17410

15116

3 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

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

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

Marks

1. a) **Attempt any SIX of the following:** **12**

(i) State first law of thermodynamics.

(ii) Define thermodynamic work. Write its SI unit.

(iii) Write Charles Law as applied to an Ideal gas.

(iv) Represent Isothermal Process for an Ideal Gas on P - V and T - S chart.

(v) Define:

1) Degree of superheat

2) Latent Heat for steam

(vi) Explain what is bleeding of a steam.

Marks

(vii) Define Mach Number and state the significance of the same.

(viii) Write the sources of air leakage in steam condenser.

b) **Attempt any <u>TWO</u> of the following:** **8**

(i) List six boiler mountings. Sketch any one boiler mounting and label the same.

(ii) Define Daltons law of partial pressure and give its application.

(iii) Explain working of Shell and Tube type of Heat Exchanger with a neat sketch.

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

a) Write general Steady Flow Energy Equation (SFEE) per unit mass. Apply this equation to a

(i) Nozzle

(ii) Steam condenser

b) 0.340 m^3 of gas at 8 bar and 130°C is expanded adiabatically untill its pressure is 5 bar. It is then compressed isothermally to its original volume. Calculate

(i) Final temperature

(ii) Final pressure

of gas. Take $C_p = 0.950$ kJ/kg K

$C_v = 0.710$ kJ/kg K

c) Give classification of steam boilers on the basis of

(i) according to use

(ii) location of furnace

(iii) axis of shell

(iv) fuel used

Marks

d) Differentiate between impulse steam turbine and reaction type steam turbine (minimum six points)

e) Describe throttle governing of steam turbines.

f) Define:

(i) Zeroth law of thermodynamics.

(ii) Law of conservation of energy.

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

a) Explain:

(i) Point function

(ii) Path function

(iii) State

(iv) Process

b) Write equation for

(i) change in internal energy

(ii) work done

for a reversible adiabatic process.

c) Explain the principle used in forced draught and induced draught in a boiler. Also, state advantages of artificial draught over natural draught.

d) Explain the necessity of compounding of steam turbines. Also, state various types of compounding in steam turbines.

e) Explain the function of cooling tower in steam power plant. List various types of cooling towers.

f) (i) Define thermal conductivity. State its unit.

(ii) State Fouriers law of heat conduction.

Marks

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

a) Differentiate between Heat Pump and Refrigerator. (any four)

b) Sketch La-Mont boiler and explain its working.

c) Explain different energy losses in steam turbine.

d) Differentiate between force convection and natural convection (minimum four points)

e) A vacuum of 714 mm was obtained with a barometer reading of 752 mm of Hg. Correct the vacuum to a standard barometer reading of 760 mm of Hg.

f) The pressure of steam in a power plant is 10 bar. Its temperature is 195°C. State the quality of steam with reason.

Also calculate its degree of superaheat and its volume.

From steam tables, at 10 bar,

$T_s = 179.91°C$

$V_g = 0.19429\ m^3/kg$

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

a) Prove the equivalence of Kelvin Plank and Clausius statement.

b) Classify steam turbines with respect to

(i) Action of steam over moving blades

(ii) Expansion stages

(iii) Pressure of steam entering

(iv) Exhaust steam pressure

c) Differentiate between

(i) isobaric and isochoric process

(ii) isothermal process and adiabatic process for an Ideal gas.

Marks

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

a) Explain construction, working and application of evaporative type surface condenser along with a neat sketch.

b) (i) Draw a Mollier chart or h - s chart for steam. Show various regions and properties on this chart.

(ii) Draw and explain an Ideal Rankine cycle for a steam power plant. Show the cycle on

1) P - V chart

2) T - S chart

c) (i) The wall of refrigerated van of 1.8 mm of steel sheet at outer surface, 12 mm plywood at the inner surface, and 2 cm of glass wool in between. Calculate the rate of heat flow if the temperature at the inside and outside surface are –10°C and 22°C.

Take K (steel) 23.2 W/mK

K (for glass) 0.14 W/mK

K (plywood) 0.052 W/mK

(ii) Which type of heat exchanger you will use for the following applications?

1) Mills Chiller Plant

2) Radiator of an Automobile

Justify your answer.

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