Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B. TECH (IP ENGG.) END SEMESTER EXAMINATIONS, DECEMBER 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, 25 ^{o}C initially occupying a cylinder volume of 0.020 m^{3} is compressed reversibly and adiabatically by a piston to a pressure of 7 bar. Calculate
i) The final temperature
ii) The final volume
iii) The work done **5**

1B. What are the effects of following parameters on Rankine cycle work and efficiency?
i) Boiler pressure
ii) Condenser pressure
iii) Super heating **3**

1C. State Kelvin Planck's and Clausius's statements on second law of thermodynamics. **2**

2A. State and prove the Carnot theorem with a neat sketch. **5**

2B. A reversible heat engine operates between a source temperature of 500 ^{o}C and a sink temperature of 20 ^{o}C. Find the heat rejected per net-work output of the engine. **3**

2C. Write the steady flow energy equation for a turbine. **2**

3A. Briefly explain air standard Otto cycle with the help of a p-V diagram and derive an expression for thermal efficiency. **5**

3B. The minimum pressure and temperature in a Diesel cycle are 100 kPa and 27 ^{0}C. The amount of heat added per cycle is 1500 kJ/kg. Determine the pressure and temperature at all salient points. Assume compression ratio as 15. **3**

3C. What are the assumptions made in air standard cycles? **2**

4A. What are the different stages of combustion in spark Ignition engines? Explain with a neat sketch. **4**

4B. Derive an expression for work done in reciprocating compressors with and without clearance using suitable sketch. **4**

4C. What is multistaging in a reciprocating compressor? Explain with a p-V diagram. **2**

5A. A composite wall is made of 3 layers, middle layer being packed grass of 10 cm thick (k=0.02 W/m ^{o}C) and the sides are made of plywood each of 2 cm thickness (k=0.12 W/m ^{o}C). Determine the heat flow if one surface is at 35^{0}C and other at 20^{0}C with the help of a neat sketch. **3**

5B. Define emissivity and state Stefan-Boltzmann law. **2**

5C. With T-s diagram explain ideal Rankine and Rankine reheat cycles. **5**