Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 711106N **Date: 16-01-2013**

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)**	Enlist primary functions of a suspension system and explain types of solid axle drives.	**07**
	(b)	Define suspension roll center and roll axis. Explain the procedure for locating the roll center for an independent suspension with suitable example.	**07**
Q.2	**(a)**	A vehicle having semi elliptic types of leaf spring has leaves of 70mm width and 10mm thickness and having effective length of 870mm.If the stress is not to exceed 220MPa, when spring is designed to carry a maximum load of 4950N.Calculate no. of leaves and deflection under this condition. If the spring is replaced by a coil suspension spring has a mean diameter 125mm and made out of wires of diameter 15mm, Calculate no.of effective coils for same loading and deflection. Take Modulus of elasticity = 196.2 X 10^6 KPa and Modulus of rigidity = 73575 X 10^3 KPa.	**07**
	(b)	i) What is wheel wobble and wheel shimmy? Enlist the reasons for wheel wobble, wheel shimmy and solutions for diminishes wheel wobble and wheel shimmy.	**04**
		ii) What is the purpose of shock absorber? Why does a shock absorber provide more control for rapid movement than for slow movement of vehicle?	**03**
		OR	
	(b)	Compare leaf spring, coil spring, torsion bar and rubber spring as a part of vehicle suspension system.	**07**
Q.3	**(a)**	Explain the effect of steering geometry on dynamics of vehicle.	**07**
	(b)	Derive the fundamental condition to be satisfied by all types of steering mechanism ,if true rolling for all the wheels is to be obtained without skidding.	**07**
		OR	
Q.3	**(a)**	What is steering geometry error? Discuss the effect of steering geometry error.	**07**
	(b)	Explain the condition for neutral steer, understeer and oversteer for vehicle while turning.	**07**
Q.4	**(a)**	Draw quarter car model for active and passive suspension system representing steady state vibration. Derive the equation of motion for sprung and unsprung masses representing dynamic behavior for the quarter car model in steady state vibration.	**07**
	(b)	Define vehicle ride. Enlist the components of ride dynamic system.	**07**

Explain the various excitation sources of vehicle ride.

OR

Q.4	**(a)**	Draw model of a car vibration with two degree of freedom and derive the equation of motion for the same.	**07**
	(b)	An engine weighing 1790.5N is to be supported on four helical coil springs. The primary vertical disturbing force is 333 N due to the unbalanced reciprocating weight at an engine speed of 1100 rpm. Consider single degree of freedom and calculate the stiffness of each spring of deflection to limit the maximum total periodic force on the foundations to 22.3N.What will be the amplitude of vibration of the engine when its speed is 680 rpm?	**07**
Q.5	**(a)**	Calculate the maximum gradeability of a vehicle for the two combinations of drives front wheel drive and rear wheel drive with coefficient of friction = 0.3.The following information on the vehicle is given: Gross vehicle weight = 23000 N Static weight distribution on axle = 50:50 Wheel base = 3m CG height from road surface = 0.55 m Neglect aerodynamic and inertia forces acting on vehicle.	**07**
	(b)	Explain the dynamics of vehicle running on a banked track with vehicle model representing forces acting on them.	**07**

OR

Q.5	**(a)**	Enlist the mechanism for rolling resistance on vehicle. Explain factors affecting rolling resistance.	**07**
	(b)	Explain traction and tractive effort. A car weighing 14950 N is travelling up a hill of slope 1 in 25 at a speed of 35.35km/h. Consider coefficient of rolling resistance is 0.015 and there is a head wind of 12.8 km/hr. If the projected area of the car is $1.67m^2$, Calculate the total power employed in propelling the car. Take coefficient of air resistance Ka= 0.036788 consider V in km/hr.	**07**

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