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Subject Code:- AMTME0118

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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech

SEM: I - THEORY EXAMINATION (2022 - 2023)

Subject: Advanced I.C. Engines

Time: 3 Hours

Max. Marks: 70

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of **three Sections -A, B, & C.** It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A

15

1. Attempt all parts:-

- 1-a. The operation of forcing additional air under pressure in the engine cylinder is known as (CO1) 1
- (a) Scavenging
(b) Turbulence
(c) Supercharging
(d) Pre-ignition
- 1-b. The knocking in spark ignition engines can be reduced by (CO2) 1
- (a) Retarding the spark
(b) Increasing the engine speed
(c) Both are correct
(d) None of these
- 1-c. Supercharging is the process of (CO3) 1

- (a) Supplying the intake of an engine with air at a density greater than the density of the surrounding atmosphere
 - (b) Providing forced cooling air
 - (c) Injecting excess fuel for raising more loads
 - (d) Supplying compressed air to remove combustion products fully
- 1-d. which are produced by the incomplete burning of the air-fuel mixture in the combustion chamber? (CO4) 1
- (a) Pollutants
 - (b) Combustion
 - (c) Nitrogen di-oxide
 - (d) None of the above
- 1-e. Which of the following is true for the HCCI engine? (CO5) 1
- (a) Emits high NO_x and soot
 - (b) Have a large power range
 - (c) Efficiency is comparatively less
 - (d) Pre-catalyst hydrocarbon emissions are higher

2. Attempt all parts:-

- 2.a. Draw the valve timing diagram of 4-stroke diesel engine. (CO1) 2
- 2.b. What is equivalence ratio? (CO2) 2
- 2.c. What are the basic functions of lubricant in I.C. Engine? (CO3) 2
- 2.d. Why catalytic converter called as three-way converters? (CO4) 2
- 2.e. Can a car engine run on hydrogen? (CO5) 2

SECTION B

20

3. Answer any five of the following:-

- 3-a. What is the use of heat balance sheet of an engine? Mention the various items to be determined to complete the heat balance sheet. (CO1) 4
- 3-b. Explain the factors responsible for causing deviations between theoretical and actual cycles of I.C. engine? (CO1) 4
- 3-c. Explain – (i). Pre-ignition (ii). Auto-ignition (iii). Detonation. (CO2) 4
- 3-d. Why is spark advance required? Discuss the factors that affect ignition timing. (CO2) 4
- 3.e. Discuss different types of cooling systems of I.C. engine. (CO3) 4
- 3.f. What are the causes for hydrocarbon emission from S.I Engine? (CO4) 4

3.g. Explain why fuel cell technology is the future. (CO5) 4

SECTION C

35

4. Answer any one of the following:-

4-a. In an IC Engine working on ideal Otto cycle, the air at 1 bar 290 K is compressed adiabatically to 15 bar. On adding heat, this pressure rises to 40 bar. Calculate: 7

(i) air standard efficiency

(ii) mean effective pressure for the cycle

Take $R = 8.314 \text{ kJ/kmol K}$ and $C_v = 0.718 \text{ kJ/ kg K}$. (CO1)

4-b. An oil engine works on Dual cycle having compression ratio of 10. The pressure and temperature at the beginning of compression stroke are 1 bar and 300 K respectively. If the maximum pressure reached is 42 bar and the maximum temperature of the cycle is 1500°C , calculate: 7

(i) the temperature at the end of constant volume heat addition

(ii) cut-off ratio

(iii) work output

(iv) efficiency of the cycle

Take $C_v = 0.718 \text{ kJ/ kg K}$ and $C_p = 1.005 \text{ kJ/ kg K}$ for air. (CO1)

5. Answer any one of the following:-

5-a. What is ignition lag? Discuss the effect of engine variable on ignition lag? (CO2) 7

5-b. Explain different stages of combustion in a S.I. engine? (CO2) 7

6. Answer any one of the following:-

6-a. What is the effect of supercharging on follows? (CO3) 7

a. Power output. b. Mechanical Efficiency. c. Fuel Consumption.

6-b. Explain the methods of turbo charging compare their relative merits. (CO3) 7

7. Answer any one of the following:-

7-a. How the oil consumption increases in IC engines and what are the effects? (CO4) 7

7-b. What is a thermal converter and how it helps to reduce the emission from the engines? (CO4) 7

8. Answer any one of the following:-

8-a. Define the detailed operation of GDI engines with neat sketch. Why they are so popular. (CO5) 7

8-b. How Does hybrid engines are efficient justify your answer? (CO5) 7