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

Su Su	bject bject	Code: 170203 Date: 23/11/2016 Name: Vehicle Dynamics	
Time: 10:30 AM to 01:00 PM Total Marks: 70			
	1. 2. 3.	Attempt all questions. Make suitable assumptions wherever necessary. Figures to the right indicate full marks.	
Q.1	(a)	 Define following vehicle dynamic terminologies. Euler angles Camber thrust Brake factor Soft and Hard suspension Slip angle Understeer and Oversteer Roll Steer 	07
	(b)	 1) Explain types of road resistance acting on vehicle. 2) A passenger car, with gross mass of 1100 kg, travelling at 80km/hr is accelerated up a gradient of 1 in 20, the vehicle has a frontal area of 1.9m² and air resistance coefficient of 0.02688. The rolling resistance is given by 0.0112*m*g +0.00006*m*g*V, Where V is in km/hr and m is in kg. At 80 km/hr the engine develops 60kW corresponding to an engine speed of 4400 rpm.Rear axle ratio is 5:1; transmission efficiency is 95%. Assume Wheel radius 0.335 m. Calculate: 1. The total resistance. 2. The tractive effort available at the wheels. 	03 04

- Q.2 (a) What is traction limited acceleration? Formulate the equation for maximum 07 traction force of rear wheel drive having solid rear axle with non locking differential.
 - (b) A vehicle has a gross weight of 3000 Kg and having wheel base length (L) = 07 4m.Distance of front axle from CG is 0.55*L and Distance of rear axle from CG is 0.45*L. Height of CG is 0.35*L ;Coefficient of rolling resistance is 0.02.Calculate the maximum acceleration, maximum gradability for following vehicle drive types and compare the results.
 - 1) Front wheel drive
 - 2) Rear Wheel drive

OR

- (b) With the help of road performance curve explain acceleration, gradability and 07 drawbar pull.
- Q.3 (a) Explain brake proportionality and skid number. 07
 - (b) A motor car has a wheel base of 2.6 meter, the height of its centre of gravity above the ground is 0.61 meter and it is 1.12 meter in front of the rear axle. If the car is travelling at 40 km/hr on a level track. Determine the minimum distance in which the car may be stopped, when (a) the rear wheels are brakes (b) all wheels are brakes.

- Define Understeer Gradient. Explain experimental methods for measurement 07 Q.3 (a) of understeer gradient and Write down the necessary condition for Neutral steer. Understeer and oversteer. 07
 - **(b)** Illustrate tire print and hydroplaning phenomena.
- Q.4 With neat sketch draw force and moments acting on pneumatic tyres and **(a)** 07 define each terms.
 - What is the meaning of steady state lateral force? Explain the effect of slip 07 **(b)** angle on lateral force.

OR

- 0.4 Explain all the factors of ride comfort. 07 **(a)** Explain: How the vehicle ride performance can be improved by semi or active 07 **(b)** suspensions?
- Q.5 Write down the necessary condition for antidive when all wheels are brakes. 07 **(a)** How do you obtain 100% antidive on front and 100% anti lift on rear suspension geometry? Why 100% antidive is rarely used in practice?
 - Define Roll center and roll axis. Locate the roll center for the following 07 **(b)** suspension mechanism.
 - 1) Hotchkiss suspension.
 - 2) Positive swing arm independent suspension.
 - 3) Macpherson strut suspension.
 - 4) Four link rear solid axle suspension.

OR

Q.5 **(a)** Derive Ackerman condition and determine turning radius for a vehicle having 07 following dimensions and steer angle: Wheel base= 2.62 m

Wheel track = 1.57m

Distance of CG from rear axle = 1.52 m

Steer angle of the steer angle of the inner wheel =12 deg

(b) Explain : How four wheel steering system improve low speed maneuverability 07 and high speed cornering?
