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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / (Full Time) - END SEMESTER EXAMINATIONS, APRIL / MAY 2025

MECHANICAL ENGINEERING
VI Semester
ME5006 ADVANCED INTERNAL COMBUSTION ENGINEERING
(Regulation 2019)

Time:3 hrs Max. Marks: 100

CO1	Classifying the gasoline fuel injection systems and analysing combustion knocking in SI engine combustion chambers
CO2	Understanding Diesel fuel injection systems and CI engine combustion
CO3	Explaining the mechanism of different pollutant formation and their control techniques
CO4	Evaluating various alternative fuel options and utilization techniques
CO5	Adopting advanced combustion modes and hybrid power train systems

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20 Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	List out three different techniques adopted for charge stratification in GDI system.	2	1	L1
2	Mention the reasons for pre-ignition in a SI engine.	2	1	L2
3	Depict the swirl, tumble, and squish motion in an CI engine	2	2	L2
4	Is turbocharging advantageous in a CI engine? Justify.	2	2	L2
5	Mention two in-cylinder treatment methods to control emissions in a IC engine.	2	3	L2
6	Mention the reason for blue and black smoke form a Diesel engine exhaust.	2	3	L2
7	Which of the following fuels has the highest reactivity? Why? **Gasoline / Methanol / CNG / LPG**	2	4	L2
8	List out one example each for dual fuel and bi-fuel systems.	2	4	L1
9	How different is HCCI from RCCI.	2	5	L2
10	What is low temperature combustion? Why it is used?	2	5	L1

PART- B (5 x 13= 65 Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	i) With a schematic describe how air-fuel mixture is burnt in a SI engine using an electronic port fuel injection system.	11	1	L2
	ii) List two commonly used combustion chamber in a SI engine	2	1	L2
	OR			
11 (b)	i) What is spark knock? Discuss the factors that affect knocking in a SI engine.	2+7	1	L2
	ii) Brief about SI engine air-fuel mixture requirement during different conditions.	4	1	L2

12 (a)	Explain about knocking in a CI engine. Also discuss about factors which affect knocking in a CI engine. Support your answer with appropriate illustration.	**5+5+3**	2	L2
	OR			
12 (b)	i) List three commonly used CI engine combustion chambers.	**3**	2	L2
	ii) With a schematic explain the operation of Common Rail Direct injection system	**10**	2	L2
13 (a)	List the major emissions from a CI engine. Mention the working principle of EGR, SCR, TWC, DPF and LNT systems.	**2+11**	3	L3
	OR			
13 (b)	i) Draw a schematic of a three way catalytic converter, and mention the parts.	**5**	3	L2
	ii) Discuss briefly about emission norms and driving cycles	**4+4**	3	L3
14 (a)	i)List the various alternative fuels to substitute gasoline and Diesel. Mention atleast two merits about that fuel which can replace Diesel / gasoline.	**5+4**	4	L3
	ii) List atleast four merits of hydrogen, that makes it to be a potential replacement for Gasoline & Diesel	**4**	4	L3
	OR			
14 (b)	List down the heating value, sp. gravity, flame speed, flammability limits, heat of vapourisation, octane / cetane rating, oxygen content, and self-ignition temperature of Diesel, Gasoline, ethanol, CNG, LPG and Hydrogen	**13**	4	L3
15 (a)	Explain about the spark assisted HCCI system with a schematic.	**9+4**	5	L5
	OR			
15 (b)	Expand RCCI. How different is it from DICI. List out the techniques adopted to achieve RCCI	**2+4+7**	5	L5

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	i) With a sketch explain the types of hybrid electric vehicles	**9**	5	L2
	ii) Compare fuel cell vehicle , BEV and PHEV	**6**	5	L4