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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*A Constituent Institution of Manipal University*

## VII SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

## END SEMESTER EXAMINATIONS, DEC 2016

SUBJECT: VEHICLE BODY ENGINEERING [AAE 451]

**REVISED CREDIT SYSTEM**
**(26/12/2016)**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

**1A.** What is meant by Fore and After loading that experienced by vehicle chassis? **(02)**

**1B.** Explain the coupe type of car coach and mention its type. **(03)**

**1C.** Load distribution between the front and the rear axle of a motor vehicle weighs 1350 kgs is that 48% of the total load is taken by the front axle. The width of the track is 140 cm and the distance between the centres of the spring pads is 66 cm. Design a suitable I-section for the front axle if the width of the flange and its thickness are 0.6 and 0.2 of the overall depth of the section respectively and the thickness of the web 0.25 of the width of the flange. Assume a working stress of 915 kgf/cm$^2$. **(05)**

**2A.** Explain the Airflow on Rear end of Notch back vehicle. **(02)**

**2B.** Mention the Modification can be done on Roof of car to reduce the Drag. **(03)**

**2C.** Calculate the maximum bending moment and maximum section modulus assuming the following: **(05)**

Wheel base = 180 cm, Overall length = 360 cm, Equal overhang on each side. 270 kgf acting at CG of load 45 cm in front of front axle, 180 kgf acting at CG of load 45 cm behind front axle, 180 kgf acting at CG of load 45 cm in front of rear axle, 67.5 kgf acting at CG of load 45 cm behind Rear axle.

In addition, there is a uniformly distributed load of 1.75 kgf per cm run over the entire length of the Chassis. Assume dynamic stress = twice the Static stress induced.

**3A.** Explain the difference between Viscous flow and Inviscid flow. **(02)**

**3B.** A car has a length of 4m and is travelling at 30 m/s. if Air density is 1.22 kg/$m^3$ and Air viscosity is $1.8\times10^{-5}$Ns/$m^2$ , find the Reynolds Number. **(02)**

**3C.** A racing car is fitted with an inverted aero foil of length 1.2m and chord 0.85m at such angle that Cd=0.3 and Cl=1.3. The car length is 4.6m, the body surface is 11.5$m^2$and the skin friction coefficient is given by 0.0741 $Re^{-0.2}$ where Re is based on car length. The car weight is 12.75 kN and the Rolling resistance is 40 kN of normal force between the tyres and road surface. If the form drag on the car is 500 N when the car maintains a constant speed of 60 m/s, determine at this speed: **(06)**

a) The total aerodynamic drag force on the car,
b) The total Rolling resistance, and
c) The power required to drive the car.

Assume for air assume: Density = 1.2 kg/$m^3$ and the dynamic viscosity = $1.8\times10^{-5}$ kg/ms

**4A.** What is meant by Drag coefficient? **(02)**

**4B.** With a neat sketch, explain the Boundary layer. **(03)**

**4C.** Explain the concept of Deformation of the Wheel. **(05)**

**5A.** What is meant by Under steering, over steering and Neutral steering? **(03)**

**5B.** Derive an expression to find the load on each wheel of vehicle with trailer accelerated on inclined road. **(07)**

**6A.** Explain the Adaptive wall type of wind tunnel. **(02)**

**6B.** With a neat sketch, explain the Blow down wind Tunnel. **(04)**

**6C.** A passenger car has a frontal area of 21 square feet and drag coefficient of 0.42. it is travelling along 55 mph. calculate the aerodynamic drag and the associated horsepower requirements if it is driving into a 25-mph headwind and with a 25-mph tailwind. **(04)**