



B.E DEGREE EXAMINATIONS:MAY 2017

(Regulation 2014)

Sixth Semester

AUTOMOBILE ENGINEERING

U14AUT604: Automotive Pollution and Control

COURSE OUTCOMES

- CO1:** Familiarize the norms of pollution standards
- CO2:** Analyze the sources of pollution from automobiles
- CO3:** Understand the pollution control methods and apply
- CO4:** Emission measurement techniques

Time: Three Hours

Maximum Marks: 100

Answer all the Questions: -

PART A (10 x 1 = 10 Marks)

1. Identify the limits of pollutants for BSIV norms and select the correct limits for each. CO1 [K₂]

| Pollutants | Limits (g/kg) |
|--------------------|---------------|
| A) CO | 1) 0.10 |
| B) HC | 2) 0.08 |
| C) NO _x | 3) 1.00 |

| | A | B | C |
|----|---|---|---|
| a) | 2 | 3 | 1 |
| b) | 3 | 2 | 1 |
| c) | 3 | 1 | 2 |
| d) | 1 | 3 | 2 |

2. Blue smoke in diesel engines indicates CO2 [K₂]
- a) NO_x
 - b) HC
 - c) CO
 - d) Unburnt oil
3. NO_x emission is maximum in SI engines when the A/F ratio is CO2 [K₂]
- a) nearly stoichiometric
 - b) lean
 - c) rich
 - d) neither lean nor rich

4. In India emission regulations are regulated by _____ . CO1 [K₁]
 a) EPA b) CARB
 c) EURO d) CPCB
5. Consider the following statements & Identify the correct option given below CO2 [K₂]
 1. With increase in engine load NO_x and Soot emissions increases
 2. HC emissions increases at maximum Engine load
 3. With increase in engine load, the combustion temperature decreases
 4. With increase in engine load, Engine brake thermal efficiency increases
 a) 1, 3 b) 1, 4
 c) 1, 2 d) 2, 3
6. Mostly light extinction/absorption smoke meters based on _____ . CO4 [K₂]
 a) Born's law b) Beer-Lambert's Law
 c) Fermat's principle d) Huygens–Fresnel principle
7. EGR can affect NO_x reduction because of the following effects, CO2 [K₂]
 Assertion (A) : Reduction in inlet charge oxygen concentration by dilution effect.
 Reason (R) : Increase in inlet charge heat capacity by thermal effect
 a) Both the effects are True b) E1 is True, E2 is False
 c) E1 is False, E2 is True d) Both the effects are False
8. Higher exhaust temperatures resulting with low CR would _____ of HC and CO CO2 [K₂]
 in exhaust system.
 a) Promote Reduction Reaction b) Promote Oxidation Reaction
 c) Promote Redox Reactions d) All of these reactions
9. Consider the four phases of Federal Test Procedure (FTP-75) CO4 [K₂]
 1. Stabilized Phase
 2. Hot Soak Phase
 3. Hot Transition Phase
 4. Cold Transition Phase
 a) 2-3-4-1 b) 1-3-2-4
 c) 4-3-2-1 d) 4-1-2-3
10. SMOG mainly arises due to _____ . CO3 [K₂]
 a) NO_x and HC b) Soot and PM
 c) CO and CO₂ d) Excess O₂

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

- | | |
|---|-----------------------|
| 11. Represent the Sources & Concentrations of emission from SI Engines | CO2 [K ₂] |
| 12. List any 4-test procedures for emission certifications. | CO4 [K ₂] |
| 13. Write down the possible reactions during combustion with respect to NO _x formation | CO2 [K ₂] |
| 14. The spark timing is retarded in a SI Engine, Assess the effect on NO _x formation during this scenario. | CO2 [K ₂] |
| 15. Suggest any 4 add on systems for emission control in SI Engines. | CO3 [K ₂] |
| 16. Sketch the schematic representation of diesel particulate formation mechanism in CI engines. | CO2 [K ₂] |
| 17. Explain, How the emission regulations are formed in our country? | CO1 [K ₂] |
| 18. What is Soot? | CO4 [K ₂] |
| 19. Backfiring is identified in an engine exhaust, propose a suitable modification to prevent this issue. | CO3 [K ₂] |
| 20. Identify & State reason the emission that occurs when flame quenching is detected on the cylinder walls. | CO2 [K ₂] |

Answer any FIVE Questions:-

PART C (5 x 14 = 70 Marks)

(Answer not more than 300 words)

Q.No. 21 is Compulsory

- | | |
|---|-----------------------|
| 21. Describe the health effects and environmental impacts due to various Engine Emissions. Compare its short term and long term effects for each pollutant. | CO2 [K ₃] |
| 22. i. Explain the driving cycles used for emission test procedures. ii. Discuss about FTP and ECE Test Procedures. | CO4 [K ₂] |
| 23. Discuss the Composition, Structure and formation of Diesel Particulates. In order to control the emission, what are the design changes to be performed in the Engine? Illustrate any two modifications. | CO2 [K ₃] |

24. Graphically compare NO_x formation for Rate Controlled and Equilibrium phase w.r.t CO₂ [K₃]
combustion chamber temperature and pressure. Explain briefly how concentration of NO_x
varies with spark timing.
25. Explain the working principle of the following emission reduction systems with it types CO₃ [K₃]
i. EGR
ii. Catalytic Convertor
26. Discuss on the emission Formation in CI Engines. Assess the HC Formation for the following CO₂ [K₃]
conditions,
i. Fuel Injected during Delay Period
ii. Fuel Injected after Delay Period
27. Draw & Explain the following emission measurement devices CO₄ [K₃]
(i) Chemiluminescent analyzers
(ii) NDIR analyzer
