

MANIPAL (A constituent unit of MAHE, Manipal)

# III SEMESTER B. TECH (IP ENGG.) END SEMESTER EXAMINATIONS, NOVEMBER 2019

## SUBJECT: THERMAL ENGINEERING [MME 2160]

### **REVISED CREDIT SYSTEM**

#### Time: 3 Hours

#### MAX. MARKS: 50

#### Instructions to Candidates:

- ✤ Answer ALL the questions.
- Missing data may be suitably assumed.
- Use of Thermodynamics data hand book is permitted
- 1A. Air at 1.02 bar, 22 °C initially occupying a cylinder volume of 0.015 m<sup>3</sup> is compressed reversibly and adiabatically by a piston to a pressure of 6.8 bar. Calculate
  - i) The final temperature
  - ii) The final volume
  - iii) The work done

- 5
- **1B.** Define the following processes and write the equation for work done for each process.
  - i) Isentropic
  - ii) Adiabaticiii) Polytropic
- 3 2 1C. What is a quasistatic process and give an example. 2A. Show the equivalence of Kelvin Planck's and Clausius statements on second law of thermodynamics with necessary sketches. 4 2B. Explain Carnot cycle with p-V diagram. 3 2C. A reversible heat engine operates between a source temperature of 1000 °C and a sink temperature of 40 °C. Find the heat rejected per net-work output of the engine. 3 Briefly explain air standard Diesel cycle with the help of p-V diagram and derive the 3A. expression for thermal efficiency. 5 The minimum pressure and temperature in an Otto cycle is 100 kPa and 27  $^{\circ}$ C. 3B. The amount of heat added per cycle is 1500 kJ/kg. Determine the pressure and 3 temperature at all salient points.
- **3C.** What are the assumptions made in air standard cycles?

2

4A.	What are the two methods for finding Indicated and frictional power in IC engine? Explain with suitable sketches.	4
4B.	Derive an expression for volumetric efficiency of reciprocating compressors with suitable sketch.	3
4C.	A single stage reciprocating compressor takes 1 m <sup>3</sup> of air per minute at 1.013 bar and 15 $^{0}$ C and delivers at 7 bar. Assume that law of compression is pV <sup>1.35</sup> = C and with negligible clearance. Calculate the Indicated power.	3
5A.	Derive an expression for conduction in a plain wall and composite wall with neat sketches.	4
5B.	A simple Rankine cycle works between pressure 30 bar and 1 bar. The initial conditions of steam before expansion being dry and saturated. Calculate the cycle efficiency, quality of steam after expansion and turbine work.	4
5C.	With an example define radiation heat transfer.	2