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SF-8195

B. E. - II (Sem. - IV) (Mechanical) Examination

May/June – 2011

Engineering Thermodynamics

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 2 (SEM. - 4) (MECHANICAL)**

Name of the Subject :

☛ **ENGINEERING THERMODYNAMICS**

☛ Subject Code No. : **8 1 9 5** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) Attempt **all** questions.
(3) Figures to the **right** indicate full marks.
(4) Assume suitable data, if necessary.
(5) Use of steam table, moiler diagram, refrigeration charts are permitted.

1 Answer the following short questions (Any twenty) **20**

1. Which of the following is a closed system?
   (i) Boiler (ii) Compressor (iii) I C Engine (iv) Bomb calorimeter
2. Specific volume is a _____property.
3. How will define pure substance?
4. Enthalpy is point function. (True/False)
5. The perpetual motion machine of first kind is impossible according to
   (a) First law (b) Second law (c) Third law (d) None
6. Work done during constant volume process is
   (a) maximum (b) zero (c) positive (d) negative
7. Steady flow energy equation for throttling process is
   (a) $h_1 = h_2$ (b) $T_1=T_2$ (c) $u_1 = u_2$ (d) None
8. Area under temperature-entropy gives
   (a) heat (b) work (c) power (d) none of these
9. If the temperature of source is increased, the efficiency of the Carnot engine
   (a) Increase (b)Decrease (c)No change (d) Depends on other factor
10. A refrigerator and heat pump operated between same temperature limit. COP of heat pump is 4 then the COP of refrigerator will be _____

11. The second law of thermodynamics define

(a) Enthalpy (b) Entropy (c) Internal energy (d) Heat

12. What is dead state in relation with availability?

13 State Gibbs Dalton's law of partial pressure.

14 The value of universal gas constant is_____

15 One kg mol of gas occupies a volume of_____ at NTP

22.4 m^3 22.4 Liter 21.8 m^3 21.8 Liter

16 Stoichiometric air fuel ratio by mass for octane fuel is

(a) 12:1 (b)15:1 (c) 18:1 None of the above

17 When air-fuel mixture is supplied with excess air, the mixture is called

(a) Lean (b) Rich (c) Balanced (d) None

18 Thermal efficiency of a gas turbine plant as compare to diesel plant is

(a) higher (b) lower (c) same

19 Efficiency of diesel cycle depends on

Compression ratio Cutoff ratio Index γ None

20 Rankine efficiency _____ with the increase in maximum pressure of the cycle. (Increase/Decrease)

21 Bryton cycle is also called

Jule cycle Constant pressure cycle All the above none

22 Regenerating feed heating cycle will have efficiency equal to Carnot efficiency if the number of feed water heaters are

(a) zero (b) 2-4 (c) 5-10 (d) infinite

2 **(a)** What is a system? Distinguish between homogeneous and heterogeneous system. **05**

(b) Explain the term sublimation. **04**

(c) What are the similarities and differences between heat and work? **04**

(d) Two kg of air is compressed in reversible process from 105 kPa and 27°C to 800 kPa isothermally. The initial density of air is 1.17 kg/m^3 . Calculate the work required to compress the air. Assume R = 0.287 kJ/kgK. **07**

OR

(d) 5 kg water at 10°C is to be heated with the help of water heater to 30°C.Calculate amount of heat supplied to the water. Take C_{water} = 4.187 kJ/kgK. If power of electric heater is 0.6 kW, find the time required to heat the water. **07**

3 **(a)** What do you understand by reversible process? What are the factors that affect reversibility? **04**

(b) Calculate the co-efficient of performance and heat transfer rate in condenser of refrigerator with capacity 1 ton and power required to compressor is 0.8 kW. **06**

OR

(b) What is absolute thermodynamic temperature scale? Why it is called absolute? How it is independent of working substance? **06**

(c) 10 kg metal piece with constant specific heat of 1.0 kJ/kgK at 200°C is dropped in to an insulated tank containing 100 kg water at 20°C. Determine the final equilibrium temperature and total change in entropy for the process. **05**

(d) Explain the third law of thermodynamics **05**

OR

(d) Derive the expression for availability in steady flow system **05**

4 (a) 0.45 kg of CO and 1 kg air is contained in a vessel of volume 0.4 m^3 at 15 °C. Air has 23.3% of O_2 and 76.7 % N_2 by mass. Calculate the partial pressure of each constituent and total pressure in vessel. Molar masses of CO, O_2 and N_2 are 28, 32 and 28 kg/kmol respectively. **06**

OR

(a) For ideal gas mixture, show that **06**

$$M = \sum \frac{M_i}{y_i}$$ where M = molecular mass and y = mass fraction

(b) Explain the following shortly **04**

(i) Law of corresponding state

(ii) Generalized compressibility chart.

(c) What do you understand by adiabatic flame temperature? What are the factors which affect the adiabatic flame temperature? **04**

(d) A petrol engine uses a fuel C_7H_{16}. Determine the air fuel ratio which would just suffice of theoretical combustion. **06**

OR

(d) Name the apparatus used for the measurement of calorific value of gaseous fuel and discuss its working with the help of neat sketch. **06**

5 (a) Explain Briton cycle briefly. Derive an expression for cycle efficiency **06**

OR

(a) An engine is working on Otto cycle. The pressure and temperature at the beginning of compression stroke is 1 bar and 300 K respectively and temperature at the end of compression stroke is 600 K. If the temperature at the end of constant volume heat addition process is 1800 K, calculate the air standard efficiency, heat addition and heat rejection per kg air. Assume $\gamma = 1.4$ and $C_v = 0.75$ kJ/kgK. **06**

(b) With T-S diagram, explain the effect of change in super heat, boiler pressure and condenser pressure on performance of rankine cycle. **05**

OR

(b) a steam power plant operating on Rankine cycle receives steam from the at 3.5 MPa and 350 °C It is exhausted to condenser at 10kPa. Calculate **05**

(i) Energy supplied per kg of steam

(ii) Rankine cycle efficiency

(iii) Specific steam consumption.

(c) Define Jule-Thompson coefficient. **04**

(d) Using the Clapeyron equation, estimate the enthalpy of vaporization at 110 °C and compare this with tabulated value. **05**