THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF TECHNOLOGY - LEVEL 06
FINAL EXAMINATION – 2007
MEX 6332 : VEHICLE DYNAMICS AND DESIGN OF AUTOMOTIVE COMPONENTS
PAPER I : VEHICLE DYNAMICS COMPONENT
DATE : 12 MAY 2008 (Monday)
TIME : 1330 - 1530
DURATION : TWO HOURS

INSTRUCTIONS : This question paper consists of six (06) questions. You are required to answer any four (04) questions. All questions carry equal marks.

Question 01

Determine the maximum allowable linear velocity of the passenger car to satisfy the conditions given below.

Mass of the vehicle	- 4300 kg
Coefficient of friction between the road and wheel	- 0.55
Radius of the curvature of the track	- 20 m
Inclination of the track	- 15^0
Length of the wheel track	- 1.3 m
Height of the centre of gravity from ground level	- 160 cm

Question 02

(a) Explain the construction of cross ply and radial ply tyres using sketches.
(b) Explain the notations written as 185/70 R14 on a tyre.
(c) With aid of graphs, compare the variation of rolling resistance of radial ply and cross ply tyres.

Question 03

(a) Calculate the power required and overall transmission ratio between the engine and the road wheels for a truck travelling on a level road, using the following data.

Mass of the truck	-	1,000 kg
Speed of the truck	-	40 km/h
Tractive resistance against the motion	-	0.2 N/kg
Diameter of the road wheel	-	1.2 m
Engine speed	-	1,800 rev/min
Transmission efficiency of the truck	-	0.85

(b) When the engine transmitting three times the power calculated in (a) at 1,800 rev/min, with the throttle at fully open position determine:

i. The maximum truck speed in km/hr along a 10^0 slope
ii. The overall gear ratio required.

Question 04

The following information are available for a suspension systems of a motor car.
Front suspension system consists of identical coil springs at each left and right side. Rear suspension system consists of two identical leaf-spring combinations in each left and right sides.

Wheel base of the car	-	3,300mm
Location of the Centre of Gravity (CG)	-	1,600mm in front of the rear axle and 750mm above the ground level
Gross weight of the car	-	13kN
Stiffness of a tyre-spring	-	1.2×10^6 N/m
Combined stiffness of a leaf spring assembly	-	1.0×10^5 N/m
Stiffness of a coil spring	-	1.4×10^5 N/m

The following assumptions are made for the sake of simplicity.

1. Deflection of the combined front suspension system is equal to the deflection of the combined rear suspension system.
2. All tyres have the same stifness.
3. Shock absorbing effects are not considered.

Determine the position of the elasticity centre of the vehicle under the above conditions.

Question 05

The following observations were made in respect of a car.



Curb weight :		
on the front axle	-	8,000N
on the rear axle	-	6,000N
Wheelbase	-	2,800mm
Speed of the car	-	60km/hr
Overall length of the car	-	4,120mm
Overall width of the car	-	1,660mm
Overall height of the car	-	1,370mm
Aerodynamic drag coefficient of the car	-	0.68
Transmission efficiency of the car	-	0.90
Coefficient of rolling resistance between road and tyre-wheel	-	0.2
Ambient pressure	-	$1.03 \times 10^5 N/m^2$
Ambient temperature	-	30^0C
Gas constant	-	0.287 kJ/kg.K

Determine:

(i.) Fore/aft position of the centre of gravity of the car.
(ii.) Aerodynamic drag resistance.
(iii.) Rolling resistance.
(iv.) Power developed by the engine under the given conditions.

Question 06

(i) Explain forces acting on a moving vehicle
(ii) Explain the effect of aerodynamic forces on the following performance parameters of a vehicle
   a. Maximum speed
   b. Fuel consumption
   c. Acceleration

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