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24225

3 Hours / 70 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 : **10**

a) Define the terms:

i) Thermodynamic System

ii) Thermodynamic Property.

b) Define the term Universal Gas Constant. State its unit.

c) Define the terms:

i) Sensible Heat

ii) Latent Heat

d) Classify the boilers according to -

i) Relative position of flow of water and hot gases

ii) Position of furnace.

Marks

e) State the Dalton's law of partial pressure.

f) Define the terms –

i) Black body

ii) Abosoptivity.

g) Classify the I.C. engines according to –

i) Method of igniting the fuel

ii) Cycle of operation.

2. Attempt any THREE of the following : **12**

a) Explain the concept of Heat engine, Heat pump and Refrigerator with block diagram.

b) Explain the concept of flow work with neat sketch.

c) Represent the isothermal process on P-V and T-S chart. State the relation to calculate the workdone during isothermal process.

d) Explain the process of steam generation with the help of T-H chart.

3. Attempt any THREE of the following : **12**

a) Represent the Rankine cycle on P-V and T-S chart. Name the various processes involved in it.

b) Draw the layout of steam power plant and label the following components –

i) Boiler

ii) Turbine

iii) Condenser

iv) Generator

v) Cooling tower

vi) Chimney

vii) Feed Pump

viii) Coal Circuit

Marks

c) Explain the method of velocity compounding of an impulse turbine for achieving rotor speed reduction.

d) Suggest the non mixing type and high capacity condenser for power plant. Draw its labeled sketch and explain its working in brief.

4. Attempt any THREE of the following : **12**

a) Explain the Fourier's law and Newton's law of cooling related to heat transfer.

b) Suggest the type of heat exchanger required for steam power plant. Explain its working with neat label sketch.

c) Represent the Carnot cycle on P-V and T-S diagram and label it. State its limitations.

d) Compare the Otto cycle with Diesel cycle on following basis -

i) Representation on P-V and T-S Chart.

ii) Compression ratio.

iii) Heat addition

iv) Application

e) The initial volume of 0.17 kg of a certain gas was 0.14 m^3 at a temperature of 15°C and a pressure of 1 bar. After adiabatic compression to 0.057m^3, the pressure was found to be 4 bar.

Find -

i) Gas constant

ii) If ratio of specific heat is 1.407, find the value of C_P and C_V.

iii) Change in internal energy.

Marks

5. Attempt any TWO of the following : **12**

a) Apply the steady flow energy equation to boiler. Show that the heat supplied to boiler increases the enthalpy of system.

b) A closed vessel contains 0.4 m^3 of steam at 10 bar and 300°C. Using following steam table -

i) Identify the quality of steam.

ii) Calculate the total enthalpy of steam

iii) Find specific volume of steam.

Take specific heat of sueperheated steam as 2.1KJ/kg K.

Absolute Pressure in bar	Temp. in °C	Sp. Volume (m^3/kg)		Sp. Enthalpy (kJ/kg)		Sp. Entropy (Kj/kg K)	
		vf	vg	hf	hg	Sf	Sg
10	179.9	1.127	0.1943	763.2	2778	2.140	6.586

c) A steam power plant having power generation capacity 660 MW is to be installed where availability of water is limited. Suggest the type of cooling tower required for this plant. Draw the neat labeled sketch and explain its working principle in brief.

6. Attempt any TWO of the following : **12**

a) Explain with neat label sketch the construction and working of Lamont boiler.

b) A 100 mm thick brick wall measuring 5m × 3 m is insulated externally by cork 80 mm thick which is further protected by wood 25 mm thick. If the interior wall temperature is - 5°C and outer wall temperature is 15°C. Determine the heat transfer through the wall per hour. Take thermal conductivities of brick, cork and wood as 0.7, 0.05, 0.20 KW/m°C respectively. Also find temperature at inner surfaces.

c) Explain with neat sketch the construction and working of single cylinder four stroke C.I. engine available in your institute laboratory.