

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII(NEW) • EXAMINATION – WINTER 2016

Subject Code:2170203

Date:18/11/2016

Subject Name:Vehicle Dynamics

Time:10.30 AM to 1.00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain vehicle fixed co-ordinate system with neat sketch. **07**
 (b) Derive the equation to calculate the dynamic axle load for the following condition of four wheeler: **07**
- a) When the vehicle on level ground under static condition.
 - b) When the vehicle on grads with low speed acceleration.

- Q.2** (a) Derive Tractive force for power limited acceleration. **07**
 (b) Explain relationship and impact of vehicle speed to stopping distance, stopping time and energy consumed in braking. **07**

OR

- (b) Write short notes : **07**
- a) Lumped mass
 - b) Pressure distribution around the vehicle

- Q.3** (a) A car has a frontal projected area of 1.6 m^2 and travels at 60 km/h . It has a drag coefficient of 0.35 based on frontal area. Calculate the power required to overcome wind resistance by the car. if the drag coefficient is reduced to 0.30 by streaming, for the same power expended in overcoming air resistance, what speed of the car is possible. Take air density as 1.2 kg/m^3 **07**

- (b) Define the following term: **07**
- a) Wheel centre
 - b) Camber angle
 - c) Rolling resistance
 - d) Suspension roll
 - e) Neutral steer
 - f) Under steer
 - g) Transient state

OR

- Q.3** (a) Determine the following for the tire if $R_w = 0.98 R_g$. **07**
- a) Longitudinal slip S if geometric radius (R_g) of tire is 10 cm .
 - b) Wheel angular velocity (ω_w) if the speed of the wheel is 100 km/h .
 - c) Equivalent angular velocity (ω_{eq}) of the tire.

- (b) Draw and define following related to tire force system: **07**
- a) Longitudinal force
 - b) Normal force
 - c) Lateral force
 - d) Roll moment
 - e) Pitch moment
 - f) Yaw moment

- Q.4** (a) Explain quasi static rollover of suspended vehicle showing all acting forces. **07**
 (b) Derive an expression for lateral slip in tire for a simple model. **07**

OR

- Q.4** (a) Define ride and explain ride dynamic system. **07**

- (b) Draw and explain the arbitrary forces acting on a uphill motorcycle. **07**
- Q.5** (a) Explain the various steering systems forces and moments with neat sketch. **07**
- (b) Explain functions of vehicular steering systems and steering geometry errors. **07**

OR

- Q.5** (a) Explain quasi static rollover of rigid vehicle showing all acting forces. **07**
- (b) Explain in detail effect of Aerodynamic drag and Aerodynamic aids on **07**
performance of vehicle.
