Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **B.TECH**
15BE2103

1st Semester Back Examination 2017-18
THERMODYNAMICS
BRANCH: AERO, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, ELECTRICAL, ETC, FAT, IT, MECH, METTAMIN, MINERAL, MME, PE, PLASTIC
Time: 3 Hours
Max Marks: 100
Q.CODE: B950

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.

Part – A (Answer all the questions)

Q1 **Answer the following questions: *multiple type or dash fill up type*** **(2 x 10)**

a) In free expansion process, work done is…….
b) First law of thermodynamics sates that……..
c) A process, in which the temperature of the working substance remains constant during its expansion or compression, is called……process.
d) Second law of thermodynamics defines
(a) heat (b) work (c) enthalpy
(d) entropy (e) internal energy.
e) A process, in which the temperature of the working substance remains constant during its expansion or compression, is called……process.
f) For a reversible adiabatic process, the change in entropy is
(a) zero (b) minimum (c) maximum
(d) infinite (e) unity.
g) The C.O.P. for a Carnot heat pump is equal to .....
h) In a reversible cycle, the entropy of the system
(a) increases (b) decreases
(c) does not change (d) first increases and then decreases
(e) depends on the properties of working substance.
i) Kelvin-Planck's law deals with
(a) conservation of energy (b) conservation of heat (c) conservation of mass
(d) Conversion of heat into work (e) conversion of work into heat.
j) Absolute zero temperature is taken as……

Q2 **Answer the following questions: *Short answer type*** **(2 x 10)**

a) Give one example of a system which does not interact with its surrounding in any manner. What is the name of such a system?
b) What are the measureable thermodynamic properties? Give example of one measureable extensive property.
c) Out of isothermal and adiabatic process of compression between an initial state and a given final pressure, which one will consume less work?
d) Explain Thermodynamic equilibrium.
e) What do the areas under p-v and T-S curve represent on their respective plots.
f) Define the Triple point of pure substance.
g) Explain what you understand by quality of steam. If saturated water is throttled to low pressure what will happen to quality?

h) What happens to the boiling point of water and melting point of ice when pressure increases?

i) Out of all the laws of thermodynamic which one represents the conservation of energy?

j) Define volumetric efficiency of a reciprocating air compressor.

Part – B (Answer any four questions)

Q3 **a)** 2 Kg of air expands in a piston cylinder device at constant pressure. The work output is 40 kJ. What is the change in temperature if Cp = 1.005 kJ/kg^{0}C and Cv = 0.72 kJ/kg^{0}C. ^{0}C **(10)**

b) State and explain Zeroth Law of Thermodynamics. Which property does it describe? **(5)**

Q4 **a)** Apply SFEE to (i) Compressure (ii) Nozzle (iii) Turbine and (iv) Boiler. (Neglect potential energy in all the ^{0}C cases) **(10)**

b) 2 kg of air (Cp = 1.005 kJ/kg^{0}C) at 20^0 C enters into a compressor and leaves at 80^0 C . If the heat rejected is 50 kJ. What is the work input to the compressor? **(5)**

Q5 **a)** Steam at 10 bar and 200 ^{0} C is expanded isentropic ally to 0.2 bar in a turbine. Calculate the work output. **(10)**

b) Define pure substance and critical point. What happens to the latent heat of vaporization, when pressure is increased? **(5)**

Q6 **a)** Air at 27^0 C and 1 bar is compressed at constant volume to 4 bar. Then it is expanded isothermally to 1 bar. Finally it is brought back to its initial state by a constant pressure process. Find out the efficiency of the cycle and the work output (take Cp = 1.005 kJ/kg ^{0}C and Cv = 0.72 kJ/kg^{0}C). **(10)**

b) Explain what you understand by PMM1. Prove that internal energy is a property of the system. **(5)**

Q7 **a)** State and prove the equivalence of Kelvin-Plank and Clausius statement of second law of thermodynamic. **(10)**

b) An inventor claims to have developed an engine which delivers 50 kJ of work by observing 100 kJ of heat while working between 300 K and 500K respectively. Justify his claim. **(5)**

Q8 **a)** 1 kg of air expands from 4 bar and 127^0 C to 1 bar. If the process of expansion is PV $^{1.3}$ = constant, then find out **(10)**

i)Heat exchange

ii)Work done

Take Cp = 1.005 kJ/kg^{0}C and Cv = 0.72 kJ/kg^{0}C

b) Explain the working principle of manometers. **(5)**

Q9 **a)** A refrigerator works between 250 K and 300 K. Its COP is 75% of the maximum possible value. The following data refer to the refrigerator. **(10)**

Heat enters through insulation = 10 kJ per day.

Number of time the door is opened = 30 per day

Heat leakage during door opening = 2 kJ

Average amount of food stock stored = 50 kg

Heat generated by the food stock = 0.1 kJ/kg

Electric Tariff = Rs. 4 per unit of electricity.

Estimate the monthly electric bill.

b) Explain the important components of steam power plant **(5)**