



B.E DEGREE EXAMINATIONS: APRIL /MAY 2024

(Regulation 2018)

Fourth Semester

AUTOMOBILE ENGINEERING

U18AUI4201: Automotive Engines and Systems

COURSE OUTCOMES

- CO1: Outline the various components of the engine and its functions.
 CO2: Examine the combustion process in SI and CI Engine for understanding the performance and emission characteristics.
 CO3: Summarize various fuel supply and injection system used in IC engines.
 CO4: Identify the suitable lubrication and cooling system to be used in IC Engines.
 CO5: Explain the concepts of Supercharging and Turbocharging.
 CO6: Analyze the various properties of fuels used in I.C engines.

Time: Three Hours

Maximum Marks: 100

**Answer all the Questions:-
PART A (10 x 1 = 10 Marks)**

1. Match the turbocharger component with its function

CO5 [K₄]

List I	List II
A. Turbine	i. Controls maximum boost pressure to prevent overboost
B. Compressor	ii. Converts exhaust gas energy into mechanical energy
C. Intercooler	iii. Reduces air temperature to improve engine efficiency
D. Wastegate	iv. Increases air pressure before entering the engine

- | | A | B | C | D |
|----|-----|----|-----|----|
| a) | ii | i | iii | iv |
| b) | iii | iv | ii | i |
| c) | ii | iv | iii | i |
| d) | iii | i | ii | iv |

2. Incomplete combustion is indicated by

CO2 [K₃]

- a) High percentage of CO in the exhaust gases b) High percentage of CO₂ in exhaust gases
 c) High temperature of exhaust gases d) Low temperature of exhaust gases

- | | |
|---|--|
| a) Increase the boiling point of the coolant | b) Decrease the freezing point of the coolant |
| c) Enhance corrosion protection for engine components | d) Improve thermal conductivity of the coolant |

9. Assertion (A): The cooling system in an internal combustion engine helps prevent overheating and maintains optimal operating temperature. CO4 [K₃]

Reason (R): Coolant flows through the engine to absorb excess heat and dissipate it through the radiator.

- | | |
|---|---|
| a) Both A and R are Individually true and R is the correct explanation of A | b) Both A and R are Individually true but R is not the correct explanation of A |
| c) A is true but R is false | d) A is false but R is true |

10. Which factor has the most significant influence on combustion chamber design in internal combustion engines? CO1 [K₂]

- | | |
|--------------------------|--------------------------|
| a) Fuel injection system | b) Engine displacement |
| c) Compression ratio | d) Exhaust system design |

Answer any TEN Questions:-
PART B (10 x 4 = 40 Marks)
(Answer not more than 80 words)

11. Describe the constructional details of its main components, including the piston, cylinder, crankshaft, and camshaft. CO1 [K₂]
12. Discuss the construction and function of the intake system components of an internal combustion engine. CO1 [K₂]
13. Illustrate the process of flame propagation in a spark ignition engine with a labeled diagram. Describe the factors affecting flame propagation speed and the area covered by the flame front. CO2 [K₃]
14. Discuss how engine operating and design variables affect combustion in IC engines. Provide examples of such variables and explain their impact on combustion efficiency and performance. CO2 [K₄]
15. Explain the concepts of swirl, squish, and turbulence in internal combustion engines. CO3 [K₄]
16. Differentiate between open and divided combustion chambers in internal combustion engines. Mention their respective advantages and disadvantages in terms of combustion efficiency and emissions control. CO2 [K₃]
17. List and explain the engineering challenges and limitations associated with implementing thermosyphon cooling in modern engine designs. CO4 [K₃]

18. Explain the significance of viscosity, viscosity index, pour point, flash point, and lubricity in determining the performance and longevity of engine components. CO6 [K₂]
19. Define turbo lag. Discuss the strategies employed to mitigate turbo lag in modern turbocharged engines, considering both mechanical and electronic solutions. CO5 [K₄]
20. What are the techniques employed to minimize windage losses in turbocharger design and operation? CO5 [K₄]
21. Compare and contrast the chemical and mechanical theories of detonation, discussing their underlying principles and assumptions. CO4 [K₅]
22. Discuss the necessity of a cooling system in IC engines and describe the consequences of inadequate engine cooling and the potential damage it can cause to engine components. CO5 [K₃]

Answer any FIVE Questions:-
PART C (5 x 10 = 50 Marks)
(Answer not more than 250 words)

23. Describe the operation of a four-stroke spark ignition IC engine, detailing each stroke and corresponding events. Provide a stroke-wise representation and draw a labelled PV diagram illustrating the thermodynamic cycle. CO2 [K₂]
24. Briefly outline abnormal combustion in spark ignition (SI) engines, focusing on the occurrence of knocking. Describe the causes and mechanisms of knocking. Highlight the factors influencing knocking and its adverse effects on engine performance. CO2 [K₃]
25. Draw the actual P θ diagram of CI engine combustion and explain each stage of combustion in detail. Provide a comprehensive interpretation of the P θ diagram, supporting your analysis with relevant theories and principles. CO2 [K₄]
26. What are the two essential factors which determine the rate of movement of the flame front across the combustion chamber of SI engines? Explain the factors influencing the flame speed. CO3 [K₄]
27. Compare wet sump and dry sump lubrication systems used in IC engines. Include a labeled sketch illustrating the key components and their functions in each system. Discuss the advantages and disadvantages of both systems in terms of oil capacity, lubrication efficiency, and engine performance under varied conditions. CO4 [K₃]
28. Define the purpose of turbocharging in internal combustion engines. Explain the principle of exhaust turbocharging with a clear and labelled sketch. Highlight the key components and their functions in the turbocharging system, emphasizing its role in increasing engine performance. CO5 [K₄]
