Code: 9A21702 **R09**

B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December 2015

VIBRATIONS & STRUCTURAL DYNAMICS

(Aeronautical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

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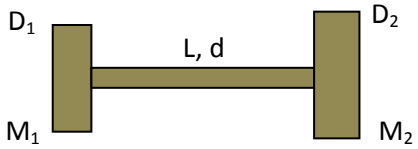
1 (a) State simple harmonic motion.
(b) Describe in detail the methodology to estimate equivalent viscous damping with an example.

2 (a) What is an accelerometer and describe its functionality?
(b) Describe in detail to determine dynamic characteristics of a cantilever beam. Explain the instruments, accessories and methodology required to perform the dynamic characteristics.

3 (a) State the energy method to determine natural frequency.
(b) Determine the equation of motion of simple pendulum by;
(i) Newton's method and (ii) Energy method.

4 (a) State the root cause of vibrations in rotating structural elements.
(b) The support of a spring mass system is vibrating with an amplitude of 5 mm and frequency of 1150 cycles/min. If the mass is 0.9 kg and the spring has stiffness 1960 N/m, determine the amplitude of vibration of the mass. What amplitude will result if a damping factor of 0.2 is included in the system?

5 (a) What are the consequences of vibration?
(b) Determine the natural frequency of torsional vibrations of a shaft with two circular discs of uniform thickness at the ends. The masses of the discs are M_1 = 500 kg and M_2 = 1000 kg, and their outer diameters 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 = 0.83 x 10^{11} N/sq.m.



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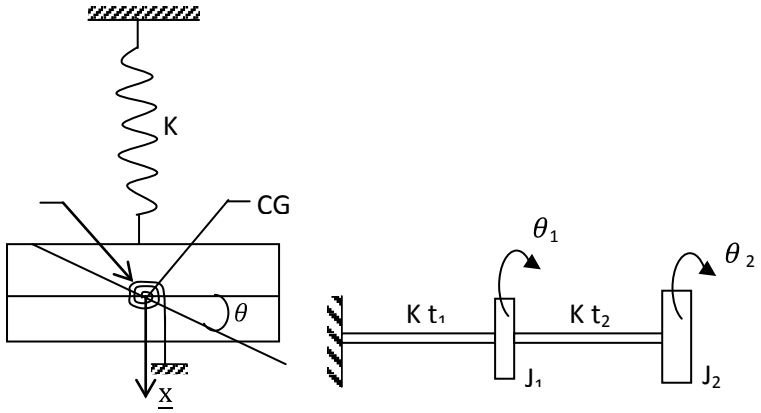
6 (a) State the principle of dynamic vibration absorber.
(b) Derive the equation for dynamic vibration absorber for 2 DOF systems (spring mass system).

7 (a) State Maxwell's reciprocal theorem.
(b) Study the type of coupling between the coordinates of the system shown in the figure given below. Use the differential equation method and the energy method.



8 (a) Write a short note on resonance.
(b) Derive an equation for natural frequency of transverse vibration by Rayleigh method for a simply supported beam of length 'l' and uniform cross section. State the assumptions clearly.

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