Total No. of Questions : 10]

SEAT No. :

P4010

[Total No. of Pages : 3

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M.E. (Mechanical) (Design Engineering)

VEHICLE DYNAMICS

(2008 Pattern) (Elective - IV(a)) (Semester - II)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates :

1) ***Answer any three questions from each section.***
2) ***Figures to the right indicate full marks.***
3) ***Use of non-programmable electronic calculator is allowed.***
4) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) Explain Kinematic behavior of vehicles with rigid wheels and with compliant tires. **[8]**

b) The sprung parts of a passenger car weigh 18 KN and the unsprung parts weigh 960 N. The combined stiffness of the suspension springs is 48.9 KN/m and that of the tires is 646 KN/m. Determine the two natural frequencies of bounce motion of the sprung and unsprung mass. **[8]**

Q2) a) A rear engine rear wheel drive passenger car has a mass of 1200 kg. The weight distribution on the front axle is 42 % and that on rear axle is 64 % under static condition. If cornering stiffness each of the front tires is 36 KN/rad and that of rear tires is 39 KN/rad determine the steady state handling behavior of the vehicle. If the vehicle has wheel base of 2.38 m find critical/characteristics speed of vehicle. **[8]**

b) Explain in brief the combined pitch and bounce motion an application to multi wheel station vehicles. **[8]**

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Q3) a) What are test carried out for determining handling characteristics of vehicle? Explain each test in detail. **[8]**

b) Explain most commonly used frequency weightings for whole-body vibration with example. **[8]**

Q4) Explain the significance of steer angle and Derive an expression for the steer angle δf required to negotiate a given turn with usual notations **[16]**

Q5) Write Short Notes on : **[18]**

a) Two degrees of freedom vehicle model for pitch and bounce.

b) Characteristic and Critical speeds.

c) effect of wheelbase in road and suspension modelling.

SECTION - II

Q6) The sprung parts of a passenger car weigh 9.5 kN and the unsprung parts weigh 850 N. The combined stiffness of the suspension springs is 41.5 kN/m and that of the tires is 551.3 kN/m. Determine the two natural frequencies of bounce motion of the sprung and unsprung mass. Derive the formula used. **[16]**

Q7) A passenger car weighs 18 kN and has a wheelbase of 2.9 m. The center of gravity is 1.2 m behind the front axle and 48 cm above ground level. In practice, the vehicle encounters a variety of surfaces, with the coefficient of road adhesion ranging from 0.3 to 0.8 and the coefficient of rolling resistance of 0.016. With a view to avoiding the loss of directional stability on surfaces with a low coefficient of adhesion under emergency braking conditions, what would you recommend regarding the braking effort distribution between the front and rear axles? **[16]**

Q8) Explain with the help of labeled sketch mechanism and handling of military vehicle. **[16]**

Q9) a) Explain two degree of freedom theory to include effects of traction and braking. **[8]**

b) Explain in Brief the analysis of sprocket torques and speeds, required to skid steer a tracked vehicle. **[8]**

Q10) Write short notes : **[18]**

a) Steering force and moments.

b) Types of dependent and independent suspensions.

c) ISO Standard for Human Response to Vibrations.

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