Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐   **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(AE) (2011 Onwards)   (Sem.–6)
# VEHICLE DYNAMICS
Subject Code : BTAE-603
Paper ID : [A2382]

Time : 3 Hrs.   **Max. Marks : 60**

INSTRUCTION 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 has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

1.   **Write briefly :**

   a)   What are the three elementary parts of a vibrating system?

   b)   Define the number of degrees of freedom of a vibrating system.

   c)   Why is it important to find the natural frequency of a vibrating system?

   d)   What is an eigenvalue problem?

   e)   How is the frequency equation derived for a multidegree of freedom system?

   f)   How will you calculate the effective spring rate of a vehicle?

   g)   What are the basic functions of a tire?

   h)   Write the advantage of Holzer method.

   i)   Explain the importance of power to weight ratio in automobile.

   j)   What is tractive effort?

SECTION-B

2. a) An automobile having a mass of 2,000 kg deflects its suspension springs 0.02 m under static conditions. Determine the natural frequency of the automobile in the vertical direction by assuming damping to be negligible.

   b) What methods are available for solving the governing equations of a vibration problem?

3. Define transmissibility. Derive an expression for motion transmissibility.

4. Explain the terms wheel hop, wheel wobble, wheel wander and wheel shimmy.

5. How are tires specified? Explain the effect of driving and braking torque on the tyre and factors affecting tire life.

6. Derive Tractive force for power limited acceleration.

SECTION-C

7. An automobile is modeled as shown in **Fig. 1** below. Derive the equations of motion using Newton's second law of motion.
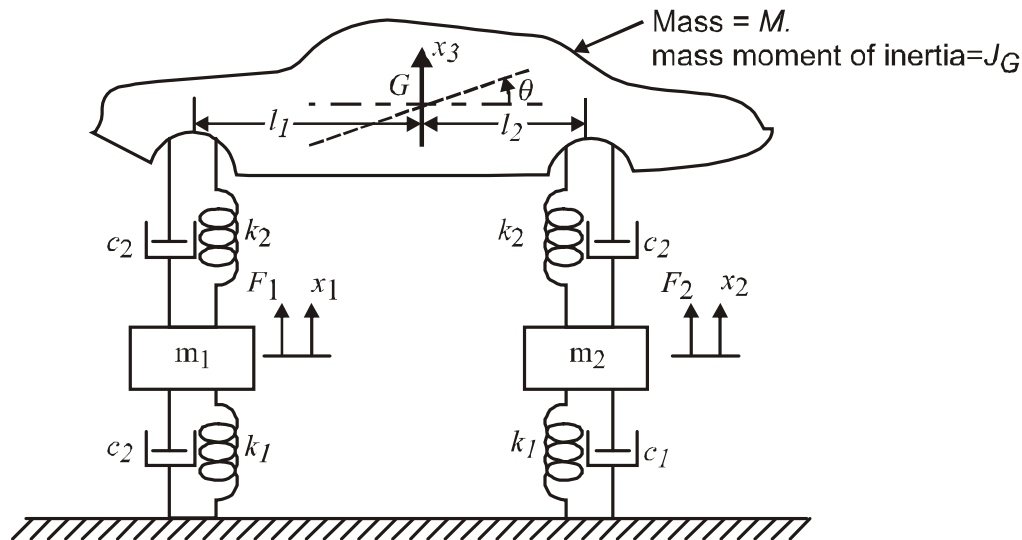

Fig. 1

8. Explain the following Turning response properties :

   Under steered gradient, Neutral steer, Under steer, Over steer, Characteristic speed and Critical speed

9. Explain the dynamics of a vehicle on a banked track.