

17407

21819

3 Hours / 100 Marks

Seat No.

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Instructions –

- (1) All Questions are *Compulsory*.
- (2) Answer each next main Question on a new page.
- (3) Illustrate your answers with neat sketches wherever necessary.
- (4) Figures to the right indicate full marks.
- (5) Assume suitable data, if necessary.
- (6) Use of Non-programmable Electronic Pocket Calculator is permissible
- (7) Use of Steam table, logarithmic, Molliers chart is permitted.

Marks

1. a) Attempt any SIX of the following :

12

- (i) Plot P.V and T.S diagram for Isobaric process.
- (ii) Define dryness fraction and degree of superheat.
- (iii) Define :
 - 1) Free air delivered.
 - 2) Volumetric efficiency of compressor.
- (iv) Write the classification of gas turbines.
- (v) List two renewable and non renewable sources of energy.
- (vi) State any two advantages and disadvantages of CNG.
- (vii) List the properties of liquid fuels.
- (viii) State two applications of compressed air in automobile workshop.

P.T.O.

b) **Attempt any TWO of the following :** **8**

- (i) Explain the terms related to the thermodynamics.
 - 1) Work done.
 - 2) Change in internal energy.
 - 3) Change in enthalpy.
- (ii) State and explain different phases in formation of steam.
- (iii) Explain with neat sketch turbojet engine.

2. **Attempt any FOUR of the following :** **16**

- a) Represent Otto cycle on P.V and T.S diagram and write equation for air standard efficiency.
- b) Explain the different modes on heat transfer.
- c) Sketch Lamont boiler with labeling.
- d) Explain working of three pass packaged type boiler.
- e) What are the factors affecting volumetric efficiency of air compressor.
- f) Explain construction and working of closed cycled gas turbine with P.V and T.S diagram.

3. **Attempt any FOUR of the following :** **16**

- a) Explain construction and working of two stage air compressors.
- b) Describe working of turboprop engine.
- c) Sketch gas turbine power plant and label the major components.
- d) Explain Brayton cycle with the help of P.V diagram.
- e) Compare ultimate analysis and proximate analysis.
- f) A sample of coal has the following composition by mass: carbon 75%, hydrogen 6%, oxygen 8% , nitrogen 2.5% sulphur 1.5% and ash 7.1%. Calculate higher and lower calorific value of per kg.

- 4. Attempt any TWO of the following :** **16**
- a) Differentiate between conventional and non conventional energy sources.
 - b) Describe with neat sketch construction and working of Bomb calorimeter. Write Dulong's formula and state its use.
 - c) (i) Write advantages and disadvantages of tidal power plant.
(ii) Write advantages of liquid fuels over solid fuels.
- 5. Attempt any TWO of the following :** **16**
- a) Derive the relation between P.V&T for adiabatic process.
 - b) Steam enters an engine at a pressure of 12 bar with 67°C of superheat. It is exhausted at a pressure of 0.15 bar and 0.95 dry. Find the drop in enthalpy in steam. Assume $C_p = 2 \text{ kJ/kg k}$.
 - (i) For 12 bar pressure ,
 $h_f = 798.4 \text{ kJ / kg}$ and $h_{f_g} = 1984.3 \text{ kJ / kg}$.
 - (ii) For 0.15 bar pressure,
 $h_f = 226 \text{ kJ / kg}$ and $h_{f_g} = 2373.2 \text{ kJ / kg}$
 - c) Explain the construction and working of screw compressor. Differentiate between centrifugal and axial flow compressor.
- 6. Attempt any FOUR of the following :** **16**
- a) Derive the equation for air standard efficiency of Carnot cycle.
 - b) Enlist sources of air leakage in condenser and define condenser efficiency.
 - c) Draw a neat sketch of two pass down flow surface condenser.
 - d) Differentiate between open cycle and closed cycle gas turbine.
 - e) Explain the use of solar energy to generate electricity with neat sketch.
 - f) State necessity of multi staging and intercooling of air compressor.
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