17407

15162

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

(i) Write the PVT relation for adiabatic process and give the meaning of each suffix used.

(ii) What is dryness fraction ? Write the value of dryness fraction for wet steam and dry saturated steam.

(iii) Define the term :-

(1) Free Air Delivery

(2) Compressor Efficiency.

(iv) Write the four applications of compressed air.

(v) Classify the gas turbine on following basis -

(1) Combustion Process

(2) Path of working substance.

(vi) What is mean by Non conventional energy sources ? Write its two examples.

Marks

(vii) Write four properties of an ideal fuel.

(viii) Define higher calorific value and lower calorific value of fuel.

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

(i) One kg of gas contained in a cylinder at a pressure of 7 bar and temperature 300 k, expands four times its original volume at constant pressure.
Calculate -

(1) Initial volume

(2) Final temperature

(3) Workdone by gas

(4) Heat added

(ii) State the condition of 1 kg of steam when it

(1) at 0.5 MPa pressure and enthalpy 2460 kJ.

(2) at 1.4 MPa and volume 0.162 m^3.

(iii) Explain turboprop engine with neat sketch. How it differs from turbojet engine.

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

a) Differentiate the otto and diesel cycle on following basis -

(i) Representation on P-V chart

(ii) Representation on T-S chart

(iii) Addition of heat

(iv) Air standard efficiency and its relation.

b) How the heat transfer in automobile engines takes place ?

c) Write the features of three pass packaged type boiler.

d) Draw the label sketch of Lamont boiler. Show the path of water, steam and flue gases on it. Write the two advantages of Lamont boiler.

e) Define the volumetric efficiency of compressor. Write the factors affecting on volumetric efficiency of compressor.

f) State the four advantages and four disadvantages of closed cycle gas turbine over open type gas turbine.

Marks

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

a) Explain the effect of perfect intercooling on two stage reciprocating air compressor with P.V. diagram.

b) Explain the Brayton cycle on P.V. and T-S diagram. Write the relation to calculate the thermal efficiency of it.

c) What are the different factors to be consider, while selecting the site for conventional power plant.

d) Draw the layout of thermal power plant. Show the path of steam, water, coal and flue gas on it. Write the two examples of thermal power plant.

e) Give the detail classification of fuel. Write two advantages and two disadvantages of liquid fuel.

f) Explain the combustion chemistry of carbon with incomplete combustion and complete combustion.

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

a) Draw the label sketch of nuclear power plant with pressurised water reactor. Explain its working in brief. State the applications of it.

b) Why the analysis of coal is carried out ? Explain the ultimate analysis and proximate analysis of coal.

c) Explain the use of solar energy to generate electricity with neat sketch. State the advantages and disadvantages of it. Write the two places where solar energy power plants are based.

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

a) One kg of air at 115 kPa and 15°C is compressed adiabatically to a volume of 0.1 m^3. Calculate final temperature and pressure of an air. Take -

Cv = 0.712 kJ/kg°k, R = 0.287 kJ/kg °k, υ = 1.4 for air.

b) (i) List the sources of air leakage in condenser. Explain its effect on condenser performance.

(ii) State the necessity of condenser. Show the location of it in thermal power plant with line diagram.

Marks

c) Compare the reciprocating compressor with rotary compressor on following parameters -

(i) Working principle

(ii) Delivery pressure range

(iii) Capacity

(iv) Volume handled

(v) Nature of flow

(vi) Maintenance

(vii) Applications

(viii) Balancing

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

a) Represent the carnot cycle on P-V and T-S chart. Why this cycle is not used in practice ?

b) Explain the working of surface condenser with neat sketch.

c) State the necessity of multistaging of air compressor ? What is its impact on compressor performance ?

d) Explain the construction and working of closed cycle gas turbine.

e) Differentiate between open cycle gas turbine and closed cycle gas turbine on following basis -

(i) Working principle

(ii) Combustion process involved

(iii) Thermal efficiency

(iv) Maintenance

f) Draw the neat sketch of screw compressor and explain its working in brief. State its application.