13141

3 Hours/100 Marks

Seat No.

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**.
(8) **Use** of Steam tables, logarithmic, Mollier's chart is **permitted**.

MARKS

1. A) Attempt **any six** of the following : **12**

   a) What is specific heat of ideal gasses ?

   b) Define the terms :
      i) Volumetric efficiency and
      ii) Isothermal efficiency related to air compressor.

   c) What is non-conventional energy sources ? Give its two examples.

   d) Define the terms :
      i) Dryness fraction and
      ii) Degree of superheat.

   e) Classify the compressors according to :
      i) Capacity of compressor and
      ii) Air motion.

   f) What is gross calorific value of liquid fuel ?

   g) State the limitations of wind energy.

   h) State Fourier's law of heat conduction.

P.T.O.

B) Attempt **any two** of the following : 8

   a) What do you understand by Bio-diesel ? How it is useful in future ?

   b) "Thermal efficiency of a constant pressure gas turbine increases with increase in pressure ratio". Justify the statement.

   c) Write the equation of continuity. Apply it to :

     i) Steam turbine

     ii) Nozzle.

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

   a) 5 kg of gas is heated at constant pressure from 30°C to 240°C. Determine heat added, work done, change in internal energy and final volume if initial volume is 4 m^3. Take :

   C_p = 1.005 kJ/kg°K

   C_v = 0.714 kJ/kg°K and γ = 1.4

   b) Compare the water tube boilers with fire tube boiler, based on following parameters :

     i) Relative motion of water and flue gasses

     ii) Pressure range

     iii) Rate of steam generation

     iv) Handling of load flexibility

     v) Floor space required

     vi) Initial and maintenance cost

     vii) Efficiency

     viii) Applications.

   c) Sketch the labelled layout of thermal power plant and explain the working of :

     i) Steam circuit

     ii) Flue gas circuit.

MARKS

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

   a) Explain the working principle of centrifugal compressor with neat sketch. State its merits over reciprocating compressor.

   b) Differentiate between open cycle and closed cycle gas turbine on following points :

      i) Line diagram showing construction

      ii) Working principle

      iii) Working pressure

      iv) Maintenance – corrosion, deposits of dust and dirt.

   c) Represent the otto cycle on P.V. and T.S. chart. Show that air standard efficiency of otto cycle depends on compression ratio.

4. Attempt **any two** of the following : 16

   a) In a cold storage, the wall measures 3m × 4m constructed of bricks 10 cm thick, cork slab insulation of 7.5 cm from outside and additional pine wood covering of 2.5 cm thick protecting cork. If the internal temperature is – 5°C and outside is 20°C, find out heat leakage per unit time. Thermal conductivities for

   brick = 0.25 W/mk

   cork = 0.036 W/mk

   Pinewood = 0.092 W/mk

   What would be interface temperature ?

   b) Explain the procedure to determine the calorific value of gaseous fuel.

   c) A pneumatic rock drill requires 10 kg/min of air at 6 bar pressure. Find the power required to drive the single acting air compressor receiving air at 1 bar and 25°C. Assume 85% mechanical efficiency and value of index n = 1.25. Also estimate the isothermal efficiency of the compressor.

   Take C_p = 1.005 kJ/kgK,

   C_v = 0.718 kJ/kgK.

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

   a) Define open system and closed system. In following cases recognize whether the system is open or closed :

     i) Water pump

     ii) Car battery

     iii) A tube of a bicycle filled with air

     iv) A household refrigerator in operation.

   b) How you will find out the percentage of volume of CO_2, CO and O_2 present in combustion gas.

   c) State the factors that affects on the site selection for the Diesel Power Plant.

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

   a) Explain the working of surface condenser with neat labelled sketch. State its application.

   b) State and explain Zeroth law of thermodynamics used for temperature measurement.

   c) Draw a labelled sketch of solar power plant and explain its working principle. State the different methods of solar energy collection.

_____