Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (AUTOMOBILE/AERONAUTICAL ENGINEERING)
END SEMESTER EXAMINATIONS, NOV/DEC 2018

SUBJECT: THERMODYNAMICS [AAE 2104]

REVISED CREDIT SYSTEM

(31/12/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- USE OF THERMODYNAMIC DATA HAND BOOK IS PERMITTED

1A. Plot different thermodynamic processes on P-V and T-s diagram. Derive the expression for work done in a polytrophic process. **(03)**

1B. Differentiate point and path function with examples **(02)**

1C. A piston cylinder device contains 0.05m^3 of gas initially at 200kPa, when a linear spring of stiffness 150kN/m touches it without exerting any force. When heat is transferred, the volume doubles. Find the final pressure of gas and total work done by the gas if piston cross-sectional area is 0.25m^2 **(05)**

2A. What is thermometric property? Briefly explain the working of constant volume gas thermometer **(02)**

2B. A room occupied by 4 people (each liberating 630kJ/hour heat), 2 fans (each liberating 0.18kW heat) and 3 lamps (each liberating 100W heat). Ventilation air flowing at 80kg/hour enters the room with enthalpy of 84kJ/kg and leaves at 59kJ/kg. If an AC is to be used to remove all the heat inside the room to maintain steady conditions, find the power needed to run the AC **(04)**

2C. In a steady flow apparatus, 135kJ of work is done by each kg of fluid. Inlet conditions are 0.37m^3/kg, 600KPa and 16m/s. The inlet is 32m above the floor and discharge pipe is at floor level. The discharge conditions are 0.62m^3/kg, 100kPa and 270m/s. The total heat lost between inlet and discharge is 9kJ/kg. In flowing through this device, does specific internal energy of the fluid increase or decrease? By how much? **(04)**

3A. Explain the working of Carnot cycle with help of P-V and T-s diagram. **(03)**

3B. Draw a schematic diagram of heat engine, heat pump and refrigerator. Briefly explain the working **(03)**

3C. A heat pump working on Carnot's cycle takes heat from reservoir at 5ºC and delivers heat to a reservoir at 60ºC. The heat pump is driven by a reversible heat engine, which takes heat from reservoir at 840ºC and rejects heat to reservoir at 60ºC. The reversible heat engine also drives a machine, which absorbs 30kW. If the heat pump extracts 17kJ/s from 5º C reservoir, find a) rate of heat supply from 840ºC source and b) rate of heat rejection to 60ºC sink **(04)**

4A. Explain phase change process of a pure substance with the help of P-v diagram highlighting on salient points on the diagram. **(03)**

4B. One kg of steam initially at 15bar pressure and 60% quality undergoes two processes.
Process 1-2: Heating at constant volume till pressure raises to 30bar. **(02)**
Process 2-3: expanded isothermally to 10 bar.
Find the enthalpy, entropy and internal energy in each states

4C. Explain cooling, heating, cooling with dehumidification, heating with humidification process with psychrometric chart. Write the expression for heat transfer and moisture content change in each processes. **(05)**

5A. Compare the efficiency of Otto, diesel and dual combustion gas power cycle under same compression ratio and same maximum pressure & maximum temperature condition. **(03)**

5B. An engine equipped with a cylinder having bore of 15cm and a stroke of 45cm operate on a Otto cycle. If the clearance volume is $2000cm^{3,}$ compute the air standard efficiency **(03)**

5C. In a gas turbine plant working on Brayton cycle with a regenerator effectiveness of 75%, the air at the inlet of the compressor is at 0.1MPa and 303K, the pressure ratio is 6 and maximum cycle temperature is 900ºC. if the turbine and compressor has efficiency of 80% each, find the percentage increase in the efficiency of Brayton cycle due to regeneration **(04)**