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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) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1.   **Attempt any FIVE of the following:**   10

a) State Zeroth law of thermodynamics.

b) Differentiate between open system and closed system.

c) Define fuel and state it's types.

d) Define

   i)   Dryness fraction

   ii)   Degree of super heat

e) State the uses of compressed air.

f) Enlist non-conventional energy sources.

g) State advantages of solar energy.

2. **Attempt any THREE of the following:** 12

   a) Explain the process of formation of steam from 0°C water with T-H diagram

   b) Represent following process on P-V and T-S diagram.

     i) Isobaric process

     ii) Isothermal process

   c) Draw neat and labelled sketch of Lamont boiler.

   d) Explain with neat sketch working of air compressor used in vehicle washing center.

3. **Attempt any THREE of the following:** 12

   a) Explain the application of conduction and convection mode of heat transfer in automobile.

   b) A coal has following composition by mass carbon : 85%, hydrogen : 4%, sulpher : 1%, oxygen : 2% and nitrogen : 1.5% and remaining is ash. Find HCV and LCV of fuel.

   c) Suggest energy conservation techniques to be used in automobile workshop. Any four points.

   d) $0.1m^3$ of air at a pressure of 1.5 bar is expanded isothermally to $0.5m^3$. Calculate heat supplied during the process.

4. **Attempt any THREE of the following:** 12

   a) Draw P-V and T-S diagram of otto cycle and explain the processes involved in it.

   b) State any four requirements of good fuel.

   c) Sketch energy flow diagram for steam boiler.

   d) State advantages of multistage air compression with P-V diagram.

   e) State the factors governing the selection of cogeneration system. Write advantages of cogeneration. (any two)

5. **Attempt any TWO of the following:**   **12**

  a) Explain with neat sketch working of calorimeter used for measuring C.V. of solid and liquid fuel.

  b) Draw a neat sketch of two pass down flow surface condenser. Describe it's construction and working.

  c) State two strength and two limitations of following power plants in relation to human aspects of environment.

    i) Solar power plant

    ii) Geothermal power plant

    iii) Wind power plant

6. **Attempt any TWO of the following:**   **12**

  a) Compare rotary and reciprocating air compressor on the basis of following points.

    i) Suitability at low and high discharge

    ii) Working principle

    iii) Nature of flow

    iv) Delivery pressure range

    v) Maintainance

    vi) Application

  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 drop in enthalpy of steam.

    (Take   at 12 bar hf = $798.4\frac{KJ}{kg}$, hfg = $1984.3\frac{KJ}{kg}$

           at 0.15 bar hf = $226\frac{KJ}{kg}$, hfg = $2373.2\frac{KJ}{kg}$)

  c) Explain how power is saved due to solar water heating system.

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