22441

23124

3 Hours / 70 Marks Seat No. | | | | | | | | |

Instructions – (1) All Questions are *Compulsory.*

(2) Illustrate your answers with neat sketches wherever necessary.

(3) Figures to the right indicate full marks.

(4) Assume suitable data, if necessary.

(5) Use of Non-programmable Electronic Pocket Calculator is permissible.

(6) Use of Steam tables, logarithmic, Mollier's chart is permitted.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. Attempt any FIVE of the following : **10**

a) Define system. List different types of systems.

b) State the "Zeroth law of thermodynamics."

c) Define "Calorific value" of fuel.

d) Enlist factors affecting volumetric efficiency of reciprocating air compressor.

e) Define :

i) Dryness fraction

ii) Degree of superheat

f) List different renewable energy sources.

g) State the advantages of solar energy.

Marks

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

a) Describe construction and working of impulse turbine.

b) Represent with the help of P–V and T–S diagram Isobaric and Isothermal processes. Also write formulae for work done.

c) Compare water tube and fire tube boiler on the basis of -

i) Path of flue gases

ii) Evaporative capacity

iii) Pressure of steam

iv) Applications with example.

d) State the necessity of multi-staging and intercooling of compressor.

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

a) Differentiate between conduction and convection.

b) Estimate higher and lower calorific value of a coal having following composition by mass, carbon = 79%, Hydrogen = 6.5% Oxygen = 8%, Nitrogen = 2.5%, Sulphur = 1.5% and remaining ash.

c) Suggest energy conservation techniques used in air compressor.

d) One kg of air contained in a cylinder at a pressure of 5 bar and temperature 200K, expands four times its original volume at constant pressure. Calculate -

i) Initial volume

ii) Final temperature

iii) Work done by gas

iv) Heat added

Take C_v = 0.714 KJ/KgK, C_p = 1.005 KJ/kgK

Marks

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

a) Represent otto and diesel cycle on P–V and T–S diagram.

b) Explain ultimate analysis and proximate analysis of coal.

c) Define energy conservation by cogeneration. State the need for cogeneration.

d) Explain with neat sketch construction and working of centrifugal compressor.

e) Sketch energy flow diagram for I.C. engines.

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

a) Describe with neat sketch construction and working of Bomb calorimeter. Write Dulong's formula and state its use.

b) Draw neat sketch of two pass down flow surface condenser. Explain its construction and working. State function of condenser in steam power plant.

c) State the steps involved to calculate the output of a solar photovolatic system.

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

a) Describe with neat sketch working of two stage reciprocating air compressor. Enlist the applications of compressed air.

b) Determine the quantity at heat required to produce 1 kg of steam at a pressure of 6 bar from water at a temperature of 25°C, under the following conditions :

i) When steam is wet having a dryness fraction 0.9.

ii) When steam is dry saturated.

iii) When steam is superheated at a constant pressure at 250°C.

(Take - C_{psup} = 2.3 KJ/kgk, C_{pwet} = 4.187 KJ/kgk, for 6 bar, h_f = 670.4 KJ/kg, h_{fg} = 2085 KJ/kg, and t_{sat} = 158.8°C)

c) Describe government policy (MNRE) for harnessing the potential power of renewable energy sources.