Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH (MECHANICAL ENGINEERING)

END SEMESTER MAKE UP EXAMINATION – JUNE-2018

SUBJECT: THERMODYNAMICS – II (MME 2201)

REVISED CREDIT SYSTEM

Time: 3 Hour **MAX.MARKS: 50**

Note: Answer ALL the questions

Use of Thermodynamic data hand book permitted.

1A. With the help of p-h and T-s diagrams explain the working of a vapor compression refrigeration system. Discuss the effect of sub cooling and superheating on the performance of vapor compression refrigeration system. **05**

1B. A 2 stage air compressor delivers 132 kg/hr of air. The condition at the suction is 1 bar and 25℃. The delivery pressure is 55 bar. Clearance in the LP and HP cylinders are 5% of the respective stroke volumes. Assuming perfect inter cooling between the stages, find (a) The power required to run the compressor at 210 rpm. (b) Find the diameters and strokes of LP and HP cylinders if strokes of both cylinders are equal to diameter of LP cylinder. Take the law of compression as $pv^{1.3}$ =C. **05**

2A. With usual notations derive an expression for the thermal efficiency of air standard diesel cycle in terms of compression ratio, cut off ratio, initial temperature and pressure. **05**

2B. An engine operates on dual cycle using air as working fluid, which is compressed from an initial condition of 101 KPa and 50°C. Pressure ratio during constant volume heat addition is 1.6, compression ratio is 12. If the fuel supply is cut off at 5% of the stroke volume, determine (a) pressures and temperatures at the salient points (b) thermal efficiency of the cycle.

Cp = 1.005 kJ/kgK and $\sqrt{}$ =1.4. **05**

3A. What are the advantages of multistage compression over single stage compression? Obtain a condition for minimum work of compression in a two stage reciprocating compressor with perfect intercooling **05**

3B. An air refrigerator works on the bell- coleman cycle. Air at 1 bar and −7°C is compressed to 5 bar and then cooled at constant pressure in a cooler to 27°C. The isentropic efficiency of the compressor and expander is 80% and 85% respectively. Determine (a) capacity of the refrigerator (b) COP of the cycle. Take Cp = 1.005 kJ/kgK and $\sqrt{}$ =1.4 **05**

4A. Derive an equation for the velocity of sound in terms of ratio of specific heats, gas constant and temperature. **05**

4B. An ideal reheat cycle has pressure at the HP turbine equal to 9MPa
reheat pressure equal to 1.6 MPa and exhaust pressure equal to 0.06 bar. Useful work developed by the turbine equal to 1400 kJ/kg. Determine the temperature of steam leaving the reheater, if the thermal efficiency of the cycle is equal to 38%. Temperature at the HP turbine inlet is 500°C, and steam expands to dry saturated state before entering the reheater. **05**

5A. Show that efficiency of air standard brayton cycle is a function of isentropic pressure ratio. **05**

5B. A two stroke diesel engine was motored and the frictional power was estimated as 1.5 kW. Test on the engine was carried out for one hour and the data observed were brake torque =120 Nm, rpm= 600, fuel used = 2.5 kg, cooling water = 818 kg, CV of the fuel =40.3 MJ/kg, rise in temperature of the cooling water = 10°C, room temperature = 27°C, A:F ratio = 32, exhaust gas temperature = 347°C, C_p of exhaust gases =1.05 kJ/kgK.
Determine BP, Mechanical efficiency, Brake thermal efficiency, Draw the heat balance sheet on minute basis. **05**