



Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MTECH
(SEM I) THEORY EXAMINATION 2025-26
ADVANCED I.C. ENGINES

TIME: 3 HRS

M.MARKS: 70

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt all questions in brief.

02 x 7 = 14

Q no.	Question
a.	Differentiate between Swirl and Squish charge motions.
b.	List two factors responsible for the differences between Ideal and Real Engine cycles.
c.	Briefly explain the purpose of Supercharging in IC Engines.
d.	What is MPFI and how does it improve the performance of an SI engine?
e.	Define Ignition Delay in a CI engine.
f.	What is the main function of a Catalytic Converter?
g.	Briefly explain the concept of HCCI (Homogeneous Charge Compression Ignition).

SECTION B

2. Attempt any three of the following:

07 x 3 = 21

Q no.	Question
a.	Describe the thermo-chemistry of fuel-air mixtures and their properties as related to engine cycle analysis.
b.	Explain the phenomenon of Abnormal Combustion in SI engines. Discuss the role of fuel factors in its control.
c.	Elaborate on the Fuel Spray Behavior and Mixing Formation and control mechanisms in a Compression Ignition (CI) engine.
d.	Explain the importance of heat transfer in IC engines and discuss the components of the engine energy balance.
e.	Discuss the nature and extent of pollution problems caused by IC engines. Briefly explain the formation of Nitrogen Oxides (NO _x).

SECTION C

3. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question
a.	Explain the procedure for Computer Modeling of engine cycles. Discuss how this modeling helps in understanding the differences between Ideal and Real engine cycles.
b.	What is Volumetric Efficiency? Derive an expression for the volumetric efficiency of an engine and discuss the factors affecting it.

4. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question
a.	Describe in detail the working principle of a Common Rail Fuel Injection System in a CI engine. Highlight its advantages over conventional systems.

Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MTECH
(SEM I) THEORY EXAMINATION 2025-26
ADVANCED I.C. ENGINES

TIME: 3 HRS

M.MARKS: 70

b.	Explain the effect of combustion and speed on the performance of a Spark Ignition (SI) engine. Discuss the causes and consequences of Cyclic Variations in combustion.
----	--

5. Attempt any *one* part of the following: 07 x 1 = 07

Q no.	Question
a.	Discuss the different types of particulate emissions from CI engines and describe the working of Particulate Traps used for their control.
b.	Explain the working of Selective Catalytic Reduction (SCR) and Lean NOx Catalysts used for the treatment of engine exhaust gas.

6. Attempt any *one* part of the following: 07 x 1 = 07

Q no.	Question
a.	Describe the application and necessary modifications in I.C. engines to effectively use Bio-fuels.
b.	Explain the concepts of Lean Burning and Adiabatic concepts in modern IC engines. What are the potential benefits of these trends?

7. Attempt any *one* part of the following: 07 x 1 = 07

Q no.	Question
a.	Explain the Fuel supply systems for SI and CI engines to use Gaseous fuels like LPG and CNG.
b.	Discuss the challenges and modern solutions related to adapting IC engines for use with Hydrogen as a fuel.