Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (MECHANICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: REFRIGERATION AND AIR CONDITIONING (MME- 469)

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Use of Thermodynamics data hand book is permitted.
- Missing data may be suitable assumed.

1A. With schematic and T-S diagram, obtain an expression for COP of Bell-Coleman refrigeration cycle when the compression and expansion are polytropic. **(05)**

1B. The ambient conditions for an aircraft cruising at 1000km/hr are 0.35 bar and – 15 ^{0} C. The cabin temperature is 25 ^{0} C and turbine exit pressure is 1.06 bar. The pressure ratio of the compressor is 3. Assuming 100% efficiency for compressor and turbine and ideal heat exchangers, determine for simple aircraft system of 20TR capacity, Work requirement and COP. Assume C_p of air as 1.005 kJ/kgK , R for air as 0.287 kJ/kgK. **(05)**

2A. Explain with neat sketch, working of two stage cascade refrigeration system. What are its advantages and disadvantages? **(05)**

2B. A refrigeration plant working on reversed carnot cycle is required to produce 2.5 tonnes of ice per day at – 4 ^{0} C from water at 20 ^{0} C. If the temperature range in the compressor is between 25 ^{0} C and – 6 ^{0} C, calculate the power required to drive the compressor. Latent heat of ice is 335 kJ/kg and specific heat of ice is 2.1 kJ/kgK and that of water is 4.18 kJ/kgK. **(05)**

3A. Explain with neat sketch, working of vapour absorption refrigeration system using ammonia as a refrigerant. What are the differences between vapor absorption system and vapor compression system? **(05)**

3B. Compare the coefficient of performance of a refrigeration cycle which uses wet compression with that of one which uses dry compression. In both cases use ammonia as the refrigerant, a condensing temperature of 30 ^{0} C, and an evaporating temperature of –20 ^{0} C; assume that the compressors are isentropic and that the liquid leaving the condenser is saturated. In the wet compression cycle the refrigerant enters the compressor in such a condition that it is saturated vapor upon leaving the compressor. **(05)**

4A. Show the following processes on the psychrometric chart; (a) Dehumidification of moist air by cooling, (b) adiabatic mixing of two fluids. **(03)**

4B. Write a short note on by-pass factor for cooling coil. **(02)**

4C. Air at 10 ^{0} C DBT and 8 ^{0} C WBT is supplied at the rate of 15m^3/min. It is brought to 20 ^{0} C DBT and 60% RH by heating and then by adiabatic humidification. Find: (i) Capacity of the heating coil in kW (ii) Surface temperature of the coil if the BF factor is 0.32 (iii) Capacity of the humidifier. **(05)**

5A. Explain the factors affecting comfort air conditioning. **(02)**

5B. Explain the factors affecting optimum effective temperature. **(03)**

5C. A cinema hall of seating capacity 1500 persons has been provided with an air condition plant with the following data. Outdoor conditions are 40 ^{0} C DBT and 20 ^{0} C WBT, required indoor conditions are 20 ^{0} C DBT and 60% RH. Amount of outdoor air supplied is 0.3m^3/min/person. The required conditions is achieved by adiabatic humidifying and then by cooling, find: i) The capacity of cooling coil and its surface temperature if BPF is 0.25 ii) The capacity of the humidifier and its efficiency. **(05)**

6A. Discuss the components of cooling load calculation. **(02)**

6B. Obtain an expression for sensible heat gain through building structure of composite wall with air space by conduction. **(03)**

6C. An air conditioning plant is to be designed for a small office for winter conditions: Out-door conditions: 10 ^{0} C DBT and 8 ^{0} C WBT, Required indoor conditions: 20 ^{0} C DBT and 60% RH, Amount of air circulation: 0.3 m^3/min/person, Seating capacity of the office: 50 persons, the required condition is achieved first by heating and then by adiabatic humidifying. Find; (i) Heating capacity of the coil in kW and its surface temperature, if the by-pass factor of the coil is 0.32, (ii)Capacity of the humidifier (iii) Humidifier efficiency. **(05)**