

Anna University – Regulation 2013

(Part – B) Unique Important Questions – 6th Semester BE/BTECH

AT6604 VEHICLE DYNAMICS

UNIT I - V

1. Discuss the concept of vibration absorber with a suitable expression and show mathematically how the system is completely absorbing the vibration?
2. Derive the equation for free and forced vibration for two degree of freedom?
3. What do you mean by Magnification factor? Derive a suitable expression for calculating the magnification factor for a single degree of freedom?
4. Derive the equation for free and forced vibration for single degree of freedom for i) Under damped conditions ii) Over damped conditions iii) Critically damped conditions
5. A wheel with weight W attached to it through a spring is rolling along a wavy surface with a constant speed of V is 18.25m/s . The static deflection of the spring under the load W is 0.098m and the wavy surface is given by $y=Y\cos(2\pi V/l)t$. Determine the amplitude of forced vibration if length of wavy surface is 1.83m and $Y=0.025\text{m}$
6. Derive a suitable expression for transmissibility ratio. Also draw the Magnification factor vs frequency ratio and mention its importance
7. Describe briefly the free vibration of a vehicle with single degree of freedom
8. Explain the variation of longitudinal tire force with various slip angles in detail.
9. Describe how tire road friction can be estimated for both traction and braking.
10. Describe about the tire vibration with suitable sketches
11. Explain how tire forces can be evaluated by using Magic Formula tire model with suitable illustrations
12. Explain the different types of tire structures and its uses with neat sketches.
13. Explain the effect of tread pattern and speed on the braking performance of tires on various wet surfaces.
14. Explain the three distinct types of tire vertical stiffness and its evaluation
15. Explain in detail about Full, half and quarter car suspension models with neat sketches.
16. Explain the design methodology for passive suspension system using quarter car model.
17. Explain the control system design for active suspension system using LQR formulation for quarter car model.
18. Briefly explain the design and development of semiactive control systems for automotive suspensions
19. Explain the design methodology for semi active suspension system using quarter car model
20. Explain about LQR formulation for active suspension design
21. What is meant by sky-hook damping? Explain the influence of sky hook damping in modifying the performance of active and semi active suspensions.

22. Derive an equation for distribution of weight at front and rear wheels for a three wheeled road vehicle
23. Explain about load distribution of a four wheeled road vehicle with deriving the expression.
24. Explain the calculation of maximum acceleration, maximum tractive effort and reactions for different drive
25. Explain the working of anti lock braking system with a schematic layout. Explain the various factors that influence the ABS control systems What is meant by rolling resistance? Briefly explain how rolling resistance influence the performance of vehicle.
27. Briefly explain the aerodynamic forces and moments acting on the vehicle with its sign convention. Write the equation of motion for the forces and moments.
28. Derive the expression for the relationship between the tractive effort and longitudinal slip angles of the pneumatic tyres.
29. Explain briefly vehicle suspension in fore and aft direction.
30. A passenger car has a weight of 20.105 KN and a wheel base of 3.2m. The weight distribution on the front axle is 53.5% and that on the rear axle is 46.5% under static conditions. If the cornering stiffness of each of the front tyres is 38.92 KN/rad and that of rear tyres is 38.25 KN/rad, determine the steady state handling behavior of the vehicle.
31. Write an expression for steer angle required to negotiate a given curve and explain the terms over steer, under steer and neutral steer
32. Derive a suitable expression to calculate the under steer coefficient. With that expression, compute the characteristics speed of an under steer vehicle
33. Briefly explain the steady state handling characteristics of road vehicles.
34. Briefly explain the transient response characteristics of road vehicles
35. What is meant by steady state cornering? Deduce an expression for the relationship among the steer angle of the front tyre, turning radius, wheel base, understeer coefficient and explain the terms understeer and over steer of the vehicle.
36. Derive an expression for the limiting speed to slide outward and overturning speed of a vehicle along the banked track.
37. Determine the load carried by wheels at the outer and inner sides and the max value of coefficient of adhesion if there is no side slipping when the vehicle weighing 17.795KN runs at 96KMPH round a circular path so that the C.G moves in a circle of 122 m with its wheel axes at angle of 120 to horizontal. Its C.G is 1.06 m above the ground level and wheel track is 1.3 m. Explain the forces or couple acting.
38. A vehicle of total weight 49050 N is held at rest on a slope of 10° . It has a wheel base of 2.25 m and its centre of gravity is 1.0 m in front of the rear axle and 1.5 m above the ground level. Find (a) What are the normal reactions at the wheels? (b) Assuming that sliding does not occur first, what will be the angle of slope so that the vehicle will overturning.
39. A vehicle of total weight 49.05 KN is held at rest on a slope of 10° . It has a wheel base of 2.25 m and its centre of gravity is 1.0 m in front of the rear axle and 1.5 m above the ground level. Find (a) What are the normal reactions at the wheels? (b) Assuming that sliding does not occur first, what will be the angle of slope so that the

vehicle will overturn? (c) Assuming all the wheels are to be braked, what will be the angle of slope so that the vehicle will begin to slide if the coefficient of adhesion between the tire and the ground is 0.35?

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