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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION (2024 - 2025)

Subject: Internal Combustion Engine

Time: 3 Hours Max. Marks: 100

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 20

1. Attempt all parts:-

1-a. The intake charge in a diesel engine consists of (CO1, K1) 1

(a) air alone

(b) air + lubricating oil

(c) air + fuel

(d) air + fuel + lubricating oi

1-b. In a reciprocating engine with a cylinder diameter of D and stroke of L, the cylinder volume is(CO1, K1) 1

(a) π 4 D2L× clearance volume

(b) π 4 D2L− clearance volume

(c) π 4 D2L+ clearance volume

(d) π 4 D2L÷ clearance volume

1-c. With dissociation the exhaust gas temperature(CO2, K1) 1

(a) decreases

(b) increases

(c) no effect

(d) increases upto certain air-fuel ratio and then decreases

1-d. The ratio of the actual efficiency and the fuel-air cycle efficiency for CI engines is about (CO2, K1) 1

(a) 0.2–0.3

(b) 0.5–0.6
(c) 1
(d) 0.6–0.8

1-e. Desirable characteristics of the combustion chamber for SI engines to avoid knock is (CO3, K1) 1

(a) small bore
(b) short ratio of flame path to bore
(c) absence of hot surfaces in the last region of the charge
(d) all of the above

1-f. In CI engines knocking tendency increases with (CO3, K1) 1

(a) increase in compression ratio
(b) increasing inlet temperature of air
(c) decrease in compression ratio
(d) increasing coolant water temperature

1-g. Pump used in the forced cooling system is normally (CO4, K1) 1

(a) piston pump
(b) gear pump
(c) vane pump
(d) centrifugal pump

1-h. Engine overheating may be due to (CO4, K1) 1

(a) stuck radiator pressure cap
(b) open thermostat
(c) broken fan belt
(d) excess coolant

1-i. Mechanical efficiency is ratio of (CO5, K1) 1

(a) f p to bp
(b) f p to ip
(c) bp to ip
(d) ip to f p

1-j. Indicated power is directly proportional to (CO5, K1) 1

(a) torque
(b) air consumption
(c) cylinder peak pressure
(d) none of the above

2. Attempt all parts:-

2.a. What is the use of air-standard cycle analysis? (CO1, K1) 2

2.b. Why volatility is an important quality of S.I. engine fuels ? (CO2, K1) 2

2.c. What is a very sudden rise of pressure during combustion accompanied by 2

metallic hammer like sound? Give minimum two causes of it. (CO3, K2)

2.d. What is the effect of mechanical friction on speed. (CO4, K1) 2

2.e. What do you mean by supercharging of I.C. engines? (CO5, K1) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Make a comparative statement of operations and working media for air cycle, fuel-air cycle and actual cycle of S.I. engines.(CO21, K3) 6

3-b. Why the actual cycle efficiency is much lower than the air-standard cycle efficiency? List the major losses and differences in actual engine and air-standard cycles. (CO1, K3) 6

3-c. What are the important properties which S.I. engine fuel possess? (CO2, K1) 6

3-d. Calculate the amount of theoretical air required for the combustion of 1 kg of acetylene (C_2H_2) to CO_2 and H_2O. (CO2, K4) 6

3.e. Why is spark advance required ? Discuss the factor that affect ignition timing. (CO3, K2) 6

3.f. Explain the role anti-freeze solutions in water-cooling system. (CO4, K1) 6

3.g. With a neat diagram explain the configuration of a Wankel engine. (CO5, K1) 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Derive the expression for the efficiency and mean effective pressure of the Diesel cycle. (CO1, K4) 10

4-b. Compare SI and CI engines with respect to (i) basic cycle (ii) compression ratio (iii) fuel used (iv) speed (v) introduction of fuel (vi) efficiency (vii) ignition (viii) weight (CO1, K3) 10

5. Answer any one of the following:-

5-a. Discuss the important qualities of an SI and CI engine fuel. (CO2, K1) 10

5-b. Oxygen (O_2) is heated during a steady-flow process at 1 atm from 298 to 3000 K at a rate of 0.5 kg/min. Determine the rate of heat supply needed during this process,assuming (a) some O_2 dissociates into O and (b) no dissociation takes place. (CO2, K4) 10

6. Answer any one of the following:-

6-a. What are the various types of combustion chambers used in SI engines? (CO3, K1) 10

6-b. Explain the phenomenon of knock in C.I. engines and compare it with S.I. engine knock. (CO3, K3) 10

7. Answer any one of the following:-

7-a. Explain with a sketch the forced circulation system. State its merits and demerits. (CO4, K2) 10

7-b. Why is cooling necessary for I.C. engines? What kind of cooling system is 10

employed for mobile units like automobiles? What are the effects of load and speed on the heat loss through cylinder walls? (CO4, K2)

8. Answer any <u>one</u> of the following:-

8-a.	Explain the details of the analytical method of performance estimation. (CO5, K2)	10
8-b.	A four-cylinder, four-stroke diesel engine develops 28 kW at 2000 rpm. Its bsfc is 0.26 kg/kW h. Calculate the power output of the engine and its bsfc when the fuel rate is reduced by 40% at the same speed. Mechanical efficiency is 0.80. Assume that the indicated thermal efficiency changes linearly with equivalence ratio and there is 1% increase in indicated thermal efficiency for 6% increase in the equivalence ratio. Equivalence ratio (φ) at higher fuel flow rate is 0.6666. (CO5, K4)	10