Program: B.Tech in Mechanical Engineering **Academic Year: 2022** **Duration: 3 hours**

Date: 05.01.2023

Time: 10:30 am to 01:30 pm

Subject: Automotive Prime Movers (Semester V) **Marks: 75**

(PCME 5010T)

Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover page of the Answer Book, which is provided for their use.

(1) This question paper contains 2 pages.
(2) All Questions are Compulsory.
(3) All questions carry equal marks.
(4) Answer to each new question is to be started on a fresh page.
(5) Figures in the brackets on the right indicate full marks.
(6) Assume suitable data wherever required but justify it.
(7) Draw the neat, labelled diagrams, wherever necessary.

Question No.		Max. Marks
Q1	**Answer any three:-** i. Explain the classification of IC Engines. ii. Describe actual valve timing diagram in 4 stroke SI Engine using a neat sketch. What is valve overlap? iii. Give an account of the important sensors and actuators used in the fuel injection system iv. Explain the Magneto Ignition system in brief. v. Explain knocking in SI engines	 [5] [5] [5] [5] [5]
Q2 (a)	i. Explain working with diagram: Individual Pump injection system. ii. What are requirements of a good combustion chamber in CI engines? **OR** Describe stages of Combustion in CI engines using a labeled pressure- crank angle diagram.	[05] [03] [08]
Q2 (b)	Compression ratio of an oil engine working on dual combustion cycle is 13:1. The conditions at the start of compression are 1 bar and 100 ^{0}C. The heat supplied per kg of air is 2000 kJ, half of which is supplied at constant volume and the other half at constant pressure. Find the peak pressure in the cycle and percentage of stroke where cut off occurs. Assume $\gamma = 1.4, R = 0.287 \frac{kJ}{kgK}, and\ C_v = 0.709 + 0.000028(T)\ \frac{kJ}{kgK}$	[07]

Q3	**Attempt any three:** i. Explain the necessity of engine cooling. Give a brief classification of the types of cooling systems used in engines ii. What are functions of lubricant used in engines? Explain following properties of a lubricating oil: Viscosity, Pour Point, Oiliness, Detergency. iii. What is supercharging of IC Engines? Explain any one method of supercharging iv. List the various types of combustion chambers used in a CI engine and explain any one.	[05] [05] [05] [05]
Q4 (a)	In the trial of a single cylinder diesel engine the following observations were made: Calorific value of the fuel = 43890 kJ/kg, oil consumption = 10.2 kg/hr, speed = 1900 rpm, air consumption = 3.8 kg/min, Compression ratio = 15, Torque = 186 Nm, Quantity of cooling water used = 15.5 kg/min, Temp rise = 36^0 C, Exhaust gas temperature = 410^0 C, Room Temp = 20^0 C, Cp of exhaust gas = 1.17 kJ/kg K Calculate i) Brake Power ii) BSFC iii) Heat balance sheet on minute basis	[10]
Q4 (b)	**Attempt any one:** i. Explain any one method to measure the Brake power ii. Explain Morse Test for measuring the Indicated Power	[05] [05]
Q5	**Attempt any three:** i. Explain the working principle of a Hybrid Powertrain ii. Explain the terms SOC and DOC used in battery storage system iii. Explain the classification of Hybrid Powertrain iv. Explain the operating modes of a Hybrid vehicle v. Explain the types of BLDC motors	[05] [05] [05] [05] [05]