17406

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.

Marks

1. Attempt any FIVE of the following: **20**

a) Define system. Give classification of system with one example each.

b) Define extensive property and intensive property. State two examples each.

c) State first law of thermodynamics what are the different mechanisms for transferring energy to or from a control volume.

d) A tank containing air is stirred by a paddle wheel. The work input to the paddle wheel is 9000 kJ and heat transferred to the surroundings from the tank is 3000 kJ. Determine

(i) Work done

(ii) Change in internal energy of system.

e) In an internal combustion engine, during compression stroke the heat rejected to cooling water is 50 kJ/kg and the work input is 100 kJ/kg. Calculate change in internal energy of working fluid stating whether it is gain or loss.

Marks

f) Considering heating of water at atmospheric pressure, explain sensible heat, latent heat and super heat.

g) A heat engine is supplied with 300 kJ/S of heat at fixed temperature of 290°C. The heat rejection takes place at 8.5°C and 150 kJ/sec of heat is rejected. Calculate change in entropy of cycle and state whether process is reversible or irreversible.

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

a) State value of universal gas constant with unit. Calculate characteristic gas constant using universal gas constant for water.

b) Write equation of enthalpy name of each term in it along with unit in SI system.

c) Represent isothermal and isochoric process on P-V and T-S diagram. Also state equation for above processes.

d) Gas in a container is at a pressure of 1.5 bar and volume of 4 m^3. Calculate work done if gas expands at constant pressure to twice its initial volume.

e) Air is compressed in an air compressor from 1 bar to 5 bar. Compression follows law $PV^{1.3}$ = constant. Calculate volume and temperature at the end of compression if it is $2m^3$ and 25°C at start of compression.

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

a) Compare renewable and non-renewable type of energy sources.

b) Draw a neat layout of Geo-thermal power plant. Label all the components.

c) Classify boilers. Also state pressure range for low pressure and high pressure boilers.

d) Draw a neat sketch of steam power plant and explain its working.

e) State advantages and limitations of bio-mass type of energy.

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

a) Draw a neat layout of Babcock and Wilcox Boiler and Explain its working.

Marks

b) With neat sketch explain the working of four stroke diesel engine.

c) (i) Classify I.C. engines.

(ii) Compare four stroke and two stroke I.C. engines.

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

a) Draw a neat layout of vapor compression cycle. Represent it on P-h and T-s diagram. Explain its working.

b) With neat sketch explain working of window type air conditioner.

c) Define:

(i) Refrigeration

(ii) Air conditioning

(iii) Ton of refrigeration

(iv) Coefficient of performance

(v) Moist air

(vi) Wet bulb temperature

State any four applications of refrigeration.

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

a) List any eight uses of compressed air.

b) Draw P-V diagram for compression of air in a single acting single stage reciprocating compressor with clearance. Show on it clearance volume, stroke volume and actual volume of air sucked.

c) State advantages of multistaging of compressor. Also state purpose of introducing intercooler in compressor multistaging.

d) Draw a neat sketch of centrifugal compressor and label its components. State difference between compressor and turbine.

e) Define with respect to compressor:

(i) Free Air Delivered

(ii) Volumetric efficiency

(iii) Isothermal efficiency

(iv) Adiabatic efficiency