TED (15) – 4024

(REVISION — 2015)

Reg. No.....

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2018

THERMAL ENGINEERING

[*Time* : 3 hours

(Maximum marks : 100)

[*Note* :—1. Use of Steam tables and Mollier charts are permitted.

2. Missing data if any can be assumed suitably.]

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. State Zeroth law of thermodynamics.
2. Define superheated steam.
3. State specific fuel consumption.
4. Draw P-V diagram of an Otto cycle.
5. List any four uses of compressed air. (5×2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Derive the expression for external work done during isothermal process.
2. Explain System, Boundary and Surroundings in thermodynamics.
3. Explain with neat sketch the working of four stroke diesel engine.
4. Define (i) Mechanical efficiency
   (ii) Relative efficiency
   (iii) Thermal efficiency
5. Explain process of formation of steam at constant pressure.
6. Define the methods of heat transfer.
7. An engine working an Otto cycle has a cylinder diameter of 150 mm and a stroke of 225 mm. The clearance volume is 1.25×10^{-3} m^3. Find the air standard efficiency of this engine. Take $\gamma = 1.4$ (5×6 = 30)

Marks

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

UNIT — I

III (a) Derive the expressions for work done, change in internal energy, heat transfer, change in enthalpy of gas undergoing a Constant volume process. 8

(b) Air at a pressure of 1.5 bar and a volume of 0.1 m^3 is expanded isothermally to a volume of 0.5 m^3 . Calculate the Final pressure of the gas, Heat supplied and work done during the process. 7

OR

IV (a) A mass of air has an initial pressure of 2MN/m^2, volume 0.1 m^3 and temperature 200°C. It is expanded to its final pressure of 0.3 MN/m^2 and its volume become 0.5 m^3. Determine,

(i) Mass of air (ii) Final temperature of air (assume R = 0.287 KJ/Kg K) 8

(b) Illustrate that, Heat transferred during a Constant pressure process is equal to change in enthalpy. 7

UNIT — II

V (a) The air standard efficiency of a Otto cycle engine is 51%. The pressure and temperature at the beginning of isentropic compression are 1.5 bar and 25° C respectively. Calculate,

(i) Compression ratio

(ii) Temperature at the end of compression

(iii) Pressure at the end of compression (assume $\gamma = 1.4$) 8

(b) Explain an actual valve timing diagram of a Four stroke petrol engine. 7

OR

VI (a) Derive Air standard efficiency of a Joule cycle. 8

(b) In a diesel engine the compression ratio is 13 : 1 and the fuel is cut off at 8 % of the Stroke. Find the air standard efficiency of the engine. Take $\gamma = 1.4$ for air. 7

UNIT — III

VII (a) Explain the working of a Single cylinder Double acting steam engine with neat figure. 8

(b) Dry saturated steam at a pressure of 10 bar is expanded in a nozzle to a pressure of 0.7 bar. Using Mollier diagram find the velocity and dryness fraction of steam issuing from the nozzle under following conditions.

(i) Friction in the nozzle is neglected.

(ii) 15 % of the heat drop is lost in friction. 7

OR

Marks

VIII (a) Determine the quantity of heat required to produce 1 kg of steam at a pressure of 6 bar and a temperature of 25°C, under following conditions.

(i) When steam is wet and having a dryness fraction 0.9

(ii) When the steam is dry saturated, and

(iii) When it is superheated at a constant pressure at 250°C assuming the mean Specific heat of superheated steam to be 2.3 KJ/Kg K. 8

(b) Explain the flow of steam through a convergent - divergent nozzle. 7

UNIT — IV

IX (a) A single stage reciprocating compressor is required to compress 1 kg of air from 1 bar to 4 bar. Initial temperature is 27°C. Compare the work requirement on following cases.

(i) Isothermal compression

(ii) Compression with $PV^{1.2}$ = constant

(iii) Isentropic compression (Assume R = 287 KJ/KgK). 8

(b) Explain Two stage reciprocating air compressor with intercooler using line diagram. 7

OR

X (a) Derive the expression for heat transfer through a composite wall. 8

(b) Explain the working of an axial flow compressor with sketch. 7