

CBCS SCHEME

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18AE46

Fourth Semester B.E. Degree Examination, July/August 2022 Turbomachines

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Define turbomachine. Compare the differentiate between turbomachine and positive displacement machines. (08 Marks)
- b. The performance of a turbomachine depends on Discharge (Q), Speed in rpm (N), Rotor diameter (D), Energy/unit mass (gH), Density of fluid(ρ), Power (P) and Dynamic Viscosity (μ), Analyse using Buckingham's - π theorem and obtain discharge. (12 Marks)

OR

- 2 a. Derive alternate form of Euler turbine equation and explain the significance of each energy components. (10 Marks)
- b. Derive expression for degree of reaction and obtain relationship between degree of reaction and utilization factor. (10 Marks)

Module-2

- 3 a. Define polytrophic efficiency and obtain the relation for polytrophic efficiency for compression process. (10 Marks)
- b. An axial flow compressor has 8 stages of equal pressure ratio of 1.35 and the flowrate through the compressor and its overall efficiency are 50kg/s and 0.82 receptively. If the conditions of air at entry are 1 bar and 300K. Determine :
 i) State of air at compressor exit
 ii) Polytrophic efficiency and stage efficiency
 iii) Power required if $\eta_{trans} = 90\%$. (10 Marks)

OR

- 4 a. For multistage turbines, derive the relation for constant stage pressure ratio and constant stage work. (10 Marks)
- b. Overall pressure ratio across three stage gas turbine is 11 and its efficiency is 88%. If pressure ratio each stage varies and if it is having constant stage temperature drop. Find pressure ratio and stage efficiency if the inlet temperature is 1500K. (10 Marks)

Module-3

- 5 a. Classify the power absorbing turbomachines and explain the important elements of centrifugal compressor with neat sketch. (10 Marks)
- b. Derive the expression for slip, slip co-efficient, energy transfer, power input factor, overall pressure ratio and loading pressure co-efficient. (10 Marks)

OR

- 6 a. Draw the stage velocity diagrams for an axial flow compressor and explain the important parts and working of axial flow compressor. (10 Marks)
- b. Draw the h-s diagram and derive the expression for work done factor for axial flow compressor. (10 Marks)

Module-4

- 7 a. For an axial flow turbines. Draw the velocity triangle for different values of degree of reaction and explain. (10 Marks)
b. Explain about different types of turbine cooling methods with neat sketch. (10 Marks)

OR

- 8 a. Draw the velocity triangle for radial flow turbines and obtain relation for degree of reaction. (10 Marks)
b. Explain about losses and efficiencies of radial flow turbines. (10 Marks)

Module-5

- 9 a. Explain about losses occurring in hydraulic pumps and various efficiency terms related to hydraulic pumps and write the expression. (10 Marks)
b. Draw and explain about :
i) Pumps in series
ii) Pumps in parallel
iii) Volute casing
iv) Vortex casing. (10 Marks)

OR

- 10 a. Classify the hydraulic turbines based on :
i) Based on action of water on blades
ii) Based on direction of fluid through runner
iii) Based on specific speed
Give example for each type. (10 Marks)
b. Explain about different types of draft tube used in hydraulic turbines and functions of draft tube. (10 Marks)
