17410

14115

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.

(9) Preferably, write the answers in sequential order.

Marks

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

(i) Define intensive property. Give two examples.

(ii) State Steady Flow Energy Equation (SFEE) for:

1) Boiler

2) Nozzle

(iii) State Avogadro's law.

(iv) Define ideal gas and state the assumptions made for ideal gas.

(v) State the names of two boiler mountings and two accessories.

Marks

(vi) Give four applications of steam nozzles.

(vii) List four losses in steam turbines.

(viii) State the Dalton's law of partial pressure.

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

(i) Define:

1) Dryness fraction

2) Enthalpy of dry steam

3) Enthalpy of superheated steam

4) Degree of superheat.

(ii) State the sources of air leakages and its effects in steam condenser.

(iii) Define heat transfer. Give different modes of heat transfer with one example each.

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

a) Explain Zeroth law of thermodynamic with suitable example.

b) Using Boyle's law and Charle's law derive the characteristic equation for a perfect gas.

c) Draw temperature entropy diagram for formation of steam and show the following on it -

(i) saturated liquid line

(ii) wet region

(iii) critical point

(iv) dryness fraction line.

d) Explain nozzle control governing with neat sketch.

e) Classify steam turbine on the basis of:

(i) principle of action

(ii) direction of steam flow

(iii) method of governing

(iv) steam pressure.

f) Differentiate between heat pump and refrigerator (minimum four points).

Marks

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

a) Differentiate between thermodynamic heat and work transfer (minimum three points). Give one example of each.

b) Represent the following gas processes on P-V and T-S diagram.

(i) Isothermal

(ii) Adiabatic.

c) A 5 ton of steam is compressed adiabatically in a compressor from state 1 (P_1 = 0.5 bar and x_1 = 0.85) to state 2 (P_2 = 12 bar). Determine the work input using Mollier diagram. Represent the process on enthalpy entropy diagram.

d) Explain the construction of impulse turbine with neat sketch.

e) Compare jet with surface condenser on the basis of:

(i) construction

(ii) performance

(iii) amount of cooling water circulated

(iv) application.

f) Explain working of shell and coil type of heat exchanger with neat sketch.

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

a) Define thermodynamic system. Give its classification and explain each with suitable example.

b) Define Boiler draught and state its necessity. Give its classification.

c) Explain with neat sketch, regenerative feed heating and state any two advantages.

d) In a cold storage, the wall measures 3 m × 4 m constructed of brick 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 temperature is 20°C, find out heat leakage per unit time. Thermal conductivity for brick is 0.25 W/m°K for cork 0.036 W/m°K and for pine wood 0.092 W/m°K.

Marks

e) Find the condenser efficiency, when cooling water enters a condenser at a temperature of 28°C and leaves at 39°C. The vacuum produced is 705 mm of Hg and barometer reads 760 mm of Hg.

f) Discuss the important provisions made on IBR (Indian Boiler Regulation).

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

a) (i) State Kelvin-Plank and Clausius statement of second law of thermodynamics.

(ii) Prove that the Kelvin-Plank and Clausius statement are equivalent.

b) Explain compounding to steam turbine. Sketch and explain velocity compounded impulse turbine showing pressure and velocity variations along the axis.

c) A quantity of gas has a volume of 0.14 m^3, pressure 1.5 bar and a temperature 100°C. If the gas is compressed at a constant pressure until its volume becomes 0.112 m^3.

Determine:

(i) work done in compression of gas.

(ii) change in internal energy

(iii) heat given out by a gas

Represent the above process on P-V and T-S diagram.

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

a) (i) Explain the function of cooling tower in steam power plant and give its two uses. 4

(ii) Explain forced draught cooling tower with neat sketch. 4

b) Draw labelled sketch of Babcock and Wilcox boiler. Show the path of water stream and air flue gas. Explain its working.

c) (i) State Stefan-Boltzman law. 2

(ii) Define ‘A perfect black body’. By considering a body explain the terms - absorptivity, transmissivity and reflectivity. 6