

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

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

(SEM:V) THEORY EXAMINATION (2022-2023)

Subject: Internal Combustion Engine

Time: 3Hours

Max. Marks:100

General Instructions:

IMP: Verify that you have received question paper with 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 correct sequence of the decreasing order of brake thermal efficiency of the three given basic type of IC engines is (CO1) | 1 |
| | (a) 4 stroke CI engine, 4 stroke SI engine, 2 stroke SI engine | |
| | (b) 4 stroke SI engine, 4 stroke CI engine, 2 stroke SI engine | |
| | (c) 4 stroke CI engine, 2 stroke SI engine, 4 stroke SI engine | |
| | (d) 2 stroke SI engine, 4 stroke SI engine, 4 stroke CI engine | |
| 1-b. | Scavenging is (CO1) | 1 |
| | (a) Removing burned gasses from cylinder with the help of fresh charge | |
| | (b) Inhaling fresh charge | |
| | (c) Mixing of air and fuel | |
| | (d) None of the above | |
| 1-c. | Detonation in S. I. engines is observed at (CO2) | 1 |
| | (a) Starting of the combustion process | |
| | (b) Near the end of combustion process | |
| | (c) Near the end of compression process | |
| | (d) Starting of the exhaust process | |
| 1-d. | Velocity of flame propagation in the SI engine is maximum for air fuel mixture which is ____ stoichiometric (CO2) | 1 |
| | (a) about 10% leaner than | |
| | (b) more than 20% richer than | |
| | (c) equal to | |
| | (d) about 10% richer than | |
| 1-e. | How is the fuel ignited in a diesel engine? (CO2) | 1 |

	(a) With the help of spark plug	
	(b) Self-ignition due to high compression of fuel air mixture	
	(c) Both (a) and (b) both	
	(d) None of the above	
1-f.	Combustion in C.I. engines is (CO3)	1
	(a) Homogenous	
	(b) Heterogeneous	
	(c) Laminar	
	(d) None of the above	
1-g.	Thermostatic valve is used in cooling system to (CO4)	1
	(a) Control the makeup coolant flow to the radiator	
	(b) Control the temperature of the coolant	
	(c) Control the temperature of the engine block	
	(d) None of the above	
1-h.	Mist lubrication system is used in (CO4)	1
	(a) Small 2 stroke S. I. engines	
	(b) Small 4 stroke S. I. engines	
	(c) Small 2 stroke C. I. engines	
	(d) Small 4 stroke C.I. engines	
1-i.	Eddy current dynamometer is (CO5)	1
	(a) Absorption dynamometer	
	(b) Transmission dynamometer	
	(c) Both absorption as well as transmission dynamometer	
	(d) None of the above	
1-j.	Hydrogen fuel has (CO5)	1
	(a) Highest energy density on volume basis	
	(b) Highest energy density on mass basis	
	(c) Lowest energy density on volume basis	
	(d) Lowest energy density on mass basis	
2.	Attempt all parts:-	
2.a.	Explain the fuel supply system for C.I. engines. (CO1)	2
2.b.	Why combustion is necessary for an I. C. Engine? (CO2)	2
2.c.	What is the difference between ignition lag and ignition delay? (CO3)	2
2.d.	What is the role of thermostatic valve in the cooling circuit? (CO4)	2
2.e.	What do you understand by HCCI engine? (CO5)	2
SECTION – B		
3.	Answer any <u>five</u> of the following-	
3-a.	With the help of neat diagrams explain and derive the expression for work done and air standard efficiency of Dual Cycle. (CO1)	6
3-b.	Draw a schematic diagram of carburettor and explain the circuits for idling and accelerating. Also give reason for having compensating arrangement in the carburettor. (CO3)	6
3-c.	In an engine working on the Diesel cycle, the air-fuel ratio is 30:1. The temperature of the air at the beginning of the compression is 27°C, the compression ratio is 16:1. What is the ideal efficiency of the engine based on the air-standard cycle? The calorific value of the fuel used is 42,000 kJ/kg. (CO1)	6
3-d.	Obtain the expression of thermal efficiency and mean effective pressure for Air standard Diesel cycle, also compare the thermal efficiency of Air standard Otto cycle, Diesel cycle and Dual cycle having same peak pressure, peak temperature and heat rejection (CO2)	6
3-e.	What do you understand by uncontrolled combustion in S.I. engine? How is it different then uncontrolled combustion in C.I. engine? (CO3)	6
3-f.	With the help of a neat diagram, explain the working of liquid cooling system in I.C. engine. (CO4)	6

- 3-g. How do you vary the compression ratio in Variable compression ratio engine? Explain with the help of neat diagram (CO5) 6
- SECTION – C
4. Answer any one of the following-
- 4-a. Give the detail comparison among Air Standard Cycle, Fuel-Air Cycle and Actual Cycle. Which cycle is used in real engines and why? (CO1) 10
- 4-b. A petrol engine of compression ratio 6 uses a fuel of calorific value 43950 kJ/kg. The air – fuel ratio is 15:1. The temperature and pressure of the charge at the charge at the end of the suction stroke are 60°C and 1 bar state (1). Determine the maximum pressure in the cylinder if the index of compression is 1.32 and the specific heat at constant volume is expressed by the expression; $C_v = 0.71 + 19 \times 10^{-5} T$ kJ/kg K, where T is the temperature in K. Compare this value with that when constant specific heat $C_v = 0.72$ is used. (CO1) 10
5. Answer any one of the following-
- 5-a. A mixture of hexane C_6H_{14} and air is supplied to an internal combustion engine. Determine the theoretical mass of air required for complete combustion and the composition of the products of combustion by volume if the mixture is 25% rich. Take air to contain 23.1% oxygen by mass. Assume hydrogen is completely burnt (CO2) 10
- 5-b. A diesel cycle operates at a pressure of 1 bar at the beginning of the compression and the volume is compressed to $1/16^{th}$ of the initial volume. Heat is supplied until the volume is twice that of the clearance volume. Calculate the mean effective pressure of the cycle. Take $\lambda = 1.4$. (CO2) 10
6. Answer any one of the following-
- 6-a. What do you understand by uncontrolled combustion in S.I. engine? How is it different then uncontrolled combustion in C.I. engine? (CO3) 10
- 6-b. List the factors on which ignition delay depends? Which engine has ignition lag and which type of engine has ignition delay (CO3) 10
7. Answer any one of the following-
- 7-a. Elaborate the essential properties of good lubricating oil. Also explain the working of lubricating circuit of multicylinder C.I. engine with the help of neat diagram. (CO4) 10
- 7-b. Compare the quantity of cooling water required for a 100 kW petrol and diesel engines in which the water temperature is raised by 30°C in passing through the jackets. In petrol engine the percentage of energy going to the coolant is 30% and in diesel engine 26%. The efficiency of petrol engine is 26% and of diesel engine 31%. (CO4) 10
8. Answer any one of the following-
- 8-a. What do you understand by the following terms: (i) Brake specific energy consumption (ii) Frictional horse power (iii) Spark advance (iv) Rate of pressure rise (v) Smoke? (CO5) 10
- 8-b. Discuss the factors responsible in increasing the power of a SI engine when operated on ethanol. Also find the thermal efficiency of SI engine when operated on ethanol? (Specific fuel consumption 260 gm/kW and Heating Value 6400 kcal/kg) (CO5) 10