

R16

Code No: 138FQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year II Semester Examinations, July - 2021

BASICS OF THERMODYNAMICS
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

Answer any Five Questions
All Questions Carry Equal Marks

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- 1.a) Define the following with examples.
i) Open system ii) Closed system iii) Isolated system
b) Distinguish the following terms: i) Thermal and thermodynamic equilibrium ii) Exact and Inexact differentials. [7+8]
- 2.a) Prove that heat transfer is a path function.
b) State Zeroth law of thermodynamics. The readings t_A and t_B of two Celsius thermometers A and B agree at ice and steam point, but elsewhere are related by the equation $t_A = L + Mt_B + Nt_B^2$ where L, M, N are constants, when both thermometers are immersed in a system of fluid, A registers 11°C while B registers 10°C . Determine the reading on A when B registers 37.4°C . [7+8]
- 3.a) Define the following:
i) Thermal Energy Reservoir(TER)
ii) COP of Heat pump.
b) A fish freezing plant requires 40 tons of refrigeration. The freezing temperature is -35°C , while the ambient temperature is 30°C . If the performance of the plant is 20% of the theoretical reversed Carnot cycle working with in the same temperature limits, Calculate power required. [7+8]
- 4.a) Write the first law of thermodynamics equation for closed system undergoing a non cyclic process and show that internal energy is property.
b) Steam expands through a turbine in a steady flow adiabatic process. The mass flow rate of the steam is 1.36 kg/s. The entering state of steam is 34.48 bar and 538°C , while the existing state is 6.896 bar and 294°C . Neglecting the changes in kinetic and potential energies, find the power output for the turbine. Assume C_p for steam as 2.01 kJ/kg K. [7+8]
- 5.a) Define i) Dry bulb temperature ii) Wet bulb temperature iii) Relative humidity.
b) The pressure and temperature of mixture of 4kg of O_2 and 6kg of N_2 are 4 bar and 27°C respectively. For the mixture, determine the mole fraction of each component, specific gas constant and average molecular weight. [7+8]
- 6.a) Derive the expression for specific heat at constant pressure and constant volume for mixture of gases.
b) A mixture of gases comprises 30% CO , 15% CO_2 and 55% H_2 . Find the gravimetric analysis specific gas constant and molecular weight of the mixture. [8+7]

- 7.a) Derive an expression for Otto cycle efficiency with usual notation.
- b) In a Diesel cycle, air at 0.1 MPa and 300K is compressed adiabatically until the pressure rises to 5 MPa. If 700KJ/Kg of energy in form of heat is supplied at constant pressure, determine compression ratio, cut off ration, thermal efficiency and mean effective pressure. [7+8]
- 8.a) Explain the effect of mean effective pressure on thermal efficiency of air standard cycles.
- b) Explain the working principle of Vapour compression cycle with neat diagram. [8+7]

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