Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

III SEMESTER B.TECH (INDUSTRIAL & PRODUCTION ENGG.) END SEMESTER (MAKE UP) EXAMINATIONS, DEC 2015/JAN 2016

SUBJECT: THERMAL ENGINEERING [MME 2113]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL questions.
- Use of Thermodynamics data handbook is permitted.

1A) Define internal energy. Show that energy is a property of system. (03)

1B) Explain the working of vapor compression refrigeration system. Also show the T-s diagram. (04)

1C) Write the schematic and T-s diagram of Rankine cycle with dry steam conditions at turbine inlet. (03)

2A) Explain the limitations of First law of Thermodynamics. (03)

2B) State and explain the principle of increase of entropy with a suitable example. (04)

2C) Carbon dioxide passing through a heat exchanger at a rate of 50 kg/hr is to be cooled down from 800°C to 50°C. Determine the rate of heat removal assuming flow of gas to be of steady and constant pressure type. Take Cp = 1.08 kJ/kg K. (03)

3A) Derive the expression for work transfer in a reversible polytropic process. (03)

3B) A reversible engine as shown in figure during a cycle of operation draws 5 MJ from the 400 K reservoir and does 840 kJ of work. Find the amount and direction of heat interaction with other reservoirs. (04)

3C) Derive the expression for thermal efficiency of Diesel cycle. (03)

4A) State and prove Claussius theorem. (03)

4B) Show that the clearance volume has no effect on the specific work input of a reciprocating air compressor. (04)

4C) Determine entropy change of universe, if two copper blocks of 1 kg and 0.5 kg at 150ºC and 0ºC are joined together. Specific heats for copper at (03)

150ºC and 0ºC are 0.393 kJ/kg K and 0.381 kJ/kg K respectively.

5A) Define Fourier's law of heat conduction. Mention the differences between conduction and convection heat transfer. (03)

5B) In a Diesel engine during the compression process, pressure is seen to be 138 kPa at $1/8^{th}$ of stroke and 1.38 MPa at $7/8^{th}$ of stroke. The cut-off occurs at $1/15^{th}$ of stroke. Calculate air standard efficiency and compression ratio assuming indicated thermal efficiency to be half of ideal efficiency, mechanical efficiency as 0.8, calorific value of fuel = 41800 kJ/kg and $\gamma = 1.4$. (05)

5C) Explain Morse test. (02)