



B.E DEGREE EXAMINATIONS: APRIL 2018

(Regulation 2014)

Eighth Semester

AUTOMOBILE ENGINEERING

U14AUTE01: Automotive Aerodynamics

COURSE OUTCOMES

CO1: Understand the importance of aerodynamics for automobiles

CO2: Apply the concept of wind tunnel for aerodynamic design of automobiles

CO3: Analyze various aerodynamic shapes of car

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Match the cross sections with appropriate Drag coefficient C_D

CO3 [K₂]

Cross sections	Drag coefficient C_D
A. Circular Plate	i. 0.47
B. Sphere	ii. 1.17
C. Cube	iii. 0.5
D. 60° cone	iv. 1.05

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

2. The aerodynamic drag D , as well as the other force components and moments, increases with the

CO1 [K₁]

A. Square of Vehicle speed

B. Frontal Area

- | | |
|-----------------------------------|-----------------------------------|
| a) Statement A is True B is false | b) Statement B is True A is false |
| c) Both false | d) Both true |

3. When the length of the vehicle increases the drag force CO1 [K₂]
 a) Decreases b) Increases
 c) No change d) Infinity
4. The pressure difference between the upper and lower sides of the vehicle produces a resultant force, at right angles to the direction of motion, which is called CO3 [K₁]
 a) Drag b) Thrust
 c) Lift d) Gravity
5. Which of the statements is Correct CO3 [K₁]
 Assertion (A): The position of the stagnation point determines which portion of the flow passes over the vehicle.
 Reason (R): How much air must flow between the bottom of the car and the road.
 a) Both A and R are true b) Both A and R are false
 c) A is true but R is false d) A is false but R is true
6. The drag can also be reduced by extending the trunk _____ CO2 [K₁]
 a) length b) breadth
 c) thickness d) All the Above
7. The optimum boat tail angle was $\beta = ?$ degrees CO3 [K₁]
 a) 20 b) 22
 c) 28 d) 30
8. The most common scaled model ratio in Europe for passenger cars is CO2 [K₁]
 a) 1:5 b) 1:4
 c) 1:2.5 d) 1:10
9. Which of the statements is Correct CO2 [K₁]
 Assertion (A): Flow simulation of the soiling process is imperfect
 Reason (R): The expense of reproducing wheel rotation in the wind tunnel.
 a) Both A and R are false b) Both A and R are true
 c) A is true but R is false d) A is false but R is true
10. Details in the shape of the vehicle such as indentations, curvatures, window recesses, tire beads and welds are _____ as a rule on scale models for wind tunnel testing. CO2 [K₁]
 a) not considered b) considered as it is
 c) overemphasized d) of less importance

PART B (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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| 11. Define pressure drag. | CO3 [K ₁] |
| 12. Explain the Cooling system requirements. | CO1 [K ₁] |
| 13. Why automotive aerodynamics is important? | CO3 [K ₁] |
| 14. What are the Four main categories of Vehicle Aerodynamics? | CO1 [K ₁] |
| 15. Distinguish the aerodynamic drag variation between Notchback and squareback. | CO3 [K ₁] |
| 16. Define Booming. | CO2 [K ₁] |
| 17. What are the two types of wind tunnel are distinguished by the type of air guidance? | CO2 [K ₁] |
| 18. State the constructional elements that determine the size, performance and quality of a wind tunnel. | CO2 [K ₁] |
| 19. Define Blockage ratio. | CO2 [K ₂] |
| 20. What are the advantages of open test section in a wind tunnel? | 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

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|--|-----------------------|
| 21. Explain in detail Dirt accumulation on the vehicle. | CO3 [K ₁] |
| 22. Explain the causes of Wind noise. | CO3 [K ₁] |
| 23. What is aerodynamic drag? Explain the analysis of aerodynamic drag. | CO1 [K ₁] |
| 24. Discuss the relationship between internal and external flow of vehicle. | CO1 [K ₁] |
| 25. Write in detail about the Limitations of Wind tunnel | CO2 [K ₂] |
| 26. Explain in detail the road testing methods | CO2 [K ₂] |
| i. Soil deposits on glass surfaces and body areas | |
| ii. Engine cooling tests on the road | |
| iii. Cross-wind tests | |
| 27. Describe in detail the importance of aerodynamics in vehicle performance and Fuel consumption. | CO1 [K ₁] |
