

(3 Hours)

[Total Marks: 80]

- NB: - 1) Draw neat sketches whenever necessary.  
2) Q. No. 1 is compulsory.  
3) Solve any **three** questions from the remaining five questions.  
4) Assume suitable data wherever necessary.

- Q.1 Answer **any five** of the following : 20
- What are the advantages of rack and pinion type of steering gear ?
  - What are the mechanisms which generated lateral forces at tyre road contact patch during cornering? Explain in short any one.
  - Why suspension spring rates are kept low practically?
  - What are the sensors used in vehicle dynamics control system? Explain any one.
  - What is rolling resistance? Enlist mechanisms which generate rolling resistance.
  - Enlist aerodynamic aids used to reduce profile drag and explain any one.
- Q.2 a) Find the curvature response per degree of steering angle at 60 kph. The data given as : 10  
Mass of the vehicle – 1200 Kg  
Wheel base – 2.4 m  
Position of CG from front axle – 1.25 m  
Cornering stiffness of front tyres – 60 KN/rad  
Cornering stiffness of rear tyres – 65 KN/rad
- b) Explain special properties of double conjugate points. How it is applied to real vehicle? 10
- Q.3 a) What is variable rate springs? Explain the importance of variable rate in context with vehicle dynamics. 10
- b) Explain over steer, neutral steer and under steer with the help of stability derivatives. 10
- Q.4 a) Find the distance between the double conjugate points for the passenger car – 10  
Sprung mass = 900 kg, wheel base = 1.2 m , Distance of CG from front axle = 1.2 m ,  
Front suspension stiffness = 50 KN/m,  
Rear suspension stiffness = 150 KN / m.
- b) What are the tyre properties used during cornering? How cornering stiffness affects vehicle performance? 10

TURN OVER

- Q.5 a) Explain mechanics of air flow around a vehicle with aerodynamics aids and explain how drag is created ? 10
- b) Derive an equation for steady state response to side force. Explain the importance of stability derivatives. 10
- Q.6 Write short note on (Any Four) 20
- a) Vehicle Dynamics simulations
  - b) Ride
  - c) Active suspension
  - d) Anti rollover braking
  - e) Roll center and roll axis
  - f) Wheel wobble and wheel shimmy
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