a2zpapers.com

Roll No. | | | | | | | | | | | | |

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

B.Tech (Sem.-3rd)
APPLIED THERMODYNAMICS
Subject Code: BTAE-302
Paper ID: [A1115]

Time: 3 Hrs. **Max. Marks: 60**

INSTRUCTION TO CANDIDATES:
1) ***Section-A is Compulsory.***
2) ***Attempt any four questions from Section-B.***
3) ***Attempt any two questions from Section-C.***

SECTION –A

(10x2=20)

Q.1. Write briefly:
- (a) Define polytrophic and isothermal efficiency using T-s diagram and represent in terms in terms of areas.
- (b) Classify compressors on the basis of principles of operation.
- (c) Write the names of positive displacement rotary type compressors and discuss its disadvantages with respect to centrifugal compressors?
- (d) Define volumetric efficiency of a reciprocating compressor. Name some methods to improve it.
- (e) Why vaned diffuser is used in centrifugal compressor
- (f) Explain the phenomenon of stalling in an axial flow compressors.
- (g) Why is thermal efficiency of gas turbine is high at very high altitude?
- (h) Axial compressor is more preferred than centrifugal compressor in aviation. Give reasons.
- (i) Draw a neat diagram of any Athodyd and label it.
- (j) Name two solid propellants commonly used in rockets

SECTION –B

(4x5=20)

Q.2. Explain the method of calculating the blade angle at the impeller eye root and the eye tip.

Q.3. Find the stage efficiency and work ratio of an axial flow compressor, if the actual pressure ratio developed was 1.35 and actual temperature rise was 30 ^{0}C. The blade inlet and outlet angles are 47^0 and 15^0 respectively. The peripheral and axial velocities are 250m/s and 200m/s respectively.

Q.4. Derive an expression for the optimum pressure ratio giving maximum specific output in simple cycle gas turbine.

Q.5. Determine the minimum number of stages required in an air compressor which admits air at 1 bar, 27^0C and delivers at 180 bar. The maximum is charge temperature at any stage is limited to 150^0C. Consider the index for polytrophic compression as 1.25 and perfect and optimum inter-cooling in between the stages. Neglect the effect of clearance.

www.a2zpapers.com www.a2zpapers.com
Download free old Question papers gndu, ptu hp board, punjab board

a2zpapers.com

Q.6. Considering a jet propulsion unit to have isentropic compression and expansion and heat supply at constant pressure. Show that thrust developed per kg of air per seconed for negligible velocity of approach can be given by

$$\left[2C_p.T_a(t-1)(r_p^{\frac{(\gamma-1)}{\gamma}}-1)\right]$$

Here t is the ratio of absolute temperature after combustion in and before combustion r_p is compression ratio. And T_a is absolute atmospheric temperature.

SECTION –C

(2x10=20)

Q.7. A centrifugal compressor runs at 10000 rpm and delivers 600m^3/min of free air at a pressure ratio of 4:1. The isentropic efficiency of the compressor is 82%. The outer radius of impeller (Which has radial blades) is twice the inner one and the slip coefficient is 0.9. Assume that the ambient air conditions are 1 bar and 293 K. The axial velocity of flow is 60m/s and is constant throughout. Determine:

(a) Power input to the compressor,
(b) Impeller diameters at the inlet and outlet and width at the inlet
(c) Impeller and diffuser blade angles at inlet.

Q.8. In a gas turbine unit comprising LP and HP compressors, air is taken in at 1.01 bar, 27^0C. Compression in the Lp stage is up to 3.03 bar followed by intercooling to 30^0C. The pressure of air after HP compressor is 5.7 bars. Loss in pressure during intercooling is 0.13 bar. Air from HP compressor is transferred to the heat exchanger of effectiveness 0.60 where it is heated by the gases from the LP turbine. After heat exchanger the air passes through combustion chamber, the temperature of gasses supplied to HP turbine is 750^0C. The gases expand in HP turbine to 3.25 bar and are then reheated to 700^0C before expanding in the LP turbine. The loss of pressure in reheater is 0.1 bar. If isentropic efficiency of expansion in turbine is 0.85 calculate:

(a) Overall efficiency
(b) Work ratio
(c) Mass flow rate when the gas power generated is 6500 kW. Take C_p for air =1.005/kj/kg-K, C_p for gases =1.15kj/kg-k, γ for air=1.4, γ for gases=1.3 Neglect the mass of fuel.

Q.9. Write short notes on the following:

(a) Prewhirl
(b) Losses in axial flow compressors
(c) Vane compressors
(d) Thrust and Thrust power.

www.a2zpapers.com www.a2zpapers.com
Download free old Question papers gndu, ptu hp board, punjab board