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Total No. of Questions: 09

Total No. of Pages: 02

B. Tech.(AE) (Sem. 6)
VEHICLE DYNAMICS
Subject Code: BTAE-603
Paper ID: A2382

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. Section A is **COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. Section B contains **FIVE** questions carrying **FIVE** marks each and students have to attempt any **FOUR** questions.
3. Section C contains **THREE** questions carrying **TEN** marks each and students have to attempt any **TWO** questions.

SECTION A

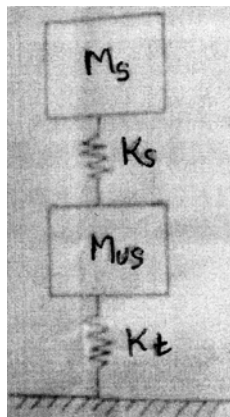
1. **Explain Briefly**
 - a) List out various sources of vibration in a vehicle?
 - b) Define magnification factor.
 - c) What do you mean by orthogonality of shape function?
 - d) What is an eigen value problem?
 - e) What do you mean by Rayleigh's coefficient?
 - f) State the importance of eigen value and eigen vector.
 - g) Define static and dynamic stiffness of a tire.
 - h) What do you mean by gyroscopic couple .
 - i) Define camber and camber thrust
 - j) What do you mean by stability of a vehicle?

SECTION B

2. For a vehicle having following specifications is moving on a plain road (without hitch load): Front axle weight $W_f = 800$ kg Rear axle weight $W_r = 400$ kg Wheel base = 1.2 m Height of CG from ground = 300 mm Distance of C.G from front axle = 200 mm

Calculate F_{xf} and F_{xr} when:
 - i) Vehicle is accelerating at 1 g
 - ii) Vehicle is accelerating at 2 g
 - iii) Vehicle is decelerating at 1.5g
3. Explain roll over criteria in detail.

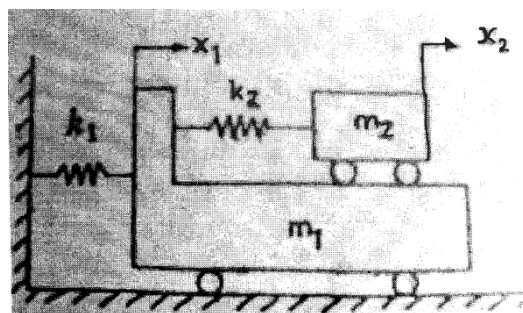
4. Discuss the following :
 - a. Camber and Camber thrust
 - b. Slip angle and Cornering force
5. Find the natural frequency of the quarter car model shown in the figure.



6. Explain in detail the directional stability of a vehicle.

SECTION C

7. Write the system of equation for the system shown below and compute the natural frequency of the system. Take $m_1 = 200$ kg; $m_2 = 50$ kg; $k_1 = 100$ kN/m; $k_2 = 20$ kN/m.



8. 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 rear axle and 1.5 m above the ground level. Find i) What are the normal reactions at wheels ii) assuming that sliding does not occur first, what will be the angle of slope so that the vehicle will overturn? iii) 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 co-efficient of adhesion between the tire and the ground is 0.35?
9. Explain the dynamics of a vehicle on a slope and on a banked road.