Code No: **R41211** **R10** **Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February/March - 2018

VIBRATIONS AND STRUCTURAL DYNAMICS

(Aeronautical Engineering)

Time: 3 hours **Max. Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
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1 a) What is discrete system? Explain in brief about the Simple harmonic motion. [8]
b) Add the following motions analytically and check the solution graphically
$X_1 = 4 \text{ Cos } (\omega t + 10°)$
$X_2 = 6 \text{ Sin } (\omega t + 60°)$. [7]

2 a) Derive an expression for response of a rotating and reciprocating unbalance system? [9]
b) What is magnification factor? Draw Phase frequency response curve. [6]

3 a) An aerofoil using in its first bending and torsional modes can be represented schematically as shown in figure 3 (a) below connected through a translational spring of stiffness k and a torsional spring of stiffness k_T. Write the equations of motion for the system and obtain the two natural frequencies. Assume the following data. m = 5kg, I= 0.12 kg m^2, k = 5 X 10^3 N/m, K_T= 0.4 X10^3 Nm/rad, a = 0.1 m.

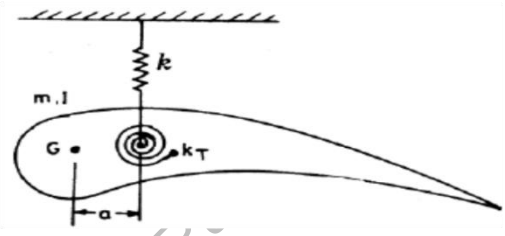

Figure 3 (a)

[12]

b) Explain in brief about the Lagrange's equation. [3]

4 a) Two pendulums of different lengths are free to rotate y-y axis and coupled together by a rubber hose of torsional stiffness 7.35 X 10^3 Nm / rad as shown in figure 4(a). Determine the natural frequencies of the system if masses m1 = 3kg, m^2 = 4kg, L_1 = 0.30 m, L_2 = 0.35 m.

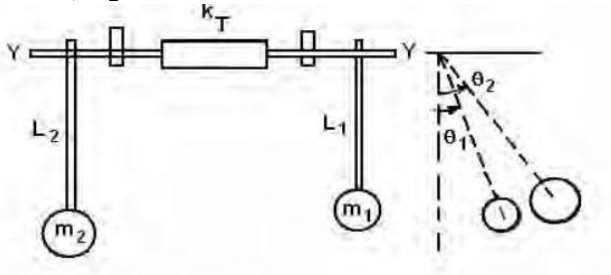

Figure 4(a)

[13]

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b) Name a few methods for finding the fundamental natural frequency of a multi degree of freedom system. [2]

5 a) What is the difference between stationary damping and rotary damping? [3]

b) Find the whirling speed of a 50 mm diameter steel shaft simply supported at the ends in bearings 1.6 m apart, carrying masses of 75 kg at 0.4 m from one end, 100 kg at the center and 125 kg at 0.4 m from the other end. Ignore the mass of the shaft. Assume the required data. [12]

6 a) A shaft of negligible weight 6 cm diameter and 5 meters long is simply supported at the ends and carries four weights 50 kg each at equal distance over the length of the shaft as shown in Figure 6 (a). Find the frequency of vibration by Dunkerley's method.
Take E = 2 x 10^6 kg / cm^2, if the ends of the fixed.

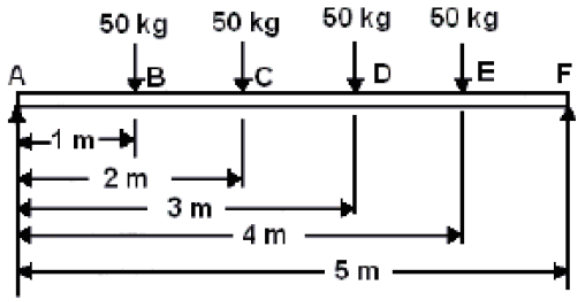

Figure 6 (a) [13]

b) What is Rayleigh's quotient? [2]

7 Determine the natural frequencies of the system shown in figure. 7 using matrix method.

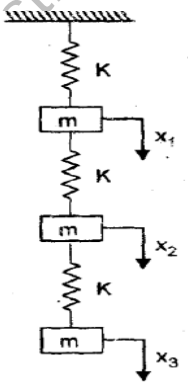

Figure. 7 [15]

8 a) Explain in brief about the Transient response analysis of modal equations using Duhamel's integrals. [10]

b) Discuss in brief about the S-plane representation. [5]