Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY

Winter Examination-2015

Subject Name: Dynamics of Machines

Subject Code: 4TE05DOM1 Branch: B.Tech (Mechanical)

Semester: 5 Date: 9/12/2015 Time : 2:30 To 5:30 Marks : 70

Instructions:

(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1 **Attempt the following questions:** **(14)**

a) Why balancing is necessary for high speed engines? **(1)**
b) What do you understand by static and dynamic balancing? **(1)**
c) Define degree of freedom. **(1)**
d) Classify types of vibrations. **(1)**
e) State Rayleigh law of natural frequency. **(1)**
f) Define hammer blow and write its formula. **(1)**
g) Name the elements used in vibratory system. **(1)**
h) Differentiate between free and forced vibration. **(1)**
i) Define damping & Classify types of damping. **(1)**
j) What do you mean by torsional vibration? **(1)**
k) Define critical speed of shaft. **(1)**
l) Write the effects of vibrations. **(1)**
m) Define damping ratio. **(1)**
n) Define and write full form of FFT analyzer. **(1)**

Attempt any four questions from Q-2 to Q-8

Q-2 **Attempt all questions**

a) Define radial engines and explain concept of direct and reverse crank method to determine the unbalanced forces? **(07)**

b) Four masses A, B, C and D are completely balanced. Masses C and D make angles of 90^o and 210^o respectively with B in the same sense. The planes containing B and C are 300 mm apart. Masses A, B, C and D can be assumed to be concentrated at radii of 360,480, 240 and 300 mm respectively. The masses B, C & D are 15Kg, 25Kg & 20Kg respectively. Determine (i) The mass A and its angular position (ii) The position of planes A and D. **(07)**

Q-3 **Attempt all questions**

The following data refer to a four coupled wheel locomotive with two inside cylinders: **(14)**

Pitch of cylinder = 600 mm
Reciprocating mass/cylinder=315kg
Revolving mass/ cylinder = 260 kg
Coupling rod crank radius = 240mm
Distance of center of mass in plane of driving wheel = 750 mm

Distance between driving wheels= 1.6 m Angle between engine crank = 90^0
Distance between coupling rods = 2 m Angle between coupling rod crank
Diameter of driving wheels = 1.9 m with adjacent engine crank = 180^0
Revolving parts for each coupling rod crank = 130 kg
Engine crank radius = 300 mm
The balanced mass required for the reciprocating parts is equally divided between each pair of coupled wheel.
Determine: (i) magnitude and position of balanced mass required to balanced two-third of reciprocating masses.
(ii) Hammer blow and maximum tractive force when the speed of locomotive is 80 km/ hr.

Q-4 **Attempt all questions**

a) Define Logarithmic decrement and derive an expression for it. **(07)**

b) The disc of a torsional pendulum has a moment of inertia of 600 kg-cm^2 and is immersed in a viscous fluid. The brass shaft attached to it is of 10 cm diameter and 40 cm long. When the pendulum is vibrating, the observed amplitudes on the same side of the rest position for successive cycles are 9^0, 6^0, 4^0. Determine (i) Logarithmic decrement (ii) the damping torque at unit velocity & periodic time of observation. Assume modulus of rigidity of shaft material is $4.5*10^{10}$ N/m$^{2.}$ **(07)**

Q-5 **Attempt all questions**

a) Derive the expression for naturally frequency for free vibration using equilibrium and energy method. **(07)**

b) Derive the characteristic equation of damped free vibration system and also derive the general solution of any one type of damped system. **(07)**

Q-6 **Attempt all questions**

a) Explain Vibration isolation & Determine the expression for force & motion transmissibility. **(07)**

b) A machine of mass 60Kg is placed on four springs. The mass of reciprocating parts of a machine is 3Kg which moves through a stroke of 100 mm. The speed of crank is 800 rpm. The damping is introduced into the system to reduce the amplitudes of successive vibrations by 20 %. Find: **(07)**
(i) The stiffness of each spring, if the damper is removed and the force transmitted to the foundation is $(1/10)^{th}$ of the impressed force.
(ii) The force transmitted to the foundation at 800 rpm.

Q-7 **Attempt all questions**

a) Explain the method to determine the critical speed of shaft carrying single rotor, considering without damping. **(07)**

b) A shaft 50 mm diameter and 3 m long is simply supported at the ends carries three loads of 100 kg, 150 kg and 75 kg at 1 m, 2 m and 2.5 m from the left support. The modulus of elasticity of the shaft material is 2×10^5 MPa. Find the critical speed of the shaft by using Dunkerley's method. **(07)**

Q-8 **Attempt all questions**

a) Explain working principle of Vibrometers & Accelerometers. **(07)**

b) Discuss cam dynamics and explain the method used for force analysis of cam. **(07)**