TED (10)–3043

(REVISION—2010)

Reg. No. .....

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FOURTH SEMESTER DIPLOMA EXAMINATION IN MECHANICAL ENGINEERING—OCTOBER, 2013

THERMAL ENGINEERING

[*Time* : 3 hours

(Maximum marks : 100)

Marks

PART—A

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

1. Define Thermodynamic system.
2. Explain reversibility.
3. Define Internal Energy.
4. What is clearance volume ?
5. Explain forced convection. (5×2=10)

PART—B

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

1. State : (i) Boyle's Law
   (ii) Gay-Lussac's Law
   (iii) Charle's Law
2. List out the advantages of fuel.
3. Explain the volumetric efficiency of an air compressor.
4. Explain the working of a calorimeter used in measuring the H.C.V of solid fuels.
5. Explain constant volume process with the help of P.V. and P.T. diagram.
6. Compare petrol engine and diesel engine.
7. Derive an expression for conduction through composite wall. (5×6=30)

PART—C

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

UNIT – I

III (a) What is Perfect gas ? Obtain a relationship between specific heat at constant pressure and constant volume. 7

Marks

(b) 0.7 kg of a gas at 1378 KPa and 315°C are expanded to 4 times the original volume according to the Law $PV^{1.3}=C$. Determine (i) Original volume and final volume (ii) Final pressure of a gas (iii) Final temperature of gas (iv) Work transfer

Take R = 287 J/KJK Cv = 0.718 KJ/KgK. 8

OR

IV (a) Explain : (i) Zeroth Law (ii) First law of thermodynamics. 8

(b) 0.45 kg of air expands isothermally through a volume ratio 6:1. The initial pressure and temperature are 2.75 MPa and 260°C respectively. Find the initial volume of air, final pressure of air and work done during expansion.

Take CP = 1.005 KJ/Kg.K and Cv = 0.712 KJ/KgK. 7

UNIT – II

V (a) Explain the working of 4 stroke petrol engine. 8

(b) Calculate the percentage of increase in the efficiency of an otto cycle, if its compression ratio increased from 6 to 8. Take $\gamma = 1.4$. 7

OR

VI (a) A 4 cylinder 4 stroke engine develops 30 KW BP 5000 rpm. The mean effective pressure on each piston is 900 KPa and the mechanical efficiency 85%. Calculate the diameter and stroke of each cylinder assuming the length of stroke is 1.5 times the diameter of cylinder. 8

(b) List out the assumptions made in deriving the air standard efficiency of the Otto cycle. 7

UNIT – III

VII (a) Enumerate the merits and demerits of gaseous fuel. 7

(b) A certain town gas has the following composition by volume CO_2 15%, CO 2%, O_2 6%, N_2 77%. Calculate the flue gas composition by mass. 8

OR

VIII (a) What are the requirement of good fuel ? 7

(b) In a boiler trail analysis of coal by weight indicate C-60%, H_2-4.5%, O_2–7.5% remainter is incombustible. The dry flue gas has the composition by volume CO_2 9%, CO 1%, N_2 80%, O_2 10%.

(i) Determine mass of fluegas per kg of coal burnt.

(ii) Theoretical air required for complete combustion. 8

Marks

UNIT – IV

IX (a) Compare reciprocating compressor and rotary compressor. 7

(b) A copper rod 190 mm long and of 7.85 x $10^{-5}m^2$ area of cross section thermally insulated at one end through 100°C while the other end is kept at 30°C. Calculate the amount of heat which will flow in 10 minutes along the way. Thermal conductivity of copper 380 w/mk. 8

OR

X (a) Explain the working of Axial flow compressor with sketch. 7

(b) Hot oil with a capacity rate of 2500 W/k flows through double pipe heat exchanger. It enters at 360°C and leaves at 300°C. Cold fluid enters 30°C and leaves at 200°C. If the overall heat transfer co-efficient is 800 W/m^2K, determine the heat exchanger area required for :

(i) Parallel flow (ii) Counter flow. 8