TED (15) – 4024

(REVISION — 2015)

Reg. No.....

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

THERMAL EGINEERING

[*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. Classify thermodynamic systems.
2. Define Air standard efficiency.
3. State Indicated thermal efficiency of an IC engine.
4. Define dryness fraction of steam.
5. State the major function of an intercooler in multistage air compression. (5×2 = 10)

PART — B

(Maximum marks : 30)

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

1. State :
   (a) Zeroth law of thermodynamics
   (b) First law of thermodynamics
   (c) Second law of thermodynamics
2. Derive characteristic gas equation.
3. Differentiate between Petrol engines and Diesel engines.
4. State the assumptions made in Air standard cycles.
5. While conducting normal load test, explain how the Frictional power of an I C engine is determined.
6. Define :
   (a) Wet steam (b) Dry steam (c) Super heated steam
7. Explain Absorptivity, Transmissivity and Reflectivity. (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) A gas having an initial pressure, volume, temperature as 1 bar, $2m^3$ and 100° C respectively is compressed at constant pressure until its temperature is 150° C. Calculate the amount of heat transferred and work done during the process. Assume Cp = 1·005KJ/Kg K and R = 0.297 KJ/Kg K 8

(b) State the following :

(i) Boyles law (ii) Charles law (iii) Avogadro's law 7

OR

IV (a) Certain mass of air has an initial volume of $0.028m^3$, pressure 1.25 bar and temperature 25° C which is compressed to a volume of $0.0042m^3$ according to the law $PV^{1.3}$ = constant. Find the Final pressure and Work done during compression. Also find the Reduction in pressure at a constant volume required to bring the air back to its original temperature. 8

(b) Define Perfect gas and obtain a relationship between Specific heat at constant pressure and Specific heat at constant volume. 7

UNIT — II

V (a) Explain the working of 4 stroke diesel engine with line diagrams. 8

(b) A Carnot engine works with isentropic compression ratio of 5 and isothermal expansion Ratio of 2. The volume of air at the beginning of isothermal expansion is 0.3 m^3 . If the Maximum temperature and pressure is limited to 550 K and 21 bar. Determine

(i) Minimum temperature

(ii) Air standard efficiency of the cycle

(iii) Pressure at the end of isothermal expansion

Take $\gamma = 1.4$ 7

OR

VI (a) Derive the expression for Air standard efficiency of an Otto cycle and show that,

Air standard efficiency $\eta = 1 - \frac{1}{(\gamma)^{\gamma-1}}$ 8

(b) A certain quantity of air at a pressure 1 bar and temperature 70°C is compressed Isentropically to the pressure of 7 bar in an Otto cycle engine. Heat is now added at the rate of 460 KJ per Kg of air at constant volume. Determine, (i) compression ratio of the engine (ii) temperature at the end of compression and (iii) temperature at the end of heat addition. Assume Cp = 1 KJ/Kg K and Cv = 0.707 KJ/Kg K. 7

Marks

UNIT — III

VII (a) Define :

(i) Brake power (iii) Mechanical efficiency

(ii) Indicated power (iv) Brake thermal efficiency 8

(b) Explain Morse test for a 4 cylinder I C engine. 7

OR

VIII (a) The following observations are made during a trial of a jacketed simple steam engine.

Pressure of steam supplied	= 10 bar
Cylinder feed	= 13.5 kg/min
Jacket feed	= 1.5 kg/min
Condition of cylinder and jacket feed	= 95% dry
Mass of circulating water	= 220 kg/min
Outlet temperature	= 35° C
Inlet temperature	= 15° C
Condenser temperature	= 50° C
Temperature of jacket drain	= 150° C
Indicated power	= 80 KW

Prepare a Heat Balance Sheet for the engine. 8

(b) Derive the velocity of steam at outlet (V_2) of a steam nozzle and show that $V_2 = 44.72\sqrt{h_d}$ where h_d = Heat drop. 7

UNIT — IV

IX (a) Derive an expression for heat transfer by conduction through a solid slab using Newton's law of cooling with Fourier law of heat conduction. 8

(b) Explain parallel and counter flow heat exchangers with figures. 7

OR

X (a) A single cylinder, single acting reciprocating air compressor has a cylinder diameter 150 mm and a stroke of 250 mm. Air is drawn in the cylinder at a pressure of 1 bar and a temperature of 15°C. It is then compressed to 6 bar. If the compressor speed is 120 rpm calculate,

(i) mass of air compressed per cycle

(ii) Work required per cycle

(iii) Power required to drive the compressor, if compression is adiabatic

(iv) Volumetric efficiency

Assume γ, = 1.4 and R = 0.290 KJ/KgK 8

(b) List the advantages of multistage compression. 7