Engg Thermodynamics Important Questions PDF

The most important Engineering Thermodynamics topics are the first law for closed and open systems, the steady flow energy equation, the second law with Carnot efficiency, entropy, steam properties with the Rankine cycle, and air standard cycles such as Otto and Diesel. Practise definitions, two or three standard derivations per unit and short numericals with units written at every step.

Key takeaways

- These are practice questions based on common B.Tech syllabus topics. They are not verified past papers.
- Check your own university syllabus and official question papers before you plan revision.
- Each unit lists definitions, derivations and numericals with a short answer outline.
- Write the system boundary, assumptions and sign convention before solving any numerical.
- Keep steam tables and a scientific calculator ready while practising.

Before you start: how to use these questions

The questions below follow the five-unit pattern most Indian B.Tech mechanical syllabi use for Engineering Thermodynamics. Your university may order units differently or add topics such as psychrometry or real gases. These are **practice questions based on common syllabus topics, not verified past papers**. Always compare them with your own syllabus and your university's official papers. AKTU students can find official old papers on the AKTU old question paper page, and the Uncodemy previous year question papers hub links official sources for other universities.

For numericals, use the free scientific calculator and the unit converter to check bar, kPa and kJ conversions.

Unit 1: Basic concepts and the zeroth law

Definitions and short questions

- Define system, surroundings and boundary. Differentiate closed, open and isolated systems with one example each.
- What are intensive and extensive properties? Is specific volume intensive?
- Define a quasi-static process and thermodynamic equilibrium.
- State the zeroth law and explain why it is the basis of temperature measurement.
- Is work a point function or a path function? Explain with a p-V diagram.

Long questions

- Explain displacement work and derive $W = \int p\,dV$. Show work for constant pressure, constant volume, isothermal and polytropic processes.
- Compare the macroscopic and microscopic approaches to thermodynamics.

Numerical

- A gas expands at a constant pressure of 2 bar from 0.1 m^3 to 0.3 m^3. Find the work done. *Outline:* $W = p(V2 - V1) = 200\ kPa \times 0.2\ m^3 =$ **40 kJ** (work done by the gas).

Unit 2: First law of thermodynamics

Definitions and short questions

- State the first law for a cycle and for a process.
- Show that internal energy is a property.
- What is PMM-1 and why is it impossible?
- Define enthalpy and explain why it is used for open systems.

Derivations

- Derive the steady flow energy equation (SFEE) and apply it to a nozzle, turbine, compressor and throttling valve.
- Derive the work done in a polytropic process: $W = (p1V1 - p2V2)/(n - 1)$.

Numericals

- 1 kg of air at 1 bar and 300 K is compressed adiabatically to 8 bar ($\gamma = 1.4$, $c_v = 0.718\ kJ/kg\ K$). Find final temperature and work. *Outline:* $T2 = T1\ (p2/p1)^{((\gamma-1)/\gamma)} = 300 \times 8^{0.2857} \approx$ **543 K**. Work on the gas $= c_v(T2 - T1) \approx 0.718 \times 243.4 \approx$ **175 kJ**.
- Steam enters a nozzle with negligible velocity and its enthalpy drops by 100 kJ/kg. Find exit velocity. *Outline:* SFEE with no work or heat: $V2 = \sqrt{(2 \times \Delta h)} = \sqrt{(2 \times 100{,}000)} \approx$ **447 m/s**. Remember to convert kJ to J.

Unit 3: Second law and entropy

Definitions and short questions

- State the Kelvin-Planck and Clausius statements and prove they are equivalent.
- What is PMM-2?
- Define reversible and irreversible processes. List four causes of irreversibility.
- State the Clausius inequality.
- Why is entropy called a property?

Derivations

- Prove that no engine working between two reservoirs can be more efficient than a reversible engine (Carnot theorem).
- Derive the entropy change of an ideal gas: $\Delta s = c_p \ln(T2/T1) - R \ln(p2/p1)$.
- Explain the principle of increase of entropy.

Numericals

- A Carnot engine works between 500 K and 300 K and receives 1000 kJ of heat. Find efficiency and work. *Outline:* $\eta = 1 - T2/T1 = 1 - 300/500 =$ **40%**, $W =$ **400 kJ**.
- A Carnot refrigerator works between 263 K and 303 K. Find its COP. *Outline:* $COP = T2/(T1 - T2) = 263/40 \approx$ **6.58**.
- 1 kg of water is heated from 300 K to 360 K ($c = 4.187$ kJ/kg K). Find entropy change. *Outline:* $\Delta s = c \ln(T2/T1) = 4.187 \times \ln 1.2 \approx$ **0.763 kJ/K**.

Unit 4: Availability, properties of steam and the Rankine cycle

Definitions and short questions

- Define available energy, unavailable energy and irreversibility.
- Define dryness fraction, wet steam and superheated steam.
- What is the triple point and critical point of water?
- Why is the Carnot cycle not practical for steam power plants?

Long questions

- Draw the p-v, T-s and h-s diagrams for steam and mark the regions.
- Explain the Rankine cycle with a T-s diagram and derive its efficiency in terms of enthalpies, $\eta = [(h1 - h2) - (h4 - h3)]/(h1 - h4)$.
- Explain how reheating and regeneration improve the Rankine cycle.
- Describe the throttling calorimeter or separating-throttling calorimeter for finding dryness fraction.

Numerical

- Steam at a given boiler pressure and temperature expands in a turbine to a given condenser pressure. Find the Rankine efficiency with and without pump work. *Outline:* read h1 and s1 from the superheat table, find dryness x2 from s1 = s2, compute h2, take pump work $\approx v(p1 - p2)$, then apply the efficiency formula. Show every table value you read.

Unit 5: Gas power cycles and refrigeration basics

Definitions and short questions

- Define compression ratio, cut-off ratio and mean effective pressure.
- Why is the Diesel cycle less efficient than the Otto cycle for the same compression ratio?
- What is ton of refrigeration?

Derivations

- Derive the air standard efficiency of the Otto cycle: $\eta = 1 - 1/r^{(\gamma-1)}$.
- Derive the efficiency of the Diesel cycle and the dual cycle.
- Compare Otto, Diesel and dual cycles for the same compression ratio and heat input.

Numericals

- Find the air standard efficiency of an Otto cycle with r = 8 and γ = 1.4. *Outline:* η = 1 - 1/8^0.4 = 1 - 1/2.297 ≈ **56.5%**.
- A Diesel cycle has r = 16 and cut-off ratio 2. Find efficiency (γ = 1.4). *Outline:* use η = 1 - (1/r^(γ-1)) × (ρ^γ - 1)/(γ(ρ - 1)). 16^0.4 ≈ 3.031 and 2^1.4 ≈ 2.639, so η ≈ 1 - 1.171/3.031 ≈ **61.4%**, lower than the Otto value of about 67% for r = 16.

How to score well in Engineering Thermodynamics

- **Draw first.** A neat p-v or T-s diagram earns marks even if your arithmetic slips.
- **Write assumptions.** "Steady flow, negligible kinetic and potential energy change" tells the examiner you know the model.
- **Track units.** Most lost marks come from mixing kPa with bar or kJ with J.
- **Learn sign conventions.** State whether heat added and work done by the system are positive.
- **Practise steam tables.** Interpolation questions are common and easy to score if you practise.
- **Revise by unit.** Two definitions, one derivation and two numericals per unit each day in the last two weeks works well.

Frequently asked questions

Are these Engineering Thermodynamics questions from past papers?

No. They are practice questions based on common B.Tech syllabus topics. Check your university syllabus and official question papers, such as the AKTU old question paper page, before you plan revision.

Which unit of thermodynamics is most important?

The first law with SFEE and the second law with entropy usually carry the most weight, because later units build on them. Your university's paper pattern decides the final weight.

Are steam tables allowed in the exam?

Most universities allow steam tables and Mollier charts in the thermodynamics exam, but rules differ. Confirm with your department or the paper instructions.

How should I prepare numericals in thermodynamics?

Draw the process diagram, write known values with units, state assumptions, pick the right equation and solve step by step. Recheck unit conversions at the end.

Which derivations should I learn for Engineering Thermodynamics?

Common ones are polytropic work, the steady flow energy equation, entropy change of an ideal gas, and Otto and Diesel cycle efficiency. Check your syllabus for others.

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Sources and further reading

- AKTU old question papers (official)

- NPTEL courses for mechanical engineering
- AICTE (model curriculum and approvals)

About this PDF

Prepared by the Uncodemy trainer team as a revision aid. Questions are practice questions based on common syllabus topics, not verified past papers. Corrections: info@uncodemy.com.

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