Student Exam. No._____

GANPAT UNIVERSITY

B. Tech. V Sem. Mechanical Engineering
CBCS Regular Examination Nov/Dec. 2015
(2ME503) Vibration and Balancing of Machines

Time: 3 Hours **Total Marks: 70**

Instructions:

(1) Attempt all questions.
(2) Assume suitable data if required.
(3) Right figure indicates full marks.
(4) Only Scientific calculator is allowed.

SECTION - I

Que. 1 Attempt the following.

(a) Explain the balancing of several masses rotating in the same plane with neat sketch. [4]

(b) A, B,C and D are four masses carried by a rotating shaft at radii 100 mm, 125 mm, 200 mm and 150 mm respectively. The planes in which the masses revolve are spaced 600 mm apart and mass of B, C and D are 10 kg, 5 kg and 4 kg respectively. Find the required mass A and relative angular setting of the four masses so that the shaft shall be in complete balance. [7]

OR

Que. 1 Attempt the following.

(a) How the system can statically balance? Enlist the different cases for Balancing of rotating masses? Explain a case in which the plane of the disturbing mass may be in between the planes of the two balancing masses with neat sketch. [4]

(b) A shaft carries four masses A, B, C and D placed in parallel planes, perpendicular to the shaft axis and in the same order along the shaft. The masses of B and C are 36 kg and 25 kg and both are assumed to be concentrated at a radius of 150 mm, while the masses A and D are both at a radius of 200 mm. The angle between the plane of B and C is 100° and that between B and A is 190°, both angles being measured in the same sense. The plane containing A and B are 250 mm apart and those containing B and C are 500 mm apart If the shaft is to be in complete dynamic balance, find: (i) The masses of A and D (ii) The distance between planes C and D; and (iii) The angular position of mass D. [7]

Que. 2 Attempt the following.

(a) Explain partial balancing of unbalanced primary force in a reciprocating engine and derive the equation for resultant unbalanced force at any instant. [4]

(b) An inside uncoupled locomotive is to be balanced for revolving masses and 2/3 of reciprocating mass. The revolving mass per cylinder is 200 kg and reciprocating mass per cylinder is 300 kg. The cylinder center lines are 600 mm apart and wheel center 1.5 m apart. Find (1). Magnitude and angular position of balance weight required at a radius of 600 mm in plane of wheels. (2). Hammer blow. (3). Variation in tractive effort. (4). Maximum Swaying couple. The cranks are at right angle and are 0.3 m long and rotate at 25 rad/sec. [8]

OR

Que. 2 Attempt the following.

(a) Explain hammer blow with neat sketch and derive the equation for limiting condition of speed. [4]

(b) The following data refer to an outside cylinder uncoupled locomotives. [8]
Weight of rotating part/ cylinder = 300 kg, Weight of reciprocating parts/cylinder = 270 kg, Angle between cranks = 90°, Crank radius = 0.3 m, Cylinder center = 1.75 m, Wheel center = 1.55 m, Radius of balancing weight = 0.7 m.
If whole of rotating unbalance and 2/3 of reciprocating parts are to be balanced in the planes of driving wheels. Find (i). Magnitude and angular position of balancing masses. (ii). speed in kmph at which the wheel start lifting when the load on each driving wheel is 2500 kg and the diameter of trend of driving wheel is 1.8 m. (iii)swaying couple at the speed arrived in at (ii).

Que. 3 Attempt the following.

(a) Explain balancing of radial engine with neat sketch. [3]

(b) Explain the jump phenomenon in cam system with neat sketch. [3]

(c) Determine displacement, velocity and acceleration of follower for a 2-3 polynomial cam. The follower rise 20 mm in 90° of cam rotation, which the cam shaft has turned through an angle of 18°. The cam shaft rotates at 60 rpm. [6]

SECTION - II

Que. 4 Attempt the following.

(a) How to add two Simple Harmonic Motions? Derive the equation of amplitude A and tanθ . [6]

(b) A uniform rod of mass 'm' is supported as shown in **Fig. (A)**. Determine the frequency of the resulting motion. [6]

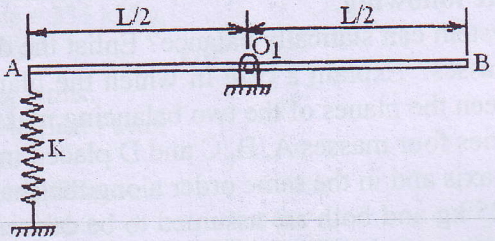

Fig. (A)

OR

Que. 4 Attempt the following.

(a) Explain torsional vibration with neat sketch and derive the equations for natural frequency. [6]

(b) Free vibration records of 1 tonne machine mounted on an isolator is shown in **Fig. (B)**. Determine the values of ζ (damping factor), ω_d, k, C, C_c. [6]

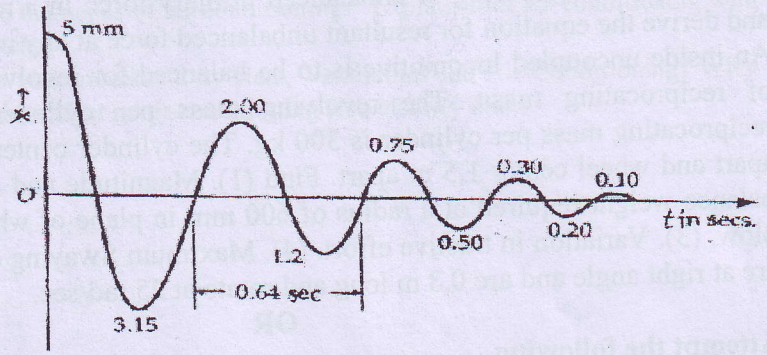

Fig. (B)

Que. 5 Attempt the following.

(a) Define Damped Free Vibration. Derive the Differential equation for Displacement x of damped free vibration. [6]

(b) A vibrating system is defined by the following parameters: [5]
m= 3 kg, k= 100 N/m, C= 3 N.sec/m
Determine (1) the damping factor (2) natural frequency of damped vibration (3) logarithmic decrement (4) the ratio of two consecutive amplitudes and (5) number of cycles after which the original amplitude is reduced to 20%.

OR

Que. 5 Attempt the following.

(a) Derive the equation of logarithmic decrement for n cycles. [6]

(b) For the system shown in **Fig. (C)**. Find mass 'm' that the system has a natural frequency of 10 Hz. Take, K_1 = 2000 N/m, K_2 =1500 N/m, K_3 = 3000 N/m and K_4 = K_5 = 500 N/m. [5]

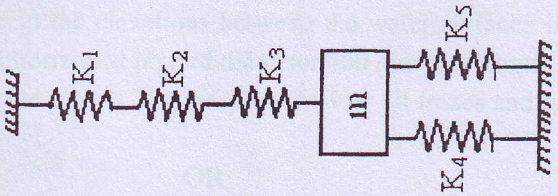

Fig. (C)

Que. 6 Attempt any Three. [12]

(a) Explain and Derive the equations for critically damped system.

(b) What are the types of damping? Explain viscous damping with neat sketch.

(c) What will be the equivalent stiffness of spring combinations? Explain them with neat sketch.

(d) Derive the equation of the motion for arrangement as shown in **Fig. (D)** by using energy method. Also find out time period and natural frequency of the system.

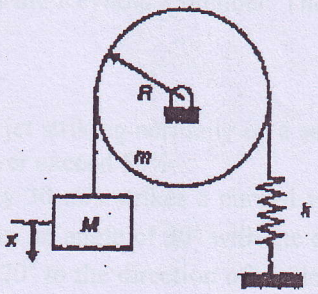

Fig. (D)

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