GUJARAT TECHNOLOGICAL UNIVERSITY BE - SEMESTER-VII • EXAMINATION – SUMMER 2013

Subject Code: 170203

Date: 28-05-2013

Subject Name: Vehicle Dynamics

Time: 02.30 pm - 05.00 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 motion variables and represent the same on vehicle 07 axis system.
 - (b) A car weighing 21500 N has a static weight distribution on the axles of 07 50:50 the wheel base in 4m and the height of centre of gravity above ground is 0.6m. If the coefficient of friction on the road surface is 0.6. Calculate the advantage of having rear wheel drive on front wheel drive as far as gradiability is concerned, if engine power is not a limitation.
- Q.2 (a) Draw a free body diagram of a solid drive axle representing the drive 07 torque reactions on the chassis and also derive the equation to calculate transverse weight shift due to drive torque as a function of tractive force.
 - (b) A motor car with wheel base 2.8m with a centre of gravity 0.85 m 07 above the ground and 1.15m behind the front axle has a coefficient of adhesion 0.62 between the tyre and ground. Calculate the maximum possible acceleration when the vehicle is,
 - i) Driven on front wheel drive
 - ii) Driven on rear wheel drive
 - iii) Driven on four wheel drive

OR

- (b) Explain the operation of Anti lock Braking system and illustrate the **07** objective of ABS by braking coefficient versus slip plot.
- Q.3 (a) What is the effect of front and rear wheel lockup? Derive an expression 07 for the stopping distance in meter of truck equipped with all wheel brakes in terms of coefficient of friction and speed in km per hour.
 - (b) Define roll center. Locate the position of roll center for positive swing 07 arm, Negative swing arm, parallel swing arm and inclined parallel swing arm and MacPherson Strut independent suspension system.

OR

- Q.3 (a) Explain the active control parameters for improvement of vehicle ride 07 performance.
 - (b) Draw quarter car model of vehicle representing passive suspension 07 system. Obtain the mathematical model for the same in steady state vibration for sprung and unsprung mass.
- Q.4 (a) Enlist the types of nonuniformities generated in tire and wheel 07 assembly as a part of ride isolation system and explain each of them.
 - (b) Explain the factor affecting rolling resistance to the vehicle.

07

Q.4 (a) i) The engine of a vehicle is providing 40.5 kW brake power for 04 propulsion purposes. In a certain application, the vehicle weighing 12500 N is required to pull a crane of gross weight 12KN at a speed of 45km/hr in top gear on level. The resistance to motion is given by R= $aW + bV^2$, where a=0.016 and b=0.055,W in N and V in km/hr. Calculate if the vehicle is capable for the job or not? Transmission efficiency is 90%. 03

ii) What is crosswind sensitivity? Enlist the parameters on which crosswind sensitivity is depends?

- (b) Explain four wheel steering system mechanism. What is the effect of **07** four wheel steering system on low speed turning and high speed turning?
- Q.5 (a) Define steering geometry error. Explain the effect of geometry error on 07 dynamics of vehicle.
 - (b) Draw and explain the vehicle model which describes the geometry in 07 turns for analysis of vehicle in steady state cornering.

OR

- Q.5 (a) Define all the forces and moments acting on tire and represent the same 07 on tire axis system.
 - (b) Enlist the parameters, which affect cornering properties of tire and 07 mention their effect on the cornering properties.
