Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_

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**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **18ME2001** | **Duration :** | **3hrs** |
| **Sub. Name :** | **THERMODYNAMICS, REFRIGERATION**  **AND AIR-CONDITIONING** | **Max. Marks:** | **100** |

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| **Q. No.** | **Questions** | **Course Outcome** | **Marks** |
| **PART – A (20 X 1 = 20 MARKS)** | | | |
| 1. | Define thermodynamic system. | CO1 | 1 |
| 2. | Give an example for intensive property. | CO1 | 1 |
| 3. | Which are the characteristics of a quasi-static process? | CO1 | 1 |
| 4. | On which law of thermodynamics does a glass tube thermometer work? | CO1 | 1 |
| 5. | List the various forms of internal energy. | CO2 | 1 |
| 6. | Define flow work. | CO2 | 1 |
| 7. | State the conditions for a steady flow. | CO2 | 1 |
| 8. | Define refrigerator. | CO2 | 1 |
| 9. | State Clausius inequality. | CO2 | 1 |
| 10. | Define the term entropy. | CO2 | 1 |
| 11. | Name the processes that constitute a dual cycle. | CO2 | 1 |
| 12. | What is the unit of refrigeration? | CO3 | 1 |
| 13. | Name the property that is maintained constant in throttling process. | CO3 | 1 |
| 14. | List the components of vapour absorption refrigeration system. | CO3 | 1 |
| 15. | List few environment friendly refrigerants. | CO3 | 1 |
| 16. | Define saturated air. | CO4 | 1 |
| 17. | Differentiate between refrigeration and air conditioning. | CO4 | 1 |
| 18. | Define the term cooling load. | CO5 | 1 |
| 19. | What is a cold storage? | CO6 | 1 |
| 20. | Write a short note on ice manufacture. | CO6 | 1 |

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| **PART – B (10 X 5 = 50 MARKS)**  **(Answer any 10 from the following)** | | | |
| 21. | Derive an expression for the displacement work done by a gas when it expands adiabatically from initial state to final state. | CO1 | 5 |
| 22. | Explain first law of thermodynamics with a suitable example. | CO1 | 5 |
| 23. | With P-v diagram and T-s diagram, explain Carnot cycle. | CO2 | 5 |
| 24. | Explain the terms available energy and irreversibility. | CO2 | 5 |
| 25. | Compare Diesel cycle with Otto cycle. | CO2 | 5 |
| 26. | With a neat sketch, explain the working of a vapour compression refrigeration system. | CO3 | 5 |
| 27. | Explain any one type of liquefaction process with T-s diagram. | CO3 | 5 |
| 28. | Draw the Psychrometric chart and explain sensible heating and dehumidification processes. | CO4 | 5 |
| 29. | Compare summer with winter air-conditioning systems. | CO4 | 5 |
| 30. | List the various components of cooling load calculations. | CO5 | 5 |
| 31. | Discuss the applications of refrigeration in trucks maintained at low temperature for food preservation. | CO6 | 5 |
| 32. | Explain the operations of cold storage system. | CO6 | 5 |

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| **PART – C (2 X 15 = 30 MARKS)**  **(Answer any 2 from the following)** | | | | |
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| 33. | a. | A perfect gas is compressed according to the law Pv1.25 = constant from an initial pressure of 1bar and volume of 0.9 m3 to a final volume of 0.6 m3. Determine the final pressure and work done per kg of gas during the process. Take R = 287 J/kgK and γ = 1.4. | CO1 | 7 |
| b. | A mixture of gases expands at constant pressure from 10 bar and 0.03 m3 to 0.06 m3 with 84 kJ of heat addition. There is no work other than that done on a piston. Find ∆E for the gaseous mixture. | CO1 | 8 |
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| 34. | a. | A household refrigerator with a COP of 1.2 removes heat from the refrigerated space at a rate of 60 kJ/min. Determine (*a*) the electric power consumed by the refrigerator and (*b*) the rate of heat transfer to the kitchen air. | CO2 | 7 |
| b. | A Carnot heat engine receives heat from a reservoir at 900°C at a rate of 800 kJ/min and rejects the waste heat to the ambient air at 27°C. The entire work output of the heat engine is used to drive a refrigerator that removes heat from the refrigerated space at - 5°C and transfers it to the same ambient air at 27°C. Determine (*a*) the maximum rate of heat removal from the refrigerated space and (*b*) the total rate of heat rejection to the ambient air. | CO2 | 8 |
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| 35. | a. | In a laboratory test a psychrometer recorded 36oC DBT and 30oC WBT. Calculate: 1.Vapour pressure 2.Relative humidity 3.Specific humidity 4.Degree of saturation 5.Dew point temperature 6.Enthalpy of the mixture. | CO4 | 7 |
| b. | A simple R-12 plant is to develop 5 tonnes of refrigeration. The condenser and evaporator temperatures are to be at 400 C and -100 C respectively. Determine (a) the refrigerant flow rate in kg/s, (b) the volume flow rate handled by the compressor in m3/s, (c) the compressor discharge temperature, (d) the pressure ratio, (e) the heat rejected to the condenser in kW, (f) the flash gas % after throttling, (g) the COP, and (h) the power required to drive the compressor. | CO3 | 8 |