Code No: **R1641242** **R16** **Set No. 1**

IV B.Tech I Semester Advanced Supplementary Examinations, May - 2022

VEHICLE DYNAMICS

(Automobile Engineering)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part-A and Part-B
Answer ALL sub questions from Part-A
Answer any FOUR questions from Part-B

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PART–A *(14 Marks)*

1. a) A light cantilever of length L has a weight W fixed at its free end. Find the frequency of lateral vibrations in the vertical plane? [3]
   b) What is slip damping? Explain? [2]
   c) Draw a graph between the magnification factor against the phase angle for various values of damping ratios. [2]
   d) What is the principle modes of vibration? Explain? [3]
   e) What is forward vehicle dynamics? [2]
   f) Explain the importance of Holzer's method? [2]

PART–B *(4x14 = 56 Marks)*

2. Find the natural frequency of vibration of the half solid cylinder shown in Fig: 1, when slightly displaced from the equilibrium position and released. [14]

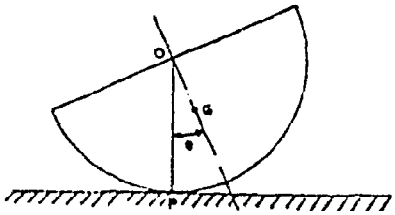

Fig:1 A half cylinder oscillating on a flat surface

3. a) A vertical spring of stiffness 10kg/cm supports a mass of 40kg. There is a friction force of 5 kg which always resists the vertical displacement whether upward or downwards. The mass is released from position in which the total extension of the spring is 12.6 cm. Determine the final extension of the spring in the position in which system comes to rest. [7]
   b) 25 Kg mass is resting on a spring of 5Kg/cm and dashpot of 0.15 kg-sec/cm in parallel. If a velocity of 10 cm/sec is applied to the mass at the rest position, what will be its displacement from the equilibrium position at the end of first second? [7]

4. a) A machine is weighing 1000kg is mounted on four identical springs of total spring constant K and having negligible damping. The machine is subjected to a harmonic external force of amplitude F_0= 50 Kg and frequency 180 rpm. Determine the amplitude of motion of the machine and maximum force transmitted to the foundation because of the unbalanced force when K= 2000 kg/cm [7]
   b) Describe how would you determine the damping in a system if you have just a frequency response curve of the system constant excitation. It being assumed that the damping is of viscous nature. [7]

5. a) Determine the two natural frequencies and the corresponding modes shapes for the system shown in Fig:2 The string is stretched with a large tension T . [5]

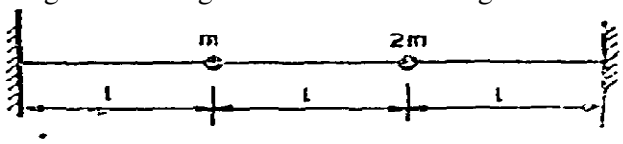

Fig:2

b) Determine the natural frequency of torsional vibrations of a shaft with two circular discs of uniform thickness at the ends. The weights of the discs are W_1= 500 Kg and W_2= 1000 Kg and their outer diameter are D_1= 125 cm and D_2= 190 cm. The length of the shaft is l= 300 cm and its diameter d= 10 cm. Modulus of rigidity for the material of the shaft is G= $0.85x10^5$ Kg/cm^3. And also find in what proportion will be the natural frequency of this shaft, if its length decreased from 300 cm to 150 cm and the diameter increased from 10 cm to 20 cm. [9]

6. a) Explain the effect of road roughness and engine unbalance on the vehicle vibration with suitable example? [7]

b) What are the different types of accelerometers used for measuring vibration? Explain any with neat diagram? [7]

7. Find the first natural frequency of transverse vibration of three masses fixed on a string as shown in Fig:3 by the matrix iteration. The string is stretched with a large tension T. [14]

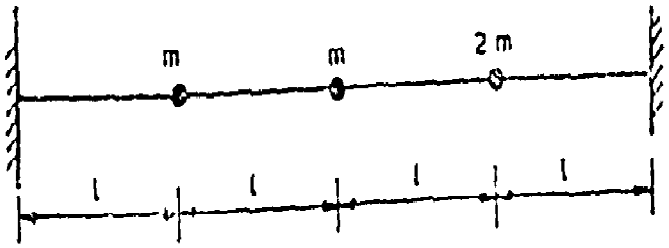

Fig:3