

M.E Semester: 3 M.E Mechanical (Automobile Engineering)
Subject Name: Automotive aerodynamic and safety MEA301

A. Course Objective

- To present a problem oriented in depth knowledge of Automotive aerodynamic safety
- To address the underlying concepts and methods behind Automotive aerodynamic safety

B. Teaching / Examination Scheme

| SUBJECT | | Teaching Scheme | | | | Total Credit | Evaluation Scheme | | | | | Total Marks |
|---------|-----------------------------------|-----------------|-----|-----|-------|--------------|-------------------|-------|-------|-------|------------|-------------|
| | | L | T | P | Total | | THEORY | | IE | CIA | PR. / VIVO | |
| CODE | NAME | Hrs | Hrs | Hrs | Hrs | | Hrs | Marks | Marks | Marks | Marks | |
| MEA301 | Automotive aerodynamic and safety | 4 | 2 | 0 | 6 | 6 | 3 | 70 | 30 | 20 | 30 | 150 |

C. Detailed Syllabus

1. INTRODUCTION

Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

2. AERODYNAMIC DRAG OF CABS

Car as a bluff body – Flow field around car – drag force – types of drag force – analysis of aerodynamic drag – drag coefficient of cars – strategies for aerodynamic development – low drag profiles.

3. SHAPE OPTIMIZATION OF CABS

Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

4. VEHICLE HANDLING

The origin of force and moments on a vehicle – side wind problems – methods to calculate forces and moments – vehicle dynamics under side winds – the effects of

forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.

5. WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS

Introduction – Principles of wind tunnel technology – Limitation of simulation – Stress with scale models – full scale wind tunnels – measurement techniques – Equipment and transducers – road testing methods – Numerical methods.

6. VEHICLE SAFETY SYSTEMS

The concept of vehicle safety; Need of safety; active safety: driving safety; conditional safety; perceptibility safety; operating safety- passive safety: exterior safety, interior safety, deformation behavior of vehicle body. Survival space requirements, Restraints systems used automobiles, Types of safety belts, Head restraints, Air bags used in automobiles, Use of energy absorbing systems in automobiles, Impact protection from steering controls, Design of seats for safety, types of seats used in automobiles. Importance of Bumpers in automobiles, Damageability criteria in bumper designs. Introduction to the types of safety glass and their requirements and rearward field of vision in automobiles, Types of rear view mirrors and their assessment. Warning devices, indicators, hinges, latches, wipers, horns, etc.

D. Lesson Planning

| <u>SR.NO</u> | <u>DATE/WEEK</u> | <u>UNIT NO</u> | <u>%WEITAGE</u> | <u>TOPIC NO</u> |
|--------------|--|----------------|-----------------|-----------------|
| 1 | 1 ST , 2 ND , 3 RD | 1 | 20 | 1 |
| 2 | 4 TH , 5 TH , 6 TH | 2 | 20 | 2 |
| 3 | 7 TH , 8 TH , 9 TH | 3 | 20 | 3 |
| 4 | 10 TH , 11 TH , 12 TH | 4 | 20 | 4,5 |
| 5 | 13 TH , 14 TH , 15 TH | 5 | 20 | 6 |

E. Instructional Method & Pedagogy

- At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all topics while teaching and conduction of all examinations.
- Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
- One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.

- Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
- Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
- Tutorials based on syllabus.

F. Students Learning Outcomes

- The student can identify different areas of Automotive aerodynamic and safety.
- Can find the applications of all the areas in day to day life.

G. Recommended Study Materials

Text & Reference Books:

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1997.
2. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.
3. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.
4. ARAI Safety standards
5. Pope, A, Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1994.
6. Automotive Aerodynamics: Update SP-706, SAE, 1987.
7. Vehicle Aerodynamics, SP-1145, SAE, 1996.

