

**B. E. METALLURGICAL AND MATERIAL ENGINEERING EXAMINATION, 2022**

(2nd Year, 2nd Semester )

**THERMODYNAMICS OF MATERIALS**

Time : Three hours

Full Marks : 100

Assume any missing Data

Answer Question *1* and any *four* from the rest

Q1. Answer all questions : Fill up the blanks using appropriate words

- a) Steam engine convert heat energy to ----- (potential/kinetic) Energy
- b) diesel engine is an example of ----- (thermodynamics/ non thermodynamics) process
- c) Generally conversion efficiency of work to heat is -----(70/30) percent
- d) heat is a more -----( versatile/ degradable) form of energy
- e) boundary of thermodynamics system is ----- (deformable/ not deformable)
- f) dropping an apple from tree is more likely to be -----(reversible/ Irreversible) process
- g) In enclosed system, (Matter/ energy) ----- can cross system boundary
- h) work and heat are -----(exact/ inexact ) differential property
- i) work and heat are ----- (state/ Path) function
- j) for constant volume process work done is- ----- (zero/ positive/ negative)
- k) In a polytropic process - volume relation is ----- (linear/ nonlinear)
- l) in Adiabatic process work done is ----- (zero/ non zero)
- m) first law of thermodynamics is -----(applicable/ not applicable) in heat exchanger
- n) First law relate work done, Total energy, and ----- (Heat transfer/ mass transfer)
- o) first law is ----- (Applicable/ not applicable) to cyclic process
- p) Isochoric process is constant ----- (pressure/ volume) process
- q) in a closed system work done is ----- (possible/ not possible)
- r) first law or cannot be applicable to flow process. (correct/ incorrect)
- s) Laws of thermodynamics can be applied to onl / heat transfer. ( correct/ incorrect)
- t) Second law states all natural processes are -----(uni-directional/ reversible)

**1x20=20**

[ Turn over

2. Butane is burned with 90% theoretical air. Calculate volume percentage of Carbon monoxide in the product gas the and air fuel ratio. **20**
3. Butane is burnt with dry air Volumetric analysis Of the product on dry basis is given as:  
Carbon dioxide 11 %, Carbon monoxide 1%, Oxygen 3.5%, Nitrogen 84%. Calculate percentage of Theoretical air. **20**
4. Air expands from 300 kilo Pascal, 227 degree centigrade to 100 kilo Pascal, 27 degree centigrade. Calculate the change of specific internal energy, entropy, and enthalpy.  
 $C_p = 1.005$ ,  $c_v = 0.718 \text{ kJ/kg}$ . **20**
5. Consider 1 kg of ice at -20 degree centigrade. as a system it is exposed to surroundings at 25 degree centigrade. ice melts to water and ultimately comes to an equilibrium with the surrounding. calculate entropy change of the system, soundings, And the universe.  
 $C_{p\text{-ice}} = 2.1 \text{ kJ/kg}$ ,  $C_{p\text{-water}} = 4.2 \text{ kJ/kg}$  **20**
6. answer the following questions
- State second law of thermodynamics as per Kelvin - Planck statement.
  - Explain the difference between heat pump and refrigerator.
  - what is the significance of coefficient of performance of refrigeration and heat pump?
  - what do you mean by reversible and Irreversible process
  - Explain with diagram the principle of Carnot cycle.

**4X5=20**