

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

Fifth Semester

Mechanical Engineering

(Common to Mechanical and Automation Engineering)

20MEIE501 - ADVANCED FUEL INJECTION SYSTEM - I

Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	<i>Marks</i>	<i>K- Level</i>	<i>CO</i>
1. Which process helps in the pleat formation of fuel filters? (a) Shearing (b) Scoring (c) Pitting (d) Nipping	1	K1	CO1
2. What is the function of heater plug? (a) Warm up fuel pump (b) Warm up combustion chamber (c) Warm up injector (d) Warm up valves	1	K1	CO1
3. In CRDI engine fuel system, where the excessive fuel return? (a) Reside in the rail itself (b) Return to high pressure pump (c) Return to the fuel tank (d) Return to the fuel filter	1	K1	CO2
4. What is one advantage of using advanced manufacturing techniques, like additive manufacturing, for common rail components? (a) higher costs (b) increased design flexibility (c) longer production times (d) more waste generation	1	K1	CO2
5. What is the primary function of the high-pressure pump in a common rail fuel injection system? (a) To cool the engine (b) To pressurize fuel and supply it to the common rail (c) To filter impurities from the fuel (d) To inject fuel into the combustion chamber	1	K1	CO3
6. Which component helps regulate the pressure of fuel delivered to the common rail? (a) Fuel injector (b) Pressure regulator (c) Fuel filter (d) ECU	1	K1	CO3
7. What is the first step in the manufacturing process of a common rail filter? (a) Assembly of components (b) Quality testing (c) Material selection and design (d) Packaging	1	K1	CO4
8. Which of the following processes is typically used to assemble the filter media and housing in a common rail filter? (a) Heat treatment (b) Adhesive bonding or crimping (c) Casting (d) Sanding	1	K1	CO4
9. In diesel injector construction, what component is responsible for opening and closing the injector nozzle? (a) Fuel pump (b) Solenoid or piezoelectric actuator (c) Nozzle cap (d) Filter screen	1	K1	CO5
10. What material is commonly used to construct the nozzle tip of a diesel injector due to its durability? (a) Plastic (b) Aluminum (c) Hardened steel (d) Rubber	1	K1	CO5

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. Define the term Driveability.	2	K1	CO1
12. Infer the common types of materials used for filters.	2	K2	CO1
13. Outline the basic requirements of fuel injection in CI engine.	2	K2	CO1

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| 14. Explain how regulatory standards influence the manufacturing processes of common rail systems. | 2 | K2 | CO2 |
| 15. Summarize how surface treatment improves the performance of common rail components. | 2 | K2 | CO2 |
| 16. List the common materials used in manufacturing high-pressure pumps and why? | 2 | K1 | CO3 |
| 17. Explain the maintenance practices are recommended for common rail pumps. | 2 | K2 | CO3 |
| 18. Summarize the advantages of using a variable displacement pump in common rail systems. | 2 | K2 | CO3 |
| 19. Explain how the fuel transfer pump supports the working of a diesel fuel system. | 2 | K2 | CO4 |
| 20. Compare common rail fuel system and traditional pump-injector system. | 2 | K2 | CO4 |
| 21. Interpret effect does poor fuel atomization have on diesel engine performance. | 2 | K2 | CO5 |
| 22. Explain the role of the nozzle in a diesel fuel injector. | 2 | K2 | CO5 |

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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| 23. a) Apply your understanding of diesel engine combustion to sketch and label the pressure–crank angle (P–θ) diagram, identifying and explaining each stage of combustion. | 11 | K3 | CO1 |
| OR | | | |
| b) Identify how the air filter management system operates in an engine and illustrate its importance with suitable examples. | 11 | K3 | CO1 |
| 24. a) Apply suitable assembly techniques to demonstrate how they affect common rail system performance and reliability. | 11 | K3 | CO2 |
| OR | | | |
| b) Apply your understanding of surface hardening treatments, such as nitriding, to justify how they enhance the performance and durability of components in common rail manufacturing. | 11 | K3 | CO2 |
| 25. a) Identify the factors can affect the performance of a high-pressure pump in a common rail system. | 11 | K3 | CO3 |
| OR | | | |
| b) Make use of an example to demonstrate how the lift pump improves common rail fuel injection system efficiency. | 11 | K3 | CO3 |
| 26. a) Identify and discuss the impact of fuel filtration on the diesel fuel pump system and its importance in maintaining system longevity. | 11 | K3 | CO4 |
| OR | | | |
| b) Apply your understanding of the diesel fuel system to explain the role of fuel injection timing in maintaining engine performance and emission standards. | 11 | K3 | CO4 |
| 27. a) Apply your understanding of the working of a diesel fuel injector to explain how a diesel fuel injector affects CI engine combustion under different engine conditions. | 11 | K3 | CO5 |
| OR | | | |
| b) Discuss the importance of injector nozzle design and how it influences the atomization of fuel and overall engine performance. | 11 | K3 | CO5 |
| 28. a) Explain in detail the Honing process in the DFP6 pump. | 11 | K2 | CO4 |
| OR | | | |
| b) Explain in detail the manufacturing process outline of diesel fuel pumps being produced in Delphi-TVS. | 11 | K2 | CO4 |