Reg. No.																

Question Paper Code	14158

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Sixth Semester

Mechanical Engineering

20MEIE601 - ADVANCED FUEL INJECTION SYSTEM - II

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What is the main advantage of Electrochemical Machining (ECM) in injector manufacturing? (a) No mechanical stress on components (b) Faster production speed (c) High thermal resistance (d) Low-cost production	1	K1	CO1
2.	Why is nozzle-needle pairing important in injectors? (a) Reduces engine noise (b) Ensures precise fuel flow and prevents leakage (c) Increases injector weight (d) Reduces fuel pressure	1	K1	CO1
3.	What type of environmental test is used to evaluate the effect of temperature variations on injectors? (a) Salt spray test (b) Thermal cycling test (c) Leakage test (d) Vibration test	1	K1	CO2
4.	What is the main purpose of durability testing in injectors? (a) To evaluate how long an injector can function without failure (b) To check for design flaws (c) To improve fuel injector appearance (d) To test fuel quality	1	K1	CO2
5.	What component is responsible for maintaining the correct fuel pressure in a common rail system? (a) Throttle Position Sensor (b) Fuel Rail Pressure Regulator (c) Oxygen Sensor (d) Knock Sensor	1	K1	CO3
6.	What does an OBD-II error code P0340 indicate? (a) Fuel pressure too high (b) Crankshaft position sensor failure (c) Camshaft position sensor circuit malfunction (d) Exhaust gas temperature too low	1	K1	CO3
7.	What is the main purpose of an oxidation catalyst in a diesel after-treatment system? (a) To reduce CO_2 (b) To convert CO and hydrocarbons into CO_2 and H_2O (c) To remove sulfur (d) To cool the exhaust gases	1	K1	CO4
8.	Which of the following is NOT a post-combustion emission control device? (a) Catalytic converter (b) Diesel Particulate Filter (DPF) (c) Exhaust Gas Recirculation (EGR) (d) Selective Catalytic Reduction (SCR)	1	K1	CO4
9.	Which of the following is a key benefit of using force and power sensors in machining? (a) Increasing paint coverage (b) Monitoring tool wear and process stability (c) Adjusting lighting levels (d) Measuring air humidity	1	K1	CO5
10.	Which of the following is NOT a component of the DTVS framework? (a) Dimension (b) Temperature (c) Tolerance (d) Stability	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

		Marks	K – Level	CO
11.	Explain the sub-zero treatment used in injector manufacturing.	2	K2	CO1
12.	What is the primary purpose of the leak test in injectors?	2	K1	CO1
13.	Explain the process of laser drilling to improve fuel injector performance.	2	K2	CO1
14.	Infer the data that can be obtained from learning test facility rigs.	2	K2	CO2
15.	Outline the importance of durability and fatigue tests for common rail injectors.	2	K2	CO2
16.	Illustrate the significance of the endurance test.	2	K2	CO2

17.	Explain the role of pressure sensors in rail pressure control.	2	K2	CO3
18.	How does an ECU handle sensor failures?	2	K1	CO3
19.	List the parameters in time factors that reduce the knocking.	2	K1	CO4
20.	What are the components required in the fuel injection system?	2	K1	CO4
21.	What is process validation in the context of manufacturing?	2	K1	CO5
22.	What does the acronym DTVS stand for in quality control?	2	K1	CO5

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Describe the importance of leak testing in fuel injector quality control.	11	K2	CO1
		OR			
	b)	Explain the various testing methods used to ensure proper nozzle-needle pairing.	11	K2	CO1
24.	a)	Identify the impact of wear and tear on injector performance over time and explain.	11	K3	CO2
		OR			
	b)	Select the key parameters measured during fuel injector durability testing and explain in detail.	11	K3	CO2
25.	a)	Describe the functions of Air path and interconnections in relation to ECU and common rail architecture.	11	K2	CO3
		OR			
	b)	Interpret the types of actuators used in fuel injection systems. Explain the working and control of pneumatic and electric actuators.	11	K2	CO3
26.	a)	Identify the role of FID, NDIR, and CLD analyzers in measuring vehicle emissions**.**	11	K3	CO4
		OR			
	b)	Discuss the working of an SCR system with simple sketch and explain its main components.	11	K3	CO4
27.	a)	Explain the different types of sensors used in quality testing during assembly, highlighting their advantages and limitations.	11	K2	CO5
		OR			
	b)	Explain the importance of process validation in manufacturing process planning. Describe the key stages involved in validating a new or modified process.	11	K2	CO5
28	a)	Summarize the significance of traceability in a manufacturing system.	11	K2	CO5
		OR			
	b)	Explain the concept of poka-yoke with example.	11	K2	CO5