17352

16117

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. Attempt **any five** of the following : **20**

a) What do you mean by extensive and intensive properties ? Give two examples of each. **4**

b) State Zeroth law, first law and second law (both statement) of thermodynamics. **4**

c) Write generalised steady flow energy equation. State meaning of each term in it. Apply SFEE to nozzle and write final equation. **4**

d) CO_2 passing through a heat exchanger at a rate of 100 Kg/hr is cooled down from 800°C to 50°C. Write SFEE. Determine rate of heat removal, assuming that change in pressure, kinetic and potential are negligible. Take Cp = 1.08 KJ/Kg.K. **4**

e) Difference between heat engine and refrigerator (any four). **4**

f) 1.5 Kg of air is compressed in quasi static process from 0.1 mpa to 0.7 mpa for which (pv) is constant. If initial volume of air is 1.3 m^3, find workdown by Piston to compress the air. **4**

g) State Charles law and Boyle's law and also write its mathematical equations. **4**

P.T.O.

Marks

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

a) One Kg mass of air expands reversibly from 6.5 bar and 0.0135 m^3 to 9 final volume of 0.1 m^3, find final pressure, final temperature and work done if the expansion is adiabatic. **4**

b) 0.1 Kg of nitrogen gas is confined in a vessel. Initial volume of gas is 0.1 m^3. Heat is transformed to nitrogen at constant pressure of 1.2 bar till volume changes to 0.075 m^3. Determine final temp. of gas and work transferred. **4**

c) Draw a neat sketch of simple carburettor and label its components. **4**

d) With the help of T-S and P-h diagram, state the effect of subcooling and superheating on COP of VCR cycle. **4**

e) Draw a neat labelled sketch of shell and tube heat exchanger and explain. **4**

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

a) Define :

i) Free air delivered

ii) Isothermal efficiency

also give the equation for them. **4**

b) Draw a neat sketch of vane compressor and state its working principle. **4**

c) Represent multistage compression with intercooling (perfect) on P-V diagram. State advantages of multistage compression. **4**

d) Draw a neat schematic block diagram of vapour compression refrigeration system and state the function of each component. **4**

e) With neat sketch explain working principle of natural draught cooling tower. **4**

Marks

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

a) Represent Rankine cycle on P-V diagram. State various processes in it. Write down the formula for calculating thermal efficiency of Rankine cycle. **4**

b) State the function of condenser in steam power plant. Draw a neat sketch of surface condenser. **4**

c) State the necessity of mountings and accessories used in boiler with their functions. **4**

d) Read steam table and write the following values.

i) Liquid enthalpy and vapour enthalpy at 4 bar.

ii) Saturation pressure for 150°C.

iii) Enthalpy of steam at 1.5 bar and 350°C.

iv) Liquid entropy at 130°C. **4**

e) Determine the amount of heat, which should be supplied to 2 Kg of water at 25°C to convert it into steam at 5 bar and 0.9 dry.

Take, C_{pw} = 4.18 J/Kg K and

at 5 bar h_f = 640 KJ/Kg and

h_{fg} = 2107 KJ/Kg. **4**

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

a) Consider a composite wall made up of three materials having different thickness and different thermal conductivities. Assume temp. at interface and prepare electrical analogy circuit and hence write equation for the heat transfer through the wall. **4**

b) The inner surface of a plane brick wall is at 60°C and outer surface is at 35°C. Calculate heat transfer per m^2 of surface area of wall. Which is 220 mm thick ? Thermal conductivity for brick wall is 0.51 W/m°C. **4**

Marks

c) Hot air at temp. of 60°C is flowing through a steel pipe of 10 cm diameter. The pipe is covered with a layer of insulation of 5 cm thickness and thermal conductivity 0.23 W/mK. The inside and outside heat transfer coefficients are 58 and 12 W/m^2K Atmospheric temperature is 25°C. Find rate of heat loss from 50 m length pipe. Neglect steel pipe resistance. **4**

d) Define : Absorptivity, Transmissivity and Reflectivity. **4**

e) State Fourier's alw of heat conduction and its equation. State Stefan-Boltzman law. **4**

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

a) Difference between two stroke and four stroke engine. **4**

b) The stroke and cylinder diameter of C.I. engine are 250 mm and 150 mm respectively. If clearance volume is 0.0004 m^3 and volume at cut-off is 0.000621 m^3. Determine compression, ratio, cut off ratio and thermal efficiency of engine. **4**

c) The minimum pressure and temperature is an otto cycle are 100 Kpa and 27°C. The amount of heat added to air per cycle is 1500 KJ/Kg. Determine pressure and temperatures at all points in cycle. **4**

d) Draw value timing diagram for 4-stroke petrol engine. Represent all salient point on it. **4**

e) Compare Spark Ignition (SI) engines with Compression Ignition (CI) engines. **4**

f) Draw a neat sketch of two stroke engine and state the function of each part and crankcase in it. **4**

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