



Regulation R20

Subject code: 3P3CD

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech III Semester Supplementary Examinations, July 2022

THERMODYNAMICS

(Mechanical Engineering)

Maximum Marks: 70

Date: 27.07.2022

Duration: 3 Hours

- Note:
1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 10 marks. Answer all questions in Part A.
 3. Part B consists of 10 questions. Answer any 5 questions which carries 12M.
 4. Each question carries 12marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks

(10x2M=20Marks)

- 1 What do you understand by macroscopic and microscopic view points?
- 2 State the thermodynamic definition of work?
- 3 State the 'Clausius' theorem.
- 4 State the PMM –I
- 5 What is meant by saturated steam?
- 6 Define Latent heat?
- 7 State the Boyle's law?
- 8 Define Mole fraction?
- 9 Mention the various process of Lenoir cycle?
- 10 State different types of power cycles.

Part-B

Answer ANY FIVE QUESTIONS

(10MX 5=50Marks)

- 11 a) A turbine operates under steady flow conditions, receiving steam at the following state: 1.2 MPa, 180°C, 2785 kJ/kg, 33.3 m/sec and elevation 3 m. Steam leaves the turbine at the following state: 20 kPa, 2512 kJ/kg, 100 m/sec and elevation 0 m. Heat is lost to the surrounding at the rate of 0.29 kJ/sec. if the rate of steam flow through the turbine is 0.42 kg/sec. what is power output of turbine in kW.
b) Give the differential form of S.F.E.E. Under what condition the S.F.E.E. does reduces to Euler's equation. [5+5]

OR

- 12 a) A cylinder/ piston contains 100 L of air at 110 kPa, 25°C. The air is compressed in reversible polytropic process to a final state of 800 kPa, 200°C. Assume the heat transfer is with the ambient at 25°C and determine the polytropic exponent 'n' and the final volume of air. Find the work done by the air, the heat transfer.

b) Nitrogen gas flows into a convergent nozzle at 200 kPa, 400K and very low velocity. It flows out of the nozzle at 100 kPa, 330K. If the nozzle is insulated, find the exit velocity. [5+5]

13 a) The amount of entropy generation quantifies the intrinsic irreversibility of a process. Explain.

b) Air flows through an adiabatic compressor at 2 kg/s. the initial conditions are 1 bar and 310 K and the exit conditions are 7 bar and 560 K. Compute the net rate of availability transfer and irreversibility. Take $T_0=298$ K. [5+5]

OR

14 Define the term irreversibility process and Reversible process give an example of each? [10]

15 Explain Throttling process with neat sketch. [10]

OR

16 Describe with neat sketch the Phase transformation process. [10]

17 A Vessel of 0.35 m^3 capacity contains 0.4 kg of Carbon monoxide (molecular weight = 28) and 1 kg of air at 20°C . Calculate i) The partial pressure of each constituent ii) The total pressure in the vessel. The gravimetric analysis of air may be taken as 23.3% Oxygen (molecular weight = 32) and 76.7% nitrogen (molecular weight = 28) [10]

OR

18 Explain about the Gravimetric analysis . [10]

19 a) Derive an expression for thermal efficiency of Otto cycle.

b) An engine works on a diesel cycle with an Inlet pressure and temperature of 1 bar and 17°C . The pressure at the end of the adiabatic compression is 35 bar. The ratio of expansion, i.e. after constant pressure heat addition is 5. Calculate the heat addition, heat rejection and efficiency of the cycle. Assume $r=1.4$, $C_p=1.005 \text{ kJ/kgk}$ $C_v=0.717 \text{ kJ/kgk}$. [5+5]

OR

20 a) Explain the working of Dual combustion cycle

b) Explain the working of Atkinson Cycle. [5+5]