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B.Tech. VII-Semester (Main&Back) Examination, Nov. - 2019
Automobile Engineering
7AE1A Vehicle Dynamics

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

Instructions to Candidates:

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

UNIT - I

1. Explain the following :
   i) Lumped mass
   ii) Euler angles
   iii) Motion variables
   iv) Importance of empirical and Analytical methods in vehicle dynamics. **(16)**

(OR)

1. a) Explain the force system acting on a rigid vehicle. **(8)**
   b) Describe earth fixed coordinate system. **(8)**

UNIT - II

2. Derive the expression for the relationship between the steer angles and slip angles of the front and rear tyres. **(16)**

(OR)

2. a) Derive the expression for the relationship between tractive effort and the longitudinal slip of pneumatic tyres. **(10)**
   b) Explain the basic function of tyres with the help of an example. **(6)**

UNIT - III

3. a) Explain briefly vehicle suspension in fore and aft direction. **(10)**
   b) A passenger car has a weight of 20.105 kN and wheel base of 3.2 m. 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 behaviour of the vehicle. **(6)**

(OR)

[Contd....

3. Explain the following :
   i) Castor theory
   ii) Roll centre geometry
   iii) Active suspension
   iv) Semitrailing Arm. (16)

UNIT - IV

4. a) Deduce an expression for the stability of a vehicle on a slope. (8)
   b) Describe stability analysis using inertial coordinates. (8)

(OR)

4. a) Explain how a vehicle can be in dynamic stability in as teady turn. (8)
   b) Explain the following :
      i) Neutral steer
      ii) Under steer gradient (8)

UNIT - V

5. a) Explain the mechanics of steering control of banking vehicles. (8)
   b) Describe the body force components of a two wheeler. (8)

(OR)

5. a) Explain the mechanics of steering control of lean angles. (8)
   b) Explain two wheel rigid vehicle dynamics with the help of a neat sketch. (8)