

B.E./B.TECH. Degree Examination, December 2020

Second Semester

**MR16201 - Marine Engineering Thermodynamics**

(Use of Steam Tables and Mollier diagram are permitted)

(Regulation 2016)

Time: Three hours

Maximum : 80 Marks

Answer **ALL** questions**PART A - (8 X 2 = 16 marks)**

1. Which of the following is not a property of the system?  
(a) Temperature (b) Pressure (c) Specific volume (d) Heat
2. For any irreversible process the net entropy change is  
(a) zero (b) positive (c) negative (d) infinite
3. In Rankine cycle the work output from the turbine is given by  
(a) change of internal energy between inlet and outlet  
(b) change of enthalpy between inlet and outlet  
(c) change of entropy between inlet and outlet  
(d) change of temperature between inlet and outlet.
4. What is the highest efficiency of heat engine operating between same two thermal energy reservoirs, that is source and sink?  
(a) Ericsson efficiency (b). Otto efficiency (c). Carnot efficiency (d). Stirling efficiency
5. Distinguish between intensive and extensive property.
6. Differentiate between Heat engine and Heat pump.
7. Show reheat Rankine cycle processes on T-s diagram.
8. State the purpose of adding excess air for combustion.

**PART B - (4 X16 = 64 marks)**

09. (a) (i) Apply first law of thermodynamics to a steady flow device like turbine and derive an expression for work output. **(10)**
- (ii) Brief in what way first law of thermodynamics is ambiguous? **(6)**

**(OR)**

- (b) A system receives 50 kJ of heat while expanding with volume change of  $0.14 \text{ m}^3$  against an atmospheric pressure of  $1.2 \times 10^5 \text{ N/m}^2$ . A mass of 90 kg in the surroundings is also lifted through a distance of 5.5 meters. Find (i). The change in energy of the system, (ii).The system is returned to its initial volume by an adiabatic process which requires 110 kJ of work. Find the change in energy of the system. (iii). For these two combined processes determine change in energy of the system. **(16)**

10. (a) A house requires  $2 \times 10^5$  kJ/h for heating in winter. Heat pump is used to absorb heat from outside air in winter and send to heat the house. Work required to operate the heat pump is  $3 \times 10^4$  kJ/h. Determine heat abstracted from outside and COP of the heat pump. ( 16 )

(OR)

- (b) A cyclic heat engine operates between a source temperature of  $1000^\circ\text{C}$  and a sink temperature of  $40^\circ\text{C}$ . Find the least rate of heat rejection per kW net output of the engine. ( 16 )
11. (a) Discuss in detail with appropriate diagrams various options available for improving thermal efficiency of Rankine cycle. ( 16 )

(OR)

- (b) A simple Rankine cycle works between pressures 28 bar and 0.06 bar. The initial condition of steam is dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption. ( 16 )
12. (a) Compare Otto Cycle, Diesel cycle and Dual cycle in all aspects with appropriate property diagrams. ( 16 )

(OR)

- (b) Derive the T-ds equations with usual notations. ( 16 )