7E7014

Roll No. 15ECTME025

Total No of Pages: 4

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B. Tech. VII Sem. (Main / Bank) Exam., Nov. – Dec. - 2018
Mechanical Engineering
7ME4A Turbomachines

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 26

Instructions to Candidates:

*Attempt any **five questions,** selecting **one question** from **each unit.** All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL

2. NIL

UNIT- I

Q.1 (a) What do you mean by specific speed of turbo machine? Also explain the significance of specific speed? [8]

(b) A turbine working under a head of 6m at a speed of 200 r.p.m. develops 80 kW power, when the rate of flow of water is $108m^3$/ minute. The runner diameter is 1 meter. If the head on this turbine is increased to 16m, determine its new speed, discharge and power. [8]

OR

Q.1 (a) What is a turbo machine? Also Derive the Euler's expressions for a turbo machine. [8]

(b) A hydraulic turbine has an output of 6000 kW under a head of 30 m and runs at 85 r.p.m. What is the type of turbine? What would be its speed and power developed when working under a head of 18m? [8]

UNIT- II

Q.2 (a) Briefly explain the phenomenon of surge and chocking in centrifugal compressor. [6]

(b) Air at 1.0132 bar and 288 K enters an axial flow compressor stage with an axial velocity of 150 m/s. There are no inlet guide vanes. The rotor stages has a tip diameter of 60 cm and a hub diameter of 50 cm and rotates at 100 r.p.s. The air enters the rotor and leaves the stator in the axial direction with no change in velocity or radius. The air is turned through 30.2° as it passes through rotor. Assume a stage pressure ratio of 1.2. Assuming the constant specific heats and that the air enters and leaves the blade at the blade angles: [10]

(i) Construct the velocity diagram at mean dia. for this stage

(ii) Mass flow rate

(iii) Power required

(iv) Degree of reaction

OR

Q.2 (a) Illustrate basic constructional features and working principle of single acting reciprocating compressor. [8]

(b) Draw a velocity diagram of centrifugal compressor? Also explain the working of centrifugal compressor? [8]

UNIT- III

Q.3 (a) Explain slip and slip factor for a centrifugal pump. [6]

(b) Derive an expression for the work done by impeller of a centrifugal pump. [10]

OR

Q.3 (a) The impeller of a centrifugal pump having an external and internal diameter 400 mm and 200 mm, width of outlet 40 mm and running at 1000 r.p.m. work against a head of 45mm. The velocity of flow through the impeller is constant and equal to 3.0m/s. The vanes are set back at an angle of 40° at outlet. Determine: [10]

(i) Inlet vane angle

(ii) Work done by the impeller on water per second

(iii) Manometric efficiency

(b) Briefly explain about indicator diagram of a reciprocating pump. [6]

UNIT- IV

Q.4 (a) Explain working of turbojet engine with the help of neat sketch and T-S diagram. [8]

(b) Derive the expression for specific work output and the efficiency of a simple gas turbine cycle with heat exchanger. [8]

OR

Q.4 (a) What are the advantages and disadvantages of a ramjet engine and what are its applications? [6]

(b) A gas turbine operates on a pressure ratio of 6. The Inlet air temperature to the compressor is 300 K and the air entering the turbine is at temperature of 577°C. If the volume rate of air entering the compressor is 240m^3/s. Calculate the net power output of the cycle in MW. Also compute its efficiency. Assume that the cycle operates under ideal conditions. [10]

UNIT- V

Q.5 (a) Explain the following: [8]

(i) Zero percent reaction turbine

(ii) Hundred percent reaction turbine

(b) Explain with a sketch and h-s diagram, the working of a reaction turbine. [8]

OR

Q.5 (a) What do you understand by blade and stage efficiency? Derive an expression for blade efficiency. [8]

(b) Explain what is meant by velocity compounding of a multistage impulse turbine. [8]
