

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- 1 SEMESTER – OLD PAPER – S22 TO S25 – QUESTION BANK

Subject Name & Code:

Basic Mechanical Engineering- 3110006

Chapter 1: Introduction to Thermodynamics & Energy

Repeated Questions:

1. **Define/Explain Open, Closed, and Isolated systems with a sketch.**
 - (WIN 24 - Q1(a) - 03 Marks)
 - (S25 - Q1(a) - 03 Marks)
2. **Explain renewable vs. non-renewable energy sources.**
 - (WIN 22 - Q1(b) - 04 Marks)
 - (S25 - Q1(b) - 04 Marks)
3. **State and explain Zeroth Law of Thermodynamics.**
 - (WIN 24 - Q1(a) - 03 Marks)
 - (S25 - Q2(a) - Part - 03 Marks)
4. **State and explain First Law of Thermodynamics for a closed system.**
 - (WIN 23 - Q1(c)ii - Equation - Part of 07 Marks)
 - (S25 - Q2(a) - Part - 03 Marks)
5. **Discuss causes/impacts of Global Warming.**
 - (WIN 24 - Q1(c) - 07 Marks)
 - (SUM 23 - Q1(b) - Reduce global warming - Part of 04 Marks)

Other Important Questions:

- - **Define: Prime Mover, Force, Pressure, Work, Power, Heat, Enthalpy.** (SUM 24 - Q1(a) - 03 Marks | S25 - Q1(c) - Classify Prime Movers - 07 Marks)
 - **Define: Absolute Pressure, Thermal Equilibrium.** (SUM 24 - Q1(a) - 03 Marks)
 - **Write a note on Renewable Energy Sources.** (SUM 24 - Q1(c) - 07 Marks)
 - **List sources of renewable energy.** (WIN 24 - Q1(b) - 04 Marks)
 - **Unit conversions and basic calculations (Power, Energy).** (WIN 23 - Q1(c)i & iii - 07 Marks | SUM 23 - Q1(c)i - 07 Marks)

Chapter 2: Properties of Gases & Gas Processes

Repeated Questions:

1. **Derive the Characteristic Gas Equation ($PV = mRT$).**
 - (SUM 22 - Q1(c) - 07 Marks)
 - (S25 - Q1(c) - 07 Marks)
 - (WIN 24 - Q2(a) - 03 Marks)
2. **Prove that $C_p - C_v = R$.**
 - (S25 - Q2(b) - 04 Marks)
3. **Numericals on Polytropic Process (finding T , W , ΔU , Q).**
 - (WIN 22 - Q2(c) (OR) - 07 Marks)
 - (S25 - Q3(c) (OR) - 07 Marks)
 - (WIN 24 - Q2(c) - 07 Marks)
4. **Numericals on Constant Pressure Process.**
 - (WIN 23 - Q2(c) - 07 Marks)
 - (SUM 23 - Q2(c) - 07 Marks)

Other Important Questions:

- **Define: Isothermal process, Adiabatic process.** (SUM 24 - Q2(a) - 03 Marks)
- **Find expression for work done and change in internal energy for an adiabatic process.** (WIN 24 - Q1(b) - 04 Marks)
- **State Boyle's, Charles's, and Gay-Lussac's laws.** (WIN 24 - Q2(a) - 03 Marks)
- **Numericals on Adiabatic and Isothermal processes.** (SUM 23 - Q2(c) (OR) - 07 Marks)

Chapter 3: Properties of Steam

Repeated Questions:

1. **Explain Throttling Calorimeter (sketch, working, limitations).**
 - (WIN 22 - Q3(a) - 03 Marks)
 - (WIN 24 - Q2(c) (OR) - 07 Marks)
 - (SUM 22 - Q3(c) (OR) - 07 Marks)
2. **Define: Dryness Fraction, Degree of Superheat, Enthalpy.**
 - (SUM 22 - Q2(b) - 04 Marks)
 - (WIN 24 - Q2(b) - 04 Marks)
 - (SUM 24 - Q2(a) - Part - 03 Marks)
3. **Numericals on finding properties of steam (using Steam Tables).**
 - (WIN 23 - Q3(c) - 07 Marks)
 - (S25 - Q2(c) (OR) - 07 Marks)
 - (SUM 23 - Q3(c) - 07 Marks)

Other Important Questions:

- **Determine the condition of steam at a given P & T (e.g., wet, dry, superheated).** (SUM 24 - Q2(b) - 04 Marks)
- **Explain Separating Calorimeter.** (SUM 23 - Q3(c) (OR) - 07 Marks | SUM 24 - Q2(c)(OR)1 - 07 Marks)
- **Numerical on heat required to generate steam from water.** (WIN 22 - Q2(c) - 07 Marks)

Chapter 4: Heat Engines & Air Standard Cycles

Repeated Questions:

1. **Derive the expression for Air Standard Efficiency of the Otto Cycle.**
 - (WIN 24 - Q3(c) - 07 Marks)
 - (WIN 22 - Q3(c) (OR) - Derive efficiency - 07 Marks)
 - (SUM 23 - Q4(c) (OR) - Derive efficiency - 07 Marks)
2. **Derive the expression for Air Standard Efficiency of the Diesel Cycle.**
 - (WIN 24 - Q3(c) (OR) - Derive efficiency - 07 Marks)
 - (S25 - Q3(c) (OR) - Derive expression - 07 Marks)
 - (SUM 22 - Q3(c) - Derive efficiency - 07 Marks)
3. **State the assumptions of Air Standard Cycles.**
 - (WIN 24 - Q3(a) (OR) - 03 Marks)
4. **State limitations/assumptions of the Carnot cycle.**
 - (WIN 24 - Q3(a) - 03 Marks)
 - (SUM 22 - Q3(b) - Justify independence from fluid - 04 Marks)

Other Important Questions:

- **Numericals on Otto Cycle efficiency, MEP, power.** (WIN 22 - Q3(b) - 04 Marks | SUM 24 - Q3(b) (OR) - 04 Marks | WIN 23 - Q5(c) - 07 Marks)
- **Numericals on Diesel Cycle efficiency, power, BSFC.** (WIN 24 - Q3(c) (OR) - 07 Marks | SUM 24 - Q3(c) (OR) - 07 Marks)
- **Draw P-V and T-S diagrams for cycles.** (WIN 24 - Q3(c) - 07 Marks)
- **Explain the Rankine cycle (T-S diagram, efficiency).** (WIN 23 - Q4(c) - 07 Marks | WIN 24 - Q3(b) (OR) - Derive efficiency - 04 Marks)

Chapter 5: Steam Boilers

Repeated Questions:

1. **Explain Babcock and Wilcox boiler with a neat sketch.**
 - (SUM 22 - Q5(c) - 07 Marks)
 - (WIN 24 - Q4(c) (OR) - 07 Marks)
2. **Explain Cochran boiler with a neat sketch.**
 - (WIN 22 - Q3(c) (OR) - 07 Marks)
 - (WIN 24 - Q4(c) - 07 Marks)
3. **Define/List essential qualities of a good boiler.**
 - (S25 - Q3(b) (OR) - 04 Marks)
 - (WIN 24 - Q4(a) (OR) - 03 Marks)
4. **Differentiate between Fire Tube and Water Tube boilers.**
 - (WIN 22 - Q3(b) - 04 Marks)
 - (SUM 22 - Q5(b) - Adv/Dis - 04 Marks)
5. **What are mountings and accessories? List them with functions.**
 - (WIN 23 - Q1(a) - 03 Marks)
 - (WIN 24 - Q4(b) (OR) - Differentiate - 04 Marks)
 - (S25 - Q3(b) (OR) - List mountings - 04 Marks)

Other Important Questions:

- **Classify boilers.** (SUM 23 - Q1(a) - 03 Marks | SUM 24 - Q4(b) - 04 Marks)
- **Explain the function of specific mountings/accessories (Economizer, Superheater, Fusible plug, etc.).** (SUM 23 - Q2(a) - 03 Marks | WIN 23 - Q2(a) - 03 Marks)
- **What is an economizer? Why is it used?** (SUM 22 - Q5(a) (OR) - 03 Marks | SUM 24 - Q4(a) (OR) - 03 Marks)

Chapter 6: Internal Combustion Engines

Repeated Questions:

1. **Compare SI (Petrol) and CI (Diesel) engines.**
 - (S25 - Q2(c) - 07 Marks)
 - (WIN 24 - Q3(a) (OR) - 03 Marks)
2. **Compare 2-Stroke and 4-Stroke engines.**
 - (WIN 24 - Q3(b) - 04 Marks)
3. **Explain 4-Stroke Diesel/Petrol engine with a neat sketch.**
 - (WIN 24 - Q3(c) (OR) - 07 Marks)
 - (SUM 22 - Q2(c) (OR) - 07 Marks)
4. **Explain 2-Stroke Petrol engine with a neat sketch.**
 - (WIN 22 - Q5(b) - 04 Marks)
5. **Numericals on Indicated Power, Brake Power, Mechanical/ Thermal efficiencies.**
 - (SUM 22 - Q2(c) - 07 Marks)
 - (WIN 22 - Q4(c) - 07 Marks)
 - (WIN 23 - Q3(b) - 04 Marks)
 - (SUM 24 - Q3(c) (OR) - 07 Marks)

Other Important Questions:

- **Classify I.C. Engines.** (SUM 24 - Q3(b) - 04 Marks)
- **Define: TDC, BDC, Compression Ratio.** (SUM 24 - Q3(a) - 03 Marks)
- **Function of engine components (Spark Plug, Injector, Piston Rings).** (S25 - Q4(a) (OR) - 03 Marks | SUM 24 - Q3(a) (OR) - 03 Marks)

Chapter 7: Pumps & Chapter 9: Air Compressors

Repeated Questions:

1. **What is priming? Why is it required in centrifugal pumps?**
 - (S25 - Q3(a) (OR) - 03 Marks)
 - (WIN 24 - Q4(a) - 03 Marks)
 - (SUM 22 - Q4(b) (OR) - 04 Marks)
2. **Explain centrifugal pump with a neat sketch.**
 - (WIN 22 - Q5(c) (OR) - 07 Marks)
 - (WIN 24 - Q5(c) - 07 Marks)
 - (SUM 24 - Q4(c) - Part - 07 Marks)
3. **Compare Reciprocating and Centrifugal Pumps.**
 - (WIN 23 - Q4(b) - 04 Marks)
 - (WIN 24 - Q4(b) (OR) - 04 Marks)
4. **Define terms for compressors: FAD, Swept Volume, Volumetric Efficiency.**
 - (SUM 23 - Q5(b) - Part - 04 Marks)
 - (WIN 24 - Q4(a) (OR) - 03 Marks)
5. **Numericals on Reciprocating Compressor power.**
 - (SUM 22 - Q4(c) (OR) - 07 Marks)
 - (S25 - Q5(c) - 07 Marks)

Other Important Questions:

- **Classify pumps/compressors.** (SUM 24 - Q4(b) (OR) - 04 Marks | WIN 23 - Q5(b) - 04 Marks)
- **Explain the need for multi-staging in compressors (with P-V diagram).** (WIN 24 - Q4(b) - 04 Marks)
- **Uses of compressed air.** (WIN 22 - Q4(b) - 04 Marks | WIN 24 - Q4(a) - 03 Marks)
- **Explain a rotary pump/compressor (e.g., Roots blower).** (WIN 23 - Q4(b) (OR) - 04 Marks | SUM 24 - Q5(b) (OR) - 04 Marks)

Chapter 10: Refrigeration & Air Conditioning

Repeated Questions:

1. **Explain Vapour Compression Refrigeration System (VCRS) with a sketch.**
 - (WIN 22 - Q5(c) - 07 Marks)
 - (WIN 24 - Q5(b) (OR) - 04 Marks)
 - (SUM 23 - Q2(b) - 04 Marks)
2. **Define: Refrigeration, Refrigerant, COP, Air Conditioning.**
 - (WIN 24 - Q5(a) - 03 Marks)
 - (SUM 24 - Q4(a) - 03 Marks)
 - (SUM 22 - Q5(a) - 1 Ton of Refrigeration - 03 Marks)
3. **Explain Vapour Absorption Refrigeration System (VARs) with a sketch.**
 - (S25 - Q4(b) - 04 Marks)
 - (WIN 23 - Q3(b) - 04 Marks)
4. **Explain a Domestic Refrigerator/Window AC/Split AC with a sketch.**
 - (SUM 24 - Q5(b) - 04 Marks)
 - (WIN 23 - Q3(b) (OR) - Window AC - 04 Marks)
 - (WIN 24 - Q4(c) (OR) - Split AC - 07 Marks)
 - (S25 - Q5(b) - 04 Marks)

Other Important Questions:

- **Properties of a good refrigerant.** (SUM 22 - Q4(b) - 04 Marks)
- **Why does a split AC consume more power?** (SUM 23 - Q3(b) (OR) - 04 Marks)

Chapter 11: Couplings, Clutches & Brakes and Chapter 12: Transmission

Repeated Questions:

1. **Differentiate between Clutch and Brake.**
 - (WIN 24 - Q5(b) (OR) - 04 Marks)
 - (WIN 23 - Q4(a) (OR) - 03 Marks)
2. **Explain Centrifugal Clutch with a neat sketch.**
 - (WIN 24 - Q5(c) (OR) - 07 Marks)
 - (S25 - Q5(c) (OR) - 07 Marks)
3. **Compare Belt, Chain, and Gear drives.**
 - (WIN 24 - Q5(b) - 04 Marks)
 - (SUM 24 - Q5(c) (OR) - 07 Marks)
 - (S25 - Q5(c) (OR) - 07 Marks)
4. **Classify clutches.**
 - (SUM 23 - Q4(a) - 03 Marks)
 - (WIN 23 - Q3(a) - 03 Marks)
5. **Function of Clutch, Brake, and Coupling.**
 - (WIN 22 - Q4(a) (OR) - 03 Marks)

Other Important Questions:

- **Define/Differentiate between Rigid and Flexible coupling.** (S25 - Q4(a) - 03 Marks | SUM 22 - Q4(a) (OR) - 03 Marks)
- **Explain Fast and Loose Pulley drive.** (WIN 22 - Q2(b) - 04 Marks | WIN 23 - Q5(a) - 03 Marks)
- **Explain an Internal Expanding Shoe Brake.** (WIN 24 - Q5(b) - 04 Marks | WIN 22 - Q5(b) (OR) - 04 Marks)
- **Application of different gears (Helical, Worm, Rack & Pinion).** (WIN 24 - Q5(a) - 03 Marks)

Chapter 13: Engineering Materials

Repeated Questions:

1. **Define mechanical properties: Hardness, Toughness, Ductility, Elasticity, etc.**
 - (S25 - Q4(b) - 04 Marks)
 - (WIN 22 - Q5(a) (OR) - 03 Marks)
 - (WIN 24 - Q5(c) (OR) - 07 Marks)
2. **Classify engineering materials / Explain properties.**
 - (WIN 22 - Q2(a) - 03 Marks)
 - (SUM 23 - Q2(b) - Identify properties - 04 Marks)
 - (SUM 24 - Q5(a) - 03 Marks)

Other Important Questions:

- **What are non-metallic materials? State applications.** (WIN 24 - Q2(b) - 04 Marks)
- **Properties and applications of Cast Iron.** (WIN 23 - Q2(b) - 04 Marks)
- **Properties and applications of Non-Ferrous metals.** (SUM 22 - Q3(b) (OR) - 04 Marks)