T.E/Sem V/ CBGS/Mod/ May -2017/15/06/17

QP Code : 608605

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question **No. 1** is **compulsory.**
(2) Attempt **any three** questions from the remaining **five** questions
(3) All questions carry equal marks.
(4) Use of steam tables, and psychrometric chart is permitted.

1. (a) A single acting, single cylinder reciprocating air compressor is compressing 20kg/min. of air from 110kPa, 30°C to 600kPa and delivers it to a receiver. Law of compression is $pV^{1.25}=C$. Mechanical efficiency is 80%. Find the power input to compressor. **5**
   (b) Explain reheating in gas turbine with neat sketches. **5**
   (c) A four cylinder engine running at 1200 rpm delivers 20 kW. The average torque when one cylinder cut is 110Nm. Find the indicated thermal efficiency if the C.V. of fuel is 43MJ/kg and the engine uses 360grams per kWh. **5**
   (d) Explain summer air conditioning with neat sketch. **5**

2. (a) Prove that for complete intercooling between two stages, the compression work would be minimum when intermediate pressure is the geometric mean of initial and final pressures. **5**
   (b) (i) Explain working of two stroke engine with neat sketch. **10**
   (ii) Explain multistaging in compressor. What are advantages of multistaging?

3. (a) Air enters the compressor of a gas turbine plant operating on air standard cycle at 100 kPa and 300K with volumetric flow rate of $5m^3/s$. The compressor pressure ratio is 10. The turbine inlet temperature is 1400K. The turbine and compressor each has an isentropic efficiency of 80%. Calculate i) thermal efficiency of cycle. ii) the back work ratio iii) net power developed in kW. **10**
   (b) (i) Explain battery ignition system with neat sketch. **5**
   (ii) Explain valve timing diagram of four stroke S.I.engine. **5**

4. (a) (i) Explain simple carburetor with neat sketch. **5**
   (ii) Explain Thermal conductivity, Convective heat transfer coefficient and overall heat transfer coefficient. **5**

[TURN OVER]

(b) A counter flow concentric tube heat exchanger is used to cool engine oil (c =2130J/kg/K) from 160°C to 60°C with water, available at 25°C as the cooling medium. The flow rate of cooling water through the inner tube of 0.5m diameter is 2 kg/s while the flow rate of oil through the outer annulus O.D.=0.7m is also 2 kg/s. If the value of the overall heat transfer coefficient is 250 W/m² K, how long must the heat exchanger be to meet its cooling requirement? **10**

5. (a) (i) What is Stefan-Boltzmann Law? Explain the concept of total emissive power of a surface. **5**

(ii) Explain psychrometric chart. **5**

(b) An ideal vapour compression system uses R -12 as the refrigerant. The system uses an evaporation temperature of 0°C and condenser temperature of 40°C. The capacity of the system is 7 TR. Determine (i) the mass flow rate of refrigerant (ii) power required to run the compressor. (iii) heat rejected in the condenser and iv) COP of the system. Use the properties of R-12 from the table given below. **10**

Temperature,	Pressure,	h_f	h_g	S_f	S_g
°C	bar	kJ/kg	kJ/kg	kJ/kgK	kJ/kgK
0	3.087	36.05	187.53	0.142	0.696
40	9.609	74.59	203.2	0.727	0.682

6. (a) Define (i) Ton of refrigeration (ii) Saturated air (iii)Specific humidity (iv) Wet bulb temperature (v)Dew point temperature **10**

(b) (i) State and explain Kirchhoffs law and Wien's displacement law. **5**

(ii) What do you understand by primary and secondary refrigerants? Explain in brief. **5**
