Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

IV SEMESTER B.TECH (MECHANICAL ENGINEERING)

END SEMESTER EXAMINATIONS, JUNE/JULY 2016

SUBJECT: THERMODYNAMICS - II [MME 2201]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Use of Thermodynamic data book is permitted

1A. Show that thermal efficiency of an air standard Otto cycle is a function of compression ratio only. **05**

1B. In a reheat steam cycle, the boiler exit conditions are 25 bar and 300^0 C. The exit pressure of steam at the end of first stage is 5 bar. The steam is then reheated to 300^0C before expanding in the second turbine to 0.05 bar. Find (i) the thermal-energy input in the re-heater, (ii) the cycle efficiency, (iii) power output for a mass flow rate of 2 kg/s. Neglect the pump work. **05**

2A. What are the desirable properties for ideal working substances in vapor power cycles? **05**

2B. The pressure and temperature at the beginning of compression in an air standard dual cycle are 1bar and 30°C.The compression ratio is 9. The maximum pressure is limited to 60 bar. The heat added during constant pressure process is upto 4% of the stroke. Assuming cylinder bore and stroke as 250mm and 300mm respectively. Determine
(a) Air standard efficiency
(b) Power developed, if the number of working cycles are 3 per second **05**

3A. With the help of Pressure - crank angle diagram explain the stages of combustion in a C.I. engine **05**

3B. An ideal vapor compression refrigeration cycle using R-12 as the refrigerant, works between the temperature limits of 0°C and 40°C. The capacity of the refrigerator is 7 tonnes. Condition of refrigerant leaving the evaporator is dry saturated vapor. Determine
a) The mass flow rate of refrigerant
b) Power required to run the compressor
c) Heat rejected in the condenser
d) COP **05**

4A. Derive an expression for intermediate pressure of a two stage reciprocating **05**

air compressor for minimum work input condition

4B. An engine is used in a process which requires 100kW of brake power with a mechanical efficiency of 78%. The engine uses 1 kg of fuel per minute. If a simple modification in design reduces the engine friction by 8 kW, then what will be the percentage saving in fuel consumption? Assume the indicated thermal efficiency remains same **05**

5A. (i) Define (a) stagnation and static states (b) Critical state (c) Nozzle efficiency and coefficient of velocity

(ii) What are the advantages of regeneration and reheating in gas turbine cycles **05**

5B. A single acting air compressor has a cylinder of 15 cm bore and the piston stroke is 25 cm. The crank speed is 600 rpm. Air is taken from atmosphere of 1 bar and 27^{o}C and is delivered at 11 bars. Assuming polytropic compression of the type $pV^{1.25}$ = C, find the power required to drive the compressor if its mechanical efficiency is 80%. The compressor has a clearance which is 1/20th of the stroke volume. How long will it take to deliver 1 m^3 of air at the compressor inlet conditions? Also find the volumetric efficiency of the compressor **05**