Student Exam. No._____

GANPAT UNIVERSITY

B. Tech. V Sem. Mechanical Engineering
CBCS Regular Examination Nov/Dec. 2016
(2ME503) Vibration and Balancing of Machines

Time: 3 Hours **Total Marks: 60**

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

(a) Define static balancing and explain a system which is statically balanced having unbalanced couple with neat sketch. Also write the conditions for dynamic balancing. **[3]**

(b) Explain single plane balancing machine with neat sketch. **[3]**

(c) Four masses A, B, C and D are 210 kg, 310 kg, 250 kg and 270 kg respectively. The corresponding radii of rotation are 0.25 m, 0.2 m, 0.3 m and 0.35 m respectively and the angles between successive masses are 50°, 80°, and 140°. Find the position and magnitude of the balancing mass required, if its radius of rotation is 0.25 using analytical method. Also draw the space diagram. **[4]**

OR

Que. 1

(a) Write the different applications in which the balancing is necessary. Enlist the various factors which are responsible for unbalance in the system. When and why it is necessary to transfer a force from one plane to another? Explain with neat sketch. **[3]**

(b) Four masses of magnitudes 5 kg, 6 kg, 7 kg and M kg revolve in planes A, B, C and D respectively. The planes are spaced A to B 0.8 m, A to C 1.2 m, A to D 2 m. The masses are all at the same radius. Find the magnitudes of the mass M and the relative angular positions of the masses for complete balance. **[7]**

Que. 2

(a) Derive the equation for unbalanced primary force acting along the line of stroke and also determine its position at which it is maximum or minimum. **[3]**

(b) The three cylinders of an air compressor have their axes at 120° to one another and their connecting rods are coupled to a single crank. The stroke is 100 mm and the length of each connecting rod is 150 mm. The weight of the reciprocating parts per cylinder is 15 N. Find the maximum primary and secondary forces acting on the frame of the compressor when running at 3000 rpm using direct and reverse crank method. **[7]**

OR

Que. 2

(a) Explain the balancing of V- engine and derive the equation of resultant primary force for V-engine. . **[3]**

(b) A two cylinder locomotive has the following specifications: **[7]**
Reciprocating mass/cylinder = 306 kg, Crank radius = 300 mm, Angle between cranks = 90°, Driving wheel diameter = 1800 mm, Distance between cylinder centers = 650 mm, Distance between the driving wheel planes = 1550 mm. Determine: (i) The fraction of reciprocating masses to be balanced, if the hammer blow is not to exceed 46 kN at 96.5 km/hr. (ii) The variation in tractive effort. (iii) The magnitude of swaying couple.

Que. 3

(a) Explain the under cutting phenomenon of roller follower with neat sketch. [3]

(b) In a 3-4-5 polynomial cam, follower returns 20 mm in 60° of cam rotation. The cam shaft rotates at 300 rpm. Find displacement, velocity, acceleration and jerk when shaft has turned through 35°. [7]

SECTION - II

Que. 4

(a) What are the types of vibration ? Explain them in details. [5]

(b) How to add two Simple Harmonic Motion? Explain. Derive the equation of amplitude A and tanθ. [5]

OR

Que. 4

(a) Explain torsional vibration with neat sketch and derive the equation for natural frequency of the torsional vibration system. [5]

(b) Derive the equation of natural frequency of compound pendulum with neat sketch. [5]

Que. 5

(a) Define damped free vibration. Derive the differential equation for displacement x of damped free vibration. [5]

(b) Free vibration records of 1 tonne machine mounted on an isolator is shown in **Fig. (A)**. Determine the values of ζ (damping factor), ω_d, k, C, C_c. [5]

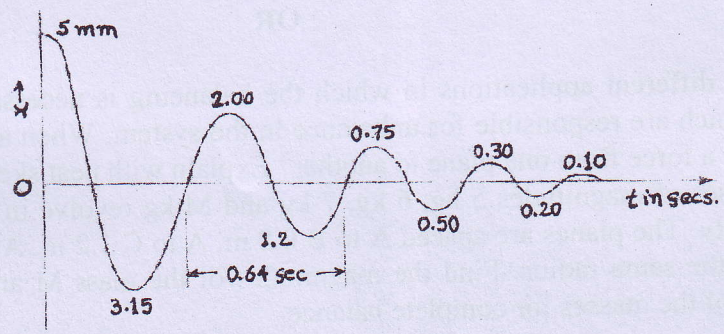

Fig. (A)

OR

Que. 5

(a) Derive the equation of logarithmic decrement for n cycles. [5]

(b) A shock absorber is to be designed so that its overshoot is 10% of the initial displacement when released. Determine the damping factor. If the damping factor is reduced to one half of this value, what will be the overshoot? [5]

Que. 6

(a) What are the types of damping? Explain viscous damping with neat sketch. [3]

(b) What will be the equivalent stiffness of spring combinations? Explain them with neat sketch. [3]

(c) Explain and derive the equations of under damped system. [4]

OR

(c) A mass of 1 kg is to be supported on a spring having stiffness of 9800 N/m. the damping coefficient is 4.9 N.sec/m. Determine the natural frequency of system. Also find δ and amplitude after 3 cycles if the initial displacement is 0.30 cm. [4]

********END OF PAPER********