

Roll No.

Total No. of Pages : 2

Total No. of Questions : 09

B.Tech (AE) (Sem.-3rd)
APPLIED THERMODYNAMICS
Subject Code : BTAE-302 (2011 Batch)
Paper ID : [A1115]

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

SECTION-A

1. Write briefly :

- a) What do you mean by Polytropic Efficiency?
- b) Draw p-v & T-s diagram for a single stage reciprocating air compressor.
- c) Compare rotary and reciprocating air compressor.
- d) What is Prewhirl and why it is provided in centrifugal compressor?
- e) What is power input factor in centrifugal compressors?
- f) Define degree of reaction for axial flow compressor?
- g) How gas turbine differs from steam turbine?
- h) Write briefly the applications of gas turbine.
- i) State the principle of jet propulsion?
- j) Explain the effect of Intercooling in a multistage reciprocating compressor.

SECTION-B

2. Prove that the volumetric efficiency of a single stage compressor is given by :

$$\eta_{\text{vol}} = 1 + k - k \left(\frac{p_2}{p_1} \right)^{\frac{1}{n}}, \quad \text{where } k = \frac{V_c}{V_s}$$

3. Discuss the working of Root type blower with the help of neat sketch.
4. Discuss the function of impeller and diffuser in centrifugal compressor with a suitable sketch and also show the pressure and velocity variation in centrifugal compressor.
5. Give a brief comparison between turbine and compressor blades. Why aerofoil blading is needed in axial flow compressor ?
6. Discuss the merits and demerits of closed cycle gas turbine over open cycle gas turbine.

SECTION-C

7. (a) Write a short note on the working principle of Ramjet Engine.
 (b) A turbojet engine flying at a speed of 800 kmph consumes air at the rate of 45 kg/s. Given that the enthalpy change is 44.5 Kcal/Kg and velocity coefficient is 0.95. Calculate the thermal efficiency of plant given η of combustion 90% and calorific value of fuel used is 10500 Kcal/Kg assuming that the air-fuel ratio is 80.
8. In a constant pressure open cycle gas turbine, air enters at 1 bar and 20°C and leaves the compressor at 5 bar. Using the following data: Temperature of gases entering the turbine is 680°C. Pressure loss in combustion chamber is 0.1 bar, $\eta_{\text{compressor}} = 85\%$, $\eta_{\text{turbine}} = 80\%$, $\eta_{\text{combustion}} = 85\%$, $\gamma = 1.4$ and $C_p = 1.024$ KJ/Kg K for air and gas, neglecting the mass of the fuel, Find :
- (i) The quantity of air circulation if the plant develops 1000kW.
 (ii) Heat supplied per Kg of air circulation.
 (iii) Thermal efficiency of the cycle.
9. (a) Show that the blades of the compressor are symmetrical for 50% reaction?
 (b) Give a brief comparison between axial flow compressor and centrifugal compressor.