

Reg. No.

Question Paper Code

13205

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

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) (20 × 1 = 20 Marks)**

Answer ALL Questions

- |   | <i>Marks</i> | <i>K-<br/>Level</i> | <i>CO</i> |
|---|--------------|---------------------|-----------|
| 1. Where is the pressure discharge valve fitted in CRDI fuel system?<br>(a) Common rail (b) Fuel pump (c) Injectors (d) Fuel filter   | 1            | K1                  | CO1       |
| 2. Which feed system reduces above 50% unburnt hydro carbon?<br>(a) In line fuel injection system (b) Distributor fuel injection system<br>(c) Electronic control system (d) Air blasé fuel injection system                | 1            | K1                  | CO1       |
| 3. What is the typical pressure range of the common rail in a CRDI system?<br>(a) 2,500 to 5,000 bar (b) 1,000 to 2,500 bar<br>(c) 100 to 500 bar (d) 500 to 1,000 bar  | 1            | K1                  | CO1       |
| 4. Number of working strokes per min. for a four stroke cycle engine are _____ the speed of the engine in r.p.m.<br>(a) Equal to (b) One-half (c) Twice (d) Four-times  | 1            | K2                  | CO1       |
| 5. Which type of fuel system is best suited for less fuel consumption, more power and reduce the exhaust emission?<br>(a) Inline pump system (b) Rotary pump system<br>(c) Distributor pump system (d) CRDI system          | 1            | K1                  | CO2       |
| 6. In CRDI engine fuel system, where the excessive fuel returns?<br>(a) Reside in the rail itself (b) Return to high pressure pump<br>(c) Return to the fuel tank (d) Return to the fuel filter                             | 1            | K2                  | CO2       |
| 7. What happens if the common rail pressure is too low?<br>(a) improved fuel efficiency (b) engine knocking and reduced performance<br>(c) increased emissions (d) all of the above   | 1            | K2                  | CO2       |
| 8. What type of heat treatment is typically applied to enhance the strength of steel components in fuel injectors?<br>(a) annealing (b) hardening (c) tempering (d) normalizing   | 1            | K1                  | CO2       |
| 9. Which type of pump is most commonly used in common rail systems?<br>(a) Gear pump (b) Diaphragm pump<br>(c) Plunger pump (d) Rotary vane pump  | 1            | K1                  | CO3       |
| 10. What happens if the high-pressure pump fails in a common rail system?<br>(a) Improved engine performance (b) Engine will fail to start or run poorly<br>(c) Increased fuel efficiency (d) No impact on engine operation | 1            | K1                  | CO3       |
| 11. Which material is commonly used for high-pressure pump components due to its durability?<br>(a) Plastic (b) Aluminum (c) Stainless steel (d) Cast iron  | 1            | K1                  | CO3       |
| 12. How does the high-pressure pump communicate with the engine control unit (ECU)?<br>(a) Through a mechanical linkage (b) Via hydraulic signals<br>(c) Using electronic signals (d) Through pneumatic tubes               | 1            | K2                  | CO3       |

13. What type of test is commonly conducted to check for leaks in a common rail filter? 1 K1 CO4  
 (a) Electrical continuity test (b) Pressure test  
 (c) Visual inspection (d) Flow rate test
14. What is typically done to the filter element after pleating to ensure structural integrity? 1 K1 CO4  
 (a) Pressure testing (b) Bonding with adhesive or end caps  
 (c) Painting (d) Heat treatment
15. Which material is most commonly used for the filtration media in diesel filters? 1 K1 CO4  
 (a) Metal mesh (b) Ceramic (c) Synthetic fiber or paper (d) Plastic
16. During assembly, which step is essential to confirm that no contaminants enter the diesel filter? 1 K2 CO4  
 (a) Heat treatment (b) Visual inspection of each component  
 (c) Pleating (d) Flow rate testing
17. What phase of the engine cycle typically experiences the highest cylinder pressure? 1 K1 CO5  
 (a) Intake stroke (b) Compression stroke (c) Power stroke (d) Exhaust stroke
18. Which of the following factors directly affects the peak cylinder pressure in a diesel engine? 1 K2 CO5  
 (a) Compression ratio (b) Fuel quality (c) Injection timing (d) All of the above
19. In a diesel engine, advanced injection timing 1 K2 CO5  
 (a) Increases both cylinder pressure and heat release rate  
 (b) Decreases both cylinder pressure and heat release rate  
 (c) Has no effect on either  
 (d) Only affects the heat release rate
20. The significance of a high peak cylinder pressure in an engine is 1 K2 CO5  
 (a) It indicates higher fuel consumption  
 (b) It can lead to increased engine wear and potential damage  
 (c) It results in lower power output  
 (d) It reduces emissions

**PART - B (10 × 2 = 20 Marks)**

Answer ALL Questions

21. Explain the term Ignition delay. 2 K2 CO1
22. Define Beta ratio. 2 K1 CO1
23. What materials are typically used in the manufacturing of common rail components, and why? 2 K2 CO2
24. List the challenges faced during the manufacturing of common rail systems. 2 K1 CO2
25. Discuss the recommended maintenance practices for common rail pumps. 2 K2 CO3
26. What are the advantages of using a variable displacement pump in common rail systems? 2 K1 CO3
27. Compare common rail fuel system and traditional pump-injector system. 2 K2 CO4
28. Discuss the design of a common rail filter optimized for high-pressure fuel systems. 2 K2 CO4
29. Interpret the influence of injector nozzle design in engine emissions. 2 K2 CO5
30. Explain the importance of measuring cylinder pressure in a diesel engine. 2 K1 CO5

**PART - C (6 × 10 = 60 Marks)**

Answer ALL Questions

31. a) Explain the various combustion stages of a diesel engine with necessary plot. 10 K2 CO1
- OR**
- b) Explain in detail the fuel filter manufacturing process. 10 K2 CO1

32. a) Explain the process of heat release rate in CI engines. 10 K2 CO2
- OR**
- b) Describe the machining processes involved in the production of a common rail. 10 K2 CO2
33. a) Explain the factors can affect the performance of a high-pressure pump in a common rail system. 10 K3 CO3
- OR**
- b) Explain the functionality of five critical parts in fuel pump with neat sketch. 10 K3 CO3
34. a) Describe the operation of a high-pressure fuel pump in a diesel engine and the factors that influence its performance. 10 K2 CO4
- OR**
- b) Discuss the Diesel Fuel system to manage the timing of fuel injection, and why is this timing critical to engine performance and emissions control? 10 K3 CO4
35. a) In what way fuel pressure affect the performance of a diesel fuel injector, and what happens if fuel pressure is too low or too high? 10 K3 CO5
- OR**
- b) Discuss about modern technologies, such as turbo charging and variable valve timing, influence cylinder pressure and HRR. 10 K3 CO5
36. a) i) Explain the machining process involved in the hydraulic head machining of DFP6 pump. 5 K2 CO4
- ii) Interpret the importance of injector nozzle design and how it influences the atomization of fuel. 5 K3 CO5
- OR**
- b) i) Explain the role of a diesel fuel pump governor and its impacts in the fuel delivery system. 5 K2 CO4
- ii) Discuss the impact of cylinder pressure and HRR on engine efficiency and emissions. 5 K3 CO5