# 12099

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

**Marks**

1. a) **Attempt any <u>SIX</u> of the following:**    **12**

   i) Define open system and closed system.

   ii) Give the classification of compressor on the basis of

      1) working and

      2) delivery pressure.

   iii) Define conventional and non-conventional energy sources with two examples from each source.

   iv) Define 'Boiler Mountings'. Give any two boiler mountings.

   v) Explain the term complete intercooling and incomplete intercooling in two stage reciprocating air compressor.

   vi) Write down four requirements of good fuel.

   vii) Give any four applications of solar energy for domestic purpose.

   viii) Define heat transfer. Explain three modes of heat transfer.

b) **Attempt any <u>TWO</u> of the following:**     **08**

    i) Draw a neat sketch of solar water heating system. Explain its working.

    ii) Explain four thermodynamic processes involved in closed. cycle gas turbine and draw its P-V and T-S diagram also.

    iii) A steam engine obtains steam from boiler at a pressure of 15 bar and 0.98 dry. It was found that the steam loses 21kJ of heat per kg as it flow through the pipe line. Pressure remaining constant calculate dryness fraction of the steam at the end of the pipeline ?

**2.**     **Attempt any <u>TWO</u> of the following:**     **16**

a) 0.336 m$^3$ of gas at 10 bar and 150°C expands adiabatically untill its pressure is 4 bar and then is compressed isotnermally untill its original volume. Find the final temperature and pressure of gas, take Cp = 0.996 kJ/kg-k, Cv = 0.703 kJ/kg-k.

b) Explain with neat sketch working of Loeffler Boiler.

c) Draw a neat sketch of tides coming in and tides going out in tidal power plant. Explain the working and also state its limitations on basis of

    i) cost

    ii) construction

    iii) electricity product

    iv) feasibility

    v) current status.

**Marks**

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

   a) Draw a neat sketch of screw compressor and explain its construction and write its working.

   b) Explain various processes involved for improvement of thermal efficiency of gas turbine on P-V and T-S diagram for

      i)    Intercooling of gas turbine.

      ii)   Reheating of gas turbine.

   c) Plot Diesel cycle on P-V and T-S diagram. Give formula for efficiency. Also state on which parameters efficiency depends ?

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

   a) A boiler is made up of iron plates of 14 mm thickness. If the temperature of the outside surface is 160° C and mat of inner surface is 90°C. Calculate the mass of water evaporated per hour. Assume that the area of heating surface is 5.2 m$^2$ and k iron = 84 w/mk.

   b) Draw a neat sketch of junker gas calorimeter and also explain its working.

   c) A single stage reciprocating air compressor takes in 7.5 m$^3$/min of air at 1 bar and 30° C and delivers it at 5 bar the clearance is the 5 percent of stroke volume. The expansion and compression are polytropic, n = 1.3, Calculate

      i)    temperature of air delivered.

      ii)   volumetric efficiency of the compressor.

**Marks**

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

a) One kg of ideal gas is heated from 18.3° C to 93.4° C assume R = 0.264 kJ/kg-K and r for gas = 1.18 (r = Cp / Cv). Calculate the following

   i) Specific beats (Cp and Cv)

   ii) Change in internal energy (du)

   iii) Change in enthalpy (dH)

b) A sample of coal has following composition by weight, Carbon - 76%, Hydrogen - 5%, Oxygen - 8.5%, Nitrogen - 2%, Sulpher - 1.5%, Ash 7%. Calculate

   i) Higher calorific value of fuel (HCV)

   ii) Lower calorific value of fuel (LCV)

c) Point out any eight parameters for site selection of gas turbine power plant.

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

a) Write down any four points to differentiate between jet and surface condensor. Draw a neat sketch of surface condenser and explain its working.

b) Define the terms:

   i) Enthalpy

   ii) Entropy

   iii) Specific heat

   iv) Isolated system

c) Draw a layout of thermal power plant and also explain the function of following components used in it

   i) Boiler

   ii) Condensor

   iii) Cooling Tower

   iv) Turbine.

———

**21314**
**3 Hours / 100 Marks**