17410

21415

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

(i) Define the term 'Path function'.

(ii) State Kelvin-Plank statement.

(iii) State Charle's law.

(iv) Draw Isochoric process on P-V and T-S diagram.

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

(vi) Define degree of reaction in turbines.

(vii) State significance of Mach number.

(viii) Define vacuum efficiency of condenser.

Marks

b) **Attempt any TWO of the following:** **8**

(i) Differentiate between wet steam and dry steam.

(ii) State the factors affecting the cooling of water in a cooling tower.

(iii) Explain with sketch shell and tube type heat exchanger.

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

a) What is heat pump? What do you understand by C.O.P.?

b) Two Kg of gas at 50°C is heated at constant volume until pressure is doubled - Determine:

(i) Final temperature and

(ii) Change in internal energy

Take C_v = 0.70 KJ/kgK.

c) Why boiler draught is necessary and explain natural boiler draught.

d) Differentiate between impluse and reaction turbine.

e) Give applications of steam nozzle.

f) Write steady flow energy equation and apply it to turbine and compressor.

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

a) Define system. State its classification with examples.

b) Two Kg of gas at 250°K is compressed polytropically from 150 KPa to 300 KPa. The index of compression is 1.25. Find:

(i) Final temperature

(ii) Change in internal energy

Take C_V = 0.70 KJ/kgK for air.

Marks

c) Explain with sketch working of air-preheater in boiler.

d) Explain with sketch regenerative feed heating system.

e) Write sources of air leakage and its effect in condensers.

f) Give any four applications of heat exchangers for thermal system.

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

a) State the limitations of first law of thermodynamics.

b) Wet steam at 10 bar pressure is having total volume of 0.125 m^3 and enthalpy content is 1800 KJ.

Calculate mass and dryness fraction of steam.

c) Give classification of steam turbines.

d) A composite wall is formed of 100 mm steel plate and 60 mm layer of asbestos and 40 mm layer of fibre glass. The wall is subjected to temperature 1000°C outer steel face and 250°C at outer fibre glass face.

Calculate heat flow per square meter area of wall.

Take thermal conductivity of steel, asbestos and fibre glass as 400 watts/m°C, 100 watts/m°C and 25 watts/m°C respectively. Also calculate interface temperature.

e) Explain with sketch working of forced draught cooling tower.

f) Explain with sketch working of La-mont boiler.

Marks

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

a) Explain the following terms related to thermodynamics:

(i) Process

(ii) State

(iii) Intensive property

(iv) Extensive property

b) What is compounding of steam turbines? Explain with sketch pressure compounding.

c) 2.5 m^3 of gas at 8 bar and 180°C is heated at constant pressure till volume is doubled. If C_p = 1 kJ/kg K and C_v = 0.715 kJ/kg K Find:

(i) Change in internal energy

(ii) Work transferred

(iii) Heat transferred

(iv) Change in entropy

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

a) Give classification of steam condensers and explain with sketch Evaporative condenser.

b) Determine the enthalpy, entropy, specific volume and internal energy for one kg of steam at 7 bar if its conditions are:

(i) 85% dry and when

(ii) Superheated upto 100°C
Assume C_p = 2.1 kJ/kg K for superheated steam.
Use steam table.

c) Explain:

(i) Absorptivity

(ii) Reflectivity

(iii) Black body

(iv) Stefan-Boltzman law.
