Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 81653

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fourth Semester

Mechanical Engineering

ME 3451 — THERMAL ENGINEERING

(Common to Mechanical Engineering (Sandwich)

(Regulations 2021)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the processes involved in a Rankine cycle.
2. Define the term 'cut-off ratio' in Diesel cycle.
3. State the function of a steam injector.
4. Mention any two effects of nozzle friction on steam flow.
5. What is meant by compounding in turbines?
6. Name any two types of gas turbine configurations.
7. What is the function of a carburetor in SI engines?
8. List two differences between two-stroke and four-stroke engines.
9. Define brake specific fuel consumption (BSFC).
10. Mention any two types of cooling systems used in IC engines.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the influence of compression ratio on the efficiency of otto and diesel cycles. How does it affect engine design?

Or

(b) Describe how reheat and regeneration improve the performance of Rankine cycles. Compare their effects using schematic diagrams.

12. (a) Discuss the significance of convergent and divergent sections in nozzle design. Explain how nozzle profiles affect expansion and energy conversion?

Or

(b) Explain how steam quality and nozzle efficiency affect the performance of an injector system. Illustrate with industrial applications.

13. (a) Explain the working of a gas turbine cycle with reheating and inter-cooling. What are the effects on specific output and thermal efficiency?

Or

(b) Compare impulse and reaction turbines in terms of construction, velocity diagrams, and applications. Why is a reaction turbine preferred in large steam power plants?

14. (a) Describe the importance of valve timing in four-stroke engines. How does advanced or retarded timing affect engine performance and emissions?

Or

(b) Compare the combustion process in direct injection and indirect injection CI engines. What are the advantages of each?

15. (a) Discuss the working and components of an electronic ignition system. How does it improve engine performance compared to a conventional system?

Or

(b) Explain the purpose and function of cooling systems in IC engines. Compare air cooling and liquid cooling methods with examples.

PART C — ($1 \times 15 = 15$ marks)

16. (a) Propose a thermodynamic layout for a solar-assisted Rankine power plant. Include thermal storage, and evaluate its efficiency improvement compared to a conventional fossil-fuel Rankine cycle.

Or

(b) Analyze the performance and emission characteristics of a hybrid engine (IC + electric) for an urban transport vehicle. Suggest design considerations to optimize fuel economy and to reduce NOx emissions.