[Total No. of Questions: 09] [Total No. of Pages: 02]

Uni. Roll No. .....

Program/ Course: B. Tech. (2018)
Semester: 4th
Name of Subject: Applied Thermodynamics
Subject Code: PCME-107
Paper ID: 16196

Time Allowed: 03 Hours **Max. Marks: 60**

NOTE:

1) Scientific calculator is allowed.
2) **Part A** and **B** are **compulsory**.
3) **Part C** has Two Questions **Q8** and **Q9**. Both are compulsory, but with internal choice.
4) Any missing data may be assumed appropriately.
5) Use of steam table is allowed.

SECTION- A [Marks: 2 each]

Q1.

a) Enlist applications of gas turbine.
b) What are the losses in axial flow compressor?
c) Write the sources of leakage in condensers.
d) Why regenerator is used in gas turbines?
e) Enlist any two types of positive displacement compressors.
f) What are the losses in steam turbine?

SECTION- B [Marks: 4 each]

Q2. How maximum work required for two stage reciprocating compressor can be calculated?

Q3. A steam power plant works between pressure of 40 bar and 0.05 bar. If the steam supplied is dry saturated and the cycle of operation is Rankine cycle, Find:

i. Cycle efficiency
ii. Specific steam consumption

Q4. Steam enters a condenser at 35°C. The barometer reading is 760 mm of mercury. If the vacuum of 690 mm is recorded, calculate the vacuum efficiency.

Q5. Explain working of vane blower compressor with neat diagram. How its efficiency can be calculated?

Q6. A centrifugal compressor compresses air from 1 bar at 15°C to 2.15 bar, 95°C. The mass of air delivered is 2.2 kg/s and no heat is added to the air from external sources during compression. Find the efficiency of the compressor relative to ideal adiabatic compression and estimate the power absorbed. Also, find the change in entropy of air during compression.

Q7. Discuss the construction and working of ram jet propulsion engine with neat diagram.

SECTION- C [Marks: 12 each]

Q8. A gas turbine plant consists of two turbines. One turbine drives the compressor and the other develops the power output. Both turbines have their own combustion chambers which are served

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by air directly from the compressor. Air enters the compressor at 1 bar and 15°C and is compressed to 8 bar with an isentropic efficiency of 80%. Due to heat addition in the combustion chamber, the inlet temperature of gas to both the turbines reaches to 900°C. The isentropic efficiency of the turbine is 85%. The mass-flow rate of air at the compressor is 20 kg/s. The calorific value of fuel is 42000 kJ/kg. Calculate the output of plant and thermal efficiency. Take Cp = 1.128 kJ/kgK and γ=1.34 for gases. Neglect the mass of fuel.

OR

An axial flow compressor having 10 stages works with 50% degree if reaction. It compresses air with a pressure ratio of 5. The inlet conditions of air are 27°C and 100 kPa. The air enters the compressor with a velocity of 110 m/s. The mean speed of the rotor blade is 220 m/s. The isentropic efficiency of the compressor is 85%. Calculate the work input per kg of air and blade angles.

Q9. The LP cylinder of a two stage double acting reciprocating air compressor running at 120 rpm has a 50 cm diameter and 75 cm stroke. It draws air at a pressure of 1 bar and 20°C and compresses it adiabatically to a pressure of 3 bar. The air is then delivered to the intercooler, where it is cooled at constant pressure to 35°C and is then further compressed polytropically (n=1.3) to 10 bar in HP cylinder. Determine the power required to drive the compressor. The mechanical efficiency of the compressor is 90% and motor efficiency is 86%.

OR

The steam is supplied to a turbine at a pressure of 32 bar and ta temperature of 410°C. The steam then expands isentropically to a pressure of 0.08 bar. Find the dryness fraction of steam at the end of expansion and thermal efficiency of the cycle.

If the steam is reheated at 5.5 bar to a temperature of 395°C and then expand isentropically to 0.08 bar. What will be the dryness fraction and thermal efficiency of the cycle?

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