Assume discharge radial at exit. Solve the following: (i) Calculate the guide blade angle and moving blade angle at inlet. (ii) Determine the diameter of the runner at inlet. Draw inlet and outlet velocity triangles also. **(10)**

Q 3 **a)** A conical draft-tube having inlet and outlet diameters **0.8 m** and **1.2 m** discharges water at outlet with a velocity of **3 m/s**. The total length of the draft-tube is **8 m** and **2 m** of the length of draft-tube is immersed in water. If the atmospheric pressure head is **10.3 m** of water and loss of head due to friction in the draft-tube is equal to **0.25 times** the velocity head at outlet of the tube (i) Calculate the pressure head at inlet, (ii) Determine the efficiency of the draft-tube

b) Draw a general layout of a hydroelectric power plant using a reaction turbine

(5, 5)

Q 4 **a)** Explain how a Cordier diagram assists in selecting a suitable type of turbo-machine based on specific speed and specific diameter, considering different operating requirements.

b) List the various regions of the Cordier diagram along with their specific speed (N_s) and specific diameter (D_s) ranges.

c) Draw a neat labeled Cordier diagram showing the classification zones for different turbo-machines.

(4, 3, 3)

P.T.O.

Section – C (10 marks)

Q 5 **a)** Define the "Buckingham theorem".

b) Analyze and explain the Performance Characteristics of Hydraulic Pumps, describing the relationship between head, discharge, efficiency, and power, with the help of neat and labeled diagrams. **(2, 8)**

Q 6 The diameter and stroke length of a single-acting reciprocating pump are **100 mm** and **200 mm**, respectively. The lengths of the suction & delivery pipes are **10 meters** and **30 meters**, respectively, and their diameters are **50 mm**. If the pump is running at **30 r.p.m.**, and the suction & delivery heads are **3.5 meters** and **20 meters**, respectively. Find the pressure head in the cylinder: (i) At the beginning of the suction and delivery stroke, (ii) In the middle of the suction and delivery stroke (iii) At the end of the suction and delivery stroke. Assume: Atmospheric pressure head = **10.3 meters** of water, Coefficient of friction = **0.009** for both pipes. Also, find out the power required to drive the pump, if the liquid flowing through the pump is water. (10)

Q 7 **a)** Explain the construction and working of the Hydraulic Intensifier with the help of a neat & labeled diagram.

b) A hydraulic ram is receiving water at the rate of **0.022 m^3/s** from a height of 3.3 m, and it raises **0.0022 m^3/s** to a height of **5 m** from the ram. Determine D'Aubuisson's and Rankine's efficiencies of the hydraulic ram.

(6, 4)

x-x-x