

## Tasks in subject Vehicle aerodynamics (ground vehicles).

1. Concepts and approaches in development of car design, including aerodynamics, methods, main characteristics, time spans.
2. Aerodynamic characteristics of flow past streamlined and bluff bodies. Streamlines at streamlined and bluff bodies and estimation of pressure coefficient distribution.
3. Expression of force acting on a body exposed to flow by pressure and shear force coefficients. Order of magnitude of pressure and shear force coefficients. Comparison of pressure and shear stress related drag force at bluff and streamlined body.
4. Drag acting on brick shaped bluff body of quadratic cross section: streamlines, pressure coefficient distribution, local drag coefficient values in case of sharp leading edges. (Flow direction is parallel to the longitudinal symmetry axis.)
5. Drag acting on brick shaped bluff body of quadratic cross section: streamlines, pressure coefficient distribution, local drag coefficient values in case of rounded leading edges. (Flow direction is parallel to the longitudinal symmetry axis.) Diagram: drag coefficient as function of dimensionless rounding radius, effect of turbulence generator (wire).
6. Effect of boat tailing of a cylindrical body of rounded front face on the drag coefficient (with justification of the effect).
7. Interaction of front spoiler and rounding up of upper horizontal leading edge of cars in terms of drag reduction.
8. List and define the force and moment coefficients related to a car.
9. Generation, effect and control of lift force acting on cars.
10. Effect of side wind on the pressure distribution past cars (line diagram). How can be reduced the harmful effect of side wind on the directional control.
11. Please, show by using a line diagram the front and rear spoilers and list and explain their effects on lift and drag.
12. Please, list (without explanation) the modifications of car body resulting in drag reduction.
13. Please, sketch the parts of a car where boundary layer separation can be expected and the separation bubbles as well as open vortex tubes.
14. Please describe the generation of rear (base) drag of cars and methods of its reduction.
15. Please list of characteristics of flow past bus body in general and past individual parts of the body.
16. Please write about composition and reduction of drag force acting on a bus (brick shaped bluff) body and methods of reduction.
17. Please list and value the changes of bus body geometry according drag reduction capability.
18. Please, list and value the add on devices used at buses according drag reduction (or increase) capability.
19. Please explain the fluid mechanical background of mud deposition on rear wall of busses and the methods of its reduction.
20. Please explain the fluid mechanical background of mud deposition on side walls of busses and the methods and mechanisms of its reduction.
21. Please list the consequences (drag, rear and side wall mud deposition) of use of a front spoiler for a bus and explain the reasons for it.
22. The consequence of sharp vertical leading edges on the side wall mud deposition, and its explanation.
23. Please estimate the increase of values of drag and lift coefficients in comparison to that of a car body without wheelhouse when adding wheelhouse and wheel to the body.
24. Besides change of drag and lift coefficient please, define two reasons for significance of wheelhouses and wheels in term of development of flow field past a car body.
25. Please, list three possible measuring method that can be used for measurement of flow past wheels and evaluate them.
26. Please, explain the drag reduction by using shear layer conditioning.
27. Use of shear layer conditioning for drag reduction at trucks, lorries.
28. Use of spoilers, turning vanes, modification of trailer front face for reducing drag.