Section C

5. (a) Draw the performance curves of a centrifugal pump. Also discuss the effect of blade outlet angle. **5**

   (b) Define minimum starting speed of a centrifugal pump. Write down the equation for the same with notations. **5**

6. The bore and stroke of a double acting reciprocating pump are 15 cm and 30 cm respectively. The suction and delivery heads are 3 m and 30 m and the pump delivers 0.62 m^3/min when running at 60 rpm. Find the percentage slip and power required to run the pump if mechanical efficiency is 80%. **10**

Section D

7. (a) What are the advantages and disadvantages of multistage compression ? **4**

   (b) Prove that for a multi-stage compressor with perfect intercooling between stages, the work done is minimum when the intermediate pressure is the geometric mean of the suction and delivery pressure between successive stages. **6**

Roll No. ..... Total Pages : 05

July-22-00256

B. Tech. EXAMINATION, 2022

Semester IV (CBCS)

TURBO MACHINES

ME-404

Time : 3 Hours *Maximum Marks : 60*

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt *Five* questions in all, selecting *one* question from each Section A, B, C and D. Q. No. **9** is compulsory.

Section A

1. (a) Find an expression for the efficiency of a series of moving curved vanes when a jet of water strikes the vanes at one of its tips and show that the maximum efficiency is 50%. **5**

(b) A jet of water moving with a velocity of 22 m/s impinges on a curved vane at one end tangentially. The jet leaves vane at a angle of 120° to the direction of motion of the vane. The velocity of the vane is 10 m/s and the angle of the nozzle is 20°. Determine the work done per kg of water. 5

2. (a) A Pelton wheel is to be designed for a head of 60 m when running at 200 r.p.m. The Pelton wheel develops 95.6475 kW shaft power. The velocity of the buckets is 0.45 times the velocity of the jet, overall efficiency is 0.85 and co-efficient of the velocity is equal to 0.98. 5

(b) Prove that the hydraulic efficiency of a Pelton wheel turbine is maximum when the jet velocity striking the runner is twice the tangential velocity of the runner. 5

Section B

3. (a) Differentiate between inward flow and outward flow reaction turbines. 4

(b) Water flows through a vertical Francis turbine at the rate of 15.5 m^3/s and makes its runner to

rotate at 428.4 rpm. The velocity and pressure head at the inlet of the spiral casing are 8.5 m/s and 240 m respectively and the centre line of its inlet is 3 m above the tail race level. The diameter and width of the runner at inlet are 2 m and 300 mm respectively, determine output power, guide vane angle and runner vane angle at inlet. 6

4. (a) Define unit speed, unit discharge and unit power of a turbine. 4

(b) In a projected low head hydroelectric scheme 283 m^3/s of water are available under a head of 3.66 m. Alternative schemes to use Francis turbines having a specific speed of 400 or Kaplan turbines with a specific speed of 686 are investigated. The normal running speed is 50 rpm in both the schemes. Compare the proposals so far as the numbers of machines are concerned and estimate the power to be developed by each machine. The units in either installations are to be of equal power and the efficiency of each type may be assumed to be 90%. 6

8. (a) Compare reciprocating and rotary air compressors. 4

(b) With neat sketch, explain the construction and working of a vane compressor. 6

(Compulsory Question)

9. Attempt all questions : 4×5=20

(a) Write and explain Euler's equation applied to a turbine.

(b) Differentiate Francis and Kaplan turbines.

(c) What do you mean by governing of turbines ?

(d) Explain the function of diffuser.

(e) Discuss major pump losses.