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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 (2025 - 2026)**

**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**

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1. Attempt all parts:-

- 1-a. In air standard Diesel cycle at fixed  $r$  and fixed  $\gamma$ ... (CO1, K1) 1
- (a)  $\eta_{thermal}$  increases with increase in heat addition and cut-off ratio
- (b)  $\eta_{thermal}$  decreases with increase in heat addition and cut=off ratio
- (c)  $\eta_{thermal}$  remains the same with increase in heat addition and cut=off ratio
- (d) none of the above
- 1-b. For dual combustion cycle for fixed value of heat addition and compression ratio... (CO1, K1) 1
- (a)  $mep$  will be greater with increase in  $r_p$  and decrease in  $r_c$
- (b)  $mep$  will be greater with decrease in  $r_p$  and decrease in  $r_c$
- (c)  $mep$  remain the same with increase in  $r_p$  and decrease in  $r_c$
- (d) none of the above
- 1-c. For a given compression ratio, as the mixture is made progressively rich from lean the mean effective pressure... (CO2, K1) 1
- (a) increases
- (b) decreases
- (c) initially increases and then decreases
- (d) remains more or less same
- 1-d. Enthalpy of formation is defined as enthalpy of compounds at... (CO2, K1) 1
- (a) 25°C and 10 atmospheres
- (b) 25°C and 1 atmosphere
- (c) 0°C and 1 atmosphere
- (d) 100°C and 1 atmosphere.

1-e.	In SI engines flame speed increases... (CO3, K1)	1
	(a) with turbulence	
	(b) with fuel-air ratio	
	(c) both (a) and (b)	
	(d) none of the above	
1-f.	Detonation in SI engines occur due to... (CO3, K1)	1
	(a) preignition of the charge before the spark	
	(b) sudden ignition of the charge before the spark	
	(c) autoignition of the charge after the spark in struck	
	(d) none of the above	
1-g.	With increase in compression ratio, mechanical efficiency (CO4, K1)	1
	(a) increases	
	(b) decreases	
	(c) remains constant	
	(d) compression ratio has nothing to do with $\eta_{mech}$	
1-h.	The main purpose of a thermostat in an engine cooling system is to... (CO4, K1)	1
	(a) allow engine to warm-up quickly	
	(b) prevent the coolant from boiling	
	(c) pressurize the system	
	(d) indicate to the driver the coolant temperature	
1-i.	Lean burn concept is more ideal for... (CO5, K1)	1
	(a) C I engine	
	(b) S I Engine	
	(c) Free piston engine	
	(d) Wankel engine	
1-j.	Supercharging increases the power output of the engine by...(CO5, K1)	1
	(a) increasing the charge temperature	
	(b) increasing the charge pressure	
	(c) increasing the speed of the engine	
	(d) quantity of fuel admitted	
2. Attempt all parts:-		
2.a.	In what respects four stroke diesel cycle (compression ignition) engine differs from four stroke cycle spark ignition engine? (CO1, K1)	2
2.b.	What is the difference between higher heating value (HHV) and lower heating value (LHV) of the fuel? (CO2, K1)	2
2.c.	Define detonation.(CO3, K1)	2
2.d.	What are affect of F/A ratio changes on temperature of cylinder gases and flame speed.(CO4, K1)	2
2.e.	Enumerate the main objects of supercharging. (CO5, K1)	2
<b>SECTION-B</b>		<b>30</b>

3. Attempt all parts:-
- 3.a. Answer any one of the following:-
- 3.a.(i) A four-cylinder, four-stroke, spark-ignition engine has a bore of 80 mm and stroke of 80 mm. The compression ratio is 8. Calculate the cubic capacity of the engine and the clearance volume of each cylinder. What type of engine is this? (CO1, K3) 6
- 3.a.(ii) What is the difference between air cycle and fuel-air cycle? What are the assumptions in fuel-air cycle? (CO1, K2) 6
- 3.b. Answer any one of the following:-
- 3.b.(i) What qualities are desired in fuels to inhibit detonation? (CO2, K1) 6
- 3.b.(ii) What modifications in engine are required when blends are used? (CO2,K1) 6
- 3.c. Answer any one of the following:-
- 3.c.(i) "Abnormal combustion knock produced by surface ignition in S.I. engines is more harmful than normal combustion knock". Justify the statement. (CO3,K3) 6
- 3.c.(ii) Write a short note on aids for starting C.I. engines under extreme cold climate. (CO3,K2) 6
- 3.d. Answer any one of the following:-
- 3.d.(i) Explain the various mechanism of lubrication and their functions. (CO4,K2) 6
- 3.d.(ii) Enumerate and discuss the main qualities to be considered in selecting oil for lubrication. (CO4,K2) 6
- 3.e. Answer any one of the following:-
- 3.e.(i) What is a multi fuel engine and what are its characteristics? (CO5,K1) 6
- 3.e.(ii) Compare the rotary Wankel engine with reciprocating I C engine. (CO5,K4) 6
- SECTION-C** 50
4. Answer any one of the following:-
- 4-a. Compare Otto, Diesel and Dual cycles for the same maximum pressure and same work output with neat diagrams. (CO1,K4) 10
- 4-b. Compare the relative advantages and disadvantages of SI and CI engines. (CO1,K4) 10
5. Answer any one of the following:-
- 5-a. "While volatility of the fuel is a determining factor in the selection of fuels for S.I. engines, ignition quality of the fuel is the primary deciding factor for C.I. engines". Discuss briefly the statements. (CO2,K2) 10
- 5-b. Orsat analysis of the products of combustion of a hydrocarbon fuel of unknown composition is as follows : Carbon dioxide (CO<sub>2</sub>) = 8% Carbon monoxide (CO) = 0.5% Oxygen (O<sub>2</sub>) = 6.3% Nitrogen (N<sub>2</sub>) = 85.2% Determine the following : (i) Air-fuel ratio (ii) Percent theoretical air required for combustion. (CO2,K3) 10
6. Answer any one of the following:-
- 6-a. Explain the phenomenon of knock in CI engines and compare it with SI engine knock. (CO3,K2) 10
- 6-b. Discuss the effect of the following engine variables on flame propagation : (i) Compression ratio ; (ii) Fuel-air ratio ; (iii) Turbulence ; (iv) Engine load ; (v) Engine speed. (CO3,K2) 10
7. Answer any one of the following:-

- 7-a. State the effect of the following engine parameters on engine friction : (i) Stroke-to-bore ratio (ii) Cylinder size and number of cylinders (iii) Piston rings (iv) Compression ratio (v) Engine speed (vi) Engine load (vii) Cooling water temperature (viii) Oil viscosity. (CO4,K2) 10
- 7-b. Describe with a neat sketch the construction and working of a thermostat. (CO4,K2) 10
8. Answer any one of the following:-
- 8-a. An engine of 175 mm bore and 375 mm stroke is governed by hit and miss type governor to 220 rpm. With a fixed setting of the gas supply and ignition advance, indicator diagrams gave the following values of mean effective pressure. Firing, positive loop 5.7 bar, negative loop 0.25 bar; missing negative loop 0.42 bar. When developing 6 kW the explosions were 100 per minute and the gas used was  $0.1 \text{ m}^3$  per minute. Calculate the friction power and assuming uniform gas supply per explosion, find the gas consumption per minute at no load. (CO5,K3) 10
- 8-b. A single-cylinder gas engine, with bore x stroke of 25 x 50 cm and running at 240 rpm fires 100 times per min. The quantity of coal gas used is  $0.3 \text{ m}^3$  per minute at 100 cm of water (gauge) (barometer pressure 1 bar) at  $17^\circ\text{C}$  while the amount of air used is 3 kg/min. Assuming that an extra volume of air is taken in during a missed cycle equal to that of a coal gas normally taken in, if both are measured at NTP, find (i) the charge of air per working cycle as measured at NTP and (ii) the volumetric efficiency. Assume 760 mm of Hg as 1 bar. (CO5,K3) 10