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BTECH
(SEM V) THEORY EXAMINATION 2024-25
TURBO MACHINES

TIME: 3 HRS

M.MARKS: 70

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt all questions in brief. 2 x 07 = 14

Q no.	Question	CO	Level
a.	Compare turbo machines with positive displacement machines.	1	K2
b.	Define Polytropic Efficiency?	1	K2
c.	What is the utilization factor in turbo machines?	2	K4
d.	What is the Parsons's turbine? Explain its working principle.	3	K2
e.	Define Net Positive Suction Head	3	K2
f.	What is manometric efficiency?	4	K2
g.	Why does slip occur in centrifugal compressors?	5	K2

SECTION B

2. Attempt any three of the following: 07 x 3 = 21

Q no.	Question	CO	Level
a.	Define the various performance parameters and coefficients used in turbo machinery in detail.	1	K2
b.	Obtain an expression for the polytropic efficiency for a compressor in terms of temperature, pressure and adiabatic index.	2	K4
c.	Explain what is meant by velocity compounding of a multistage impulse turbine.	3	K2
d.	Discuss the significance of specific speed in the selection and design of hydraulic turbines.	4	K2
e.	Define slip factor related to centrifugal compressor and derive its equation.	5	K2

SECTION C

3. Attempt any one part of the following: 07 x 1 = 07

Q no.	Question	CO	Level
a.	Define Turbo machine. With neat sketch explain the principal parts of general turbomachine	1	K2
b.	What is the reheat factor in the context of expansion processes? How does it affect the efficiency of a turbo machine?	1	K2

4. Attempt any one part of the following: 07 x 1 = 07

Q no.	Question	CO	Level
a.	Obtain the Euler's energy equation for turbo machines and state its relevance.	2	K4
b.	What is the principle of operation of axial flow compressor? Explain with suitable sketch. Also explain the performance characteristics curve of axial flow compressor.	2	K4

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5. Attempt any one part of the following: 07 x 1 = 07

Q no.	Question	CO	Level
a.	Steam at 4.9 bar and 160°C is supplied to a single stage impulse turbine at the rate of 60 kg/min. From there, it is exhausted to a condenser at a pressure of 0.196 bar. The blade speed is 300 m/s. The nozzles are inclined at 25° to the plane of the wheel and outlet blade angle is 35°. Neglect friction losses and estimate (a) the theoretical power developed by the turbine, (b) the diagram efficiency, and (c) the stage efficiency.	3	K2
b.	Explain the principle, construction and working of reaction turbine.	3	K2

6. Attempt any one part of the following: 07 x 1 = 07

Q no.	Question	CO	Level
a.	How do the losses in the draft tube effect the pressure at runner exist?	4	K2
b.	A single jet Pelton wheel runs at 300 r.p.m. under a head of 510 m. The jet diameter is 200 mm, its deflection inside the bucket is 165° and its relative velocity is reduced by 15% due to friction. Determine: (i) Water power, (ii) Resultant force on the bucket, and (iii) Overall efficiency. Take: Mechanical losses = 3%, co-efficient of velocity = 0.98, and speed ratio = 0.46.	4	K2

7. Attempt any one part of the following: 07 x 1 = 07

Q no.	Question	CO	Level
a.	What do you mean by 'characteristics of centrifugal pump'? Also explain various characteristics curves of centrifugal pump?	5	K2
b.	A centrifugal compressor handles 180 kg/min of air. The suction pressure and temperature are 1 bar and 300 K. The suction velocity is 90 m/s. The delivery conditions are 2 bar, 400 K, and 240 m/s. Calculate (a) the isentropic efficiency, (b) the power required to drive the compressor, and (c) the overall efficiency of the unit. Take $c_p = 1.005$ kJ/kg. K. Assume that entire kinetic energy gained in the impeller is converted into pressure in the diffuser.	5	K2