

TED (15) -4024
(Revision- 2015)

N20-02989

Reg.No.....
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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE – NOVEMBER -2020.

THERMAL ENGINEERING

(Maximum Marks: 75)

[Time: 2.15 hours]

[Note:-1. Use of steam table and Mollier charts are permitted.

2. Assume missing data, if any]

PART–A

Marks

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

1. Distinguish between intrinsic and extrinsic properties.
2. Define air standard efficiency.
3. State the functions of a steam nozzle.
4. Explain the concept of Black body.
5. Define Brake power.

(3x2=6)

PART - B

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

1. Derive the characteristic gas equation.
2. Explain the Zeroth law, first law and second laws of thermodynamics.
3. Explain with neat sketches the working of four stroke petrol engine.
4. Derive the expressions for Air standard efficiency of Carnot cycle.
5. Explain process of formation of steam at constant pressure with graph.
6. Explain Newton Rikhman equation of Thermal convection.
7. A brick wall 250mm thick is faced with concrete 50mm thick. The wall is 10m long and 5m high. The temperature of the exposed brick face is 300⁰C and that of concrete is 50⁰C. Thermal conductivities of brick and concrete is 0.69W/m.⁰K and 0.93W/m.⁰K Determine: (i) Heat loss per hour
(ii) Interface temperature.

[4x6 =24]

PART - C

(Answer **any of the three units** from the following. Each full question carries 15 marks)

UNIT I

- III (a)** A gas is subject to constant volume process. Derive the expression for the following:
- | | | |
|--------------------|--------------------------------|-----|
| (i) Work done | (ii) Change in internal energy | (8) |
| (ii) heat transfer | (iv) change in enthalpy | |

- (b) One kg of an ideal gas is heated at constant pressure from 25°C to 200°C . The values of specific heats at constant volume and constant pressure are 0.73kJ/kg K and 0.98kJ/kg K respectively. Find the following:
- | | | |
|--|--------------------------------|-----|
| (i) value of characteristic gas constant | (ii) the heat added | (7) |
| (iii) ideal work done | (iv) change in internal energy | |

OR

- IV (a)** 0.0001 m^3 of air at 1000kN/m^2 expands isothermally to a volume of 0.001m^3 . The initial temperature is 25°C . Assume, $R=0.297\text{ kJ/kg K}$. Find the following:
- | | | |
|-------------------------|-----------------------|-----|
| (i) the mass of the air | (ii) final pressure | (8) |
| (iii) Work transferred | (iv) heat transferred | |
- (b) Explain universal gas constant. How is it related to characteristic gas constant. (7)

UNIT- II

- V (a)** Explain Diesel Cycle with P-V and T-S diagram. (8)
- (b) A petrol engine (Otto cycle) works at a maximum temperature of 2000°C and the temperature at the end of expansion is 800°C . Find the following (Take $\gamma = 1.4$) (i) the ideal thermal efficiency (ii) compression ratio (7)

OR

- VI (a)** Derive the expression for air standard efficiency of a joule cycle. (8)

- (b) In an ideal Diesel cycle, the compression ratio is 15:1 and the expansion ratio is 7:5:1. The temperature and pressure at the beginning of compression are 44°C and 98kN/m^2 , respectively. Pressure at the end of Expansion is 258 kN/m^2 . Determine the following (Take $\gamma = 1.4$)
- (i) the maximum temperature attained during the cycle.
 - (ii) the thermal efficiency of the cycle. (7)

UNIT- III

- VII** (a) Explain the working of a Double acting steam engine with a simple sketch. (8)
- (b) Steam approaches a nozzle with a velocity 250m/s , pressure of 3.5 bar and dryness fraction 0.95 . If the isentropic expansion in the nozzle proceeds till the pressure of the exit is 2 bar . Determine the change in enthalpy and the dryness fraction of steam using mollier chart. Calculate also the exit velocity from the nozzle. (7)

OR

- VIII** (a) Explain heat balance sheet with various parameters and necessary equations. (8)
- (b) A four cylinder four stroke engine develops 30kW BP at 5000 rpm . The mean effective pressure on each piston is 900kPa and the mechanical efficiency is 85% . Calculate the diameter and stroke length of each cylinder, assuming the length of stroke is 1.5 times the diameter of cylinder. (7)

UNIT – IV

- IX** (a) (i) State the uses of compressed air.
- (ii) List the advantages of multistage compression. (8)
- (c) How are heat exchangers classified? Explain. (7)

OR

- X** (a) Explain Fourier's law of thermal conduction. (8)
- (b) Explain the working of an axial flow compressor with sketch. (7)
