

# 12099

**11122**

**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.

**Marks**

1. a) Attempt any **SIX** of the following: 12
- (i) Represent Otto cycle and Diesel cycle on PV diagram.
- (ii) Write limitations of tidal power plant.
- (iii) What are the nodes of heat transfer give examples?
- (iv) (1) Define dryness fraction of steam.  
(2) Define degree of super heat.
- (v) Define Fouriers law.
- (vi) Write Dulong's formula and state its use.
- (vii) What is the purpose of inter cooling in air compressor.
- (viii) State Boyle's law and Charle's law.

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- b) **Attempt any TWO of the following:** **8**
- (i) Point out the parameters involved in the site selection of thermal power plant.
  - (ii) Explain construction and working of closed cycle gas turbine.
  - (iii) Determine the condition of steam in the following cases.
    - (1) At a pressure of 10 bar and temperature  $210^{\circ}\text{C}$ .
    - (2) At pressure of 11 bar and volume  $0.174 \text{ m}^3/\text{kg}$ .
2. **Attempt any TWO of the following:** **16**
- a) With sketch explain working of Loeffler boiler.
  - b) Explain geothermal power plant. State its advantages and limitations.
  - c) 0.5kg of air is compressed reversibly and adiabatically from 80KPa,  $60^{\circ}\text{C}$  to 0.4MPa and is then expanded at constant pressure to the original volume. Sketch these process on PV and TS planes. Compute the heat transfer for the whole path.
3. **Attempt any TWO of the following:** **16**
- a) Explain in brief the factors affecting volumetric efficiency of reciprocating air compressor.
  - b) Explain the working of Dual combustion cycle with PV diagram. Also state the formula for its air standard efficiency.
  - c) Explain turbo prop engine with sketch.
4. **Attempt any TWO of the following:** **16**
- a) Explain with sketch working of Junker's gas calorimeter.
  - b) Differentiate between reciprocating and rotary compressor.
  - c) Explain with sketch working of surface condenser.

**5. Attempt any TWO of the following:****16**

- a) Explain with sketch working of solar power plant.
- b) Define the terms and give units:
  - (i) Thermal conductivity
  - (ii) Thermal resistance
  - (iii) Heat transfer coefficient
  - (iv) Emissivity
- c) A sample of coal has the following composition by mass Carbon 80%, Hydrogen 5%, Oxygen 6%, Nitrogen 2.5%, Sulphur 1.5% and Ash 5%. Calculate HCV and LCV per kg of coal.

**6. Attempt any TWO of the following:****16**

- a)
  - (i) Give the classification of air compressors.
  - (ii) Enlist various uses of compressed air.
- b) Calculate the quantity of heat required to produce 1 kg of steam at a pressure of 5 bar and temperature of 25°C under the following conditions.
  - (i) When the steam is wet with  $x = 0.9$
  - (ii) When the steam is dry saturated
  - (iii) When it is superheated at constant pressure at 250°CAssume:

$$\text{CP Super steam} = \frac{2.3\text{kJ}}{\text{kg/c}}$$

- c) Compare:
    - (i) Liquid fuels and gaseous fuels
    - (ii) Ultimate analysis and proximate analysis
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