Note: Use separate answer book for each section. Attempt all questions in sequence. <u>Underline</u> final answers. State clearly any assumption you make.

SECTION: A

Q1 a) Stalling leads to surge cycle in axial flow compressor. Do you agree with this statement? Justify your answer with proper illustrations. [6]

Q1 b) A radial flow hydraulic turbine is required to be designed to produce 20 MW under a head of 16 m at a speed of 90 rpm. A geometrically similar model with an output of 30 kW and a head of 4 m is to be tested under dynamically similar conditions. At what speed must the model be run? What is the required runner diameter ratio between model and prototype and what is the volume flow rate through the model if its overall efficiency can be assumed to be 90%? [7]

Q2 The pump is installed in a reservoir with the water level in the reservoir being 1.5 m below the axis of the pump. The discharge is 300 liters per second. The atmospheric pressure and the vapour pressure can be taken as 98 kN/m^2 and 2.3 kN/m^2 respectively. Assuming the total head loss in the suction pipe due to friction as 1.7 m of water. Check whether the pump is cavitating or not, if the NPSHR of a pump is given by the manufacturer as 6.3 m. [7]

Q3 A centrifugal fan delivers 6 m^3/s of air when running at 1000 rpm. The impeller diameter at inlet and outlet are 55 cm and 75 cm respectively. The blades are curved backwards and the outlet angle is 70°. The width of the blade at outlet is 10 cm. The volute casing recovers 35% of the outlet velocity head, while the losses in impeller are equivalent to 20 per cent of the outlet velocity head. Determine the (i) pressure at outlet, and (ii) the manometric efficiency when the absolute velocity of air at inlet in the axial direction is 15 m/s. [12]

SECTION: B

Q.4 a) Discuss the effect of axial velocity over the blade and on the work of an axial flow compressor and show it graphically? [5]

Q4 b) Differentiate between impulse gas turbine and impulse-reaction gas turbine. [5]

Q5 a) In gas turbines, there is limitation of maximum temperature. Is it a correct statement? justify your answer in comparison to petrol engines used in two wheelers. [5]

Q5 b) Gas turbine blades are cooled using some fluid. Is it a correct statement? Justify your answer with neat sketch. [5]

Q6 The velocity of steam leaving the nozzles of an impulse turbine is 900 m/s and the nozzle angle is 20°. The blade velocity is 300 m/s and the blade velocity coefficient is 0.7. Draw the velocity triangles and calculate for a mass flow of 10 kg/s, and symmetrical blading:

    a) The blade inlet angle.
    b) The driving force on the wheel.
    c) The axial thrust.
    d) The diagram power.
    e) The diagram efficiency. [12]

Q7 Explain using T-s andh-s plot the super saturated flow of steam in nozzle. [6]

***** BEST LUCK *****