15162

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. Solve **any five** :   **20**
    a) Define pure substance and working substance with examples.
    b) State characteristic gas equation and give units of each term in equation.
    c) Define dry steam, saturated steam, specific heat and superheated steam.
    d) Define volumetric efficiency and mechanical efficiency of air compressor.
    e) Enlist the various methods of refrigeration (any four).
    f) Draw P-V and T.S. diagram for the duel cycle of an I.C. engine.
    g) State and explain the 'Fourier's law of heat transfer.

2. Attempt **any four** of the following :   **16**
    a) State the statements of second law of thermodynamics.
    b) Write the steady flow energy equation and apply it for steam turbine and condenser.
    c) Differentiate on four point between mounting and accessories.
    d) Explain the working of industrial drought cooling tower with neat sketch.
    e) Explain effect of subcooling and superheating with P.h. diagram.
    f) State the types of lubricant additives with their advantages.

3. Attempt **any two** :   **16**
    a) Explain with neat sketch actual value-timing diagram for four stroke cycle diesel engine.
    b) A steam pipe of 16 cm inside diameter and 17 cm outside diameter (K = 58 W/m°k) is covered with first layer of insulating material 3 cm thick (K = 0.17 W/m°k) and second layer of insulating material 5 cm thick (K = 0.093 W/m°k). The temperature of steam passing through the pipe is 300°C and atmospheric temperature is 30°C, Take hi = 30 W/m^2°k, h$_0$ = 5.8 W/m^2°k. Find the heat lost per meter length of pipe.
    c) Explain with sketch shell and tube heat exchanger. Also state the selection criteria for heat exchanger.

P.T.O.

4. Attempt **any two** :   **16**

  a) $0.65\ m^3$ of hydrogen at 100 KPa and 20°C is compressed adiabatically to 1400 KPa and then expanded isothermally to the original volume. Determine

     i) Pressure at the end of isothermal expansion.

     ii) Heat added to the gas during isothermal expansion.

     iii) Heat extracted from the gas after isothermal expansion to reduce it to original state of pressure at constant volume Take, R = 4.124 KJ/Kg°k, Cp = 14.256 KJ/Kg°K.

  b) Why compounding of steam turbine is done ? Give types of compounding. Explain any one method with the help of pressure velocity variation.

  c) i) What is pre-ignition ? State the effect of preignition on J.C. engine.

     ii) Explain simple carburettor with neat sketch.

5. Attempt **any four** :   **16**

  a) Explain the working of surface condenser with neat sketch.

  b) State the factors on which the rate of evaporation of water in cooling tower depends.

  c) Explain with sketch centrifugal compressor.

  d) Explain the need of multistaging in air compressor.

  e) Compare 2 stroke and 4 stroke engine with respect to

     i) Thermal efficiency

     ii) Mechanical efficiency

     iii) No. of power stroke per cycle

     iv) Power produced

  f) Define a term transmitivity and emissivity used in heat transfer.

6. Attempt **any four** :   **16**

  a) Draw a labelled layout of steam power plant.

  b) Differentiate heat pump and refrigerator on any four point.

  c) State advantages and disadvantages of plate and fin type heat exchanger.

  d) Define thermal conductivity. Give its unit. Which metal rod is used in your lab to conduct this experiment ? What is the value of 'K' of the rod.

  e) Define perfect and incomplete intercooling in air compressor and show it by graph also.

  f) Explain simple vapour compression cycle with block diagram. Show it on P-h and T-s diagram.

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