Enrollment No: _____ Exam Seat No:_____

C.U.SHAH UNIVERSITY
Summer Examination-2020

Subject Name: Dynamic of Machines

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

Semester : 5 **Date : 04/03/2020** **Time : 10:30 To 01:30** **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) The unbalanced primary couple caused due to reciprocating mass of each cylinder is given as
(a) $mrl\omega(\cos\theta/n)$ (b) $mrl\omega^2\cos\theta$
(c) $mrl\omega^2\cos2\theta$ (d) $mr\omega^2\cos 2\theta$

b) The balancing of rotating and reciprocating parts of an engine is necessary when it runs at
(a) slow speed (b) medium speed (c) high speed

c) In order to facilitate the starting of locomotive in any position, the cranks of a locomotive, with two cylinders, are placed at . . . . . to each other.
(a) 45° (b) 90° (c) 120° (d) 180°

d) Multi-cylinder engines are desirable because
(a) only balancing problems are reduced (b) only flywheel size is reduced
(c) both (a) and (b) (d) none of these

e) The effect of hammer blow in a locomotive can be reduced by
(a) decreasing the speed
(b) using two or three pairs of wheels coupled together
(c) balancing whole of the reciprocating parts
(d) both (a) and (b)

f) When there is a reduction in amplitude over every cycle of vibration, then the body is said to have
(a) free vibration (b) forced vibration (c) damped vibration

g) In vibration isolation system, if $\omega/\omega n > 1$, then the phase difference between the transmitted force and the disturbing force is
(a) 180° (b) 90° (c) 0° (d) 270°

h) The ratio of the maximum displacement of the forced vibration to the deflection due to the static force, is known as
(a) damping factor (b) magnification factor
(c) logarithmic decrement (d) damping coefficient

i) The factor which affects the critical speed of a shaft is
(a) diameter of the disc (b) span of the shaft
(c) eccentricity (d) all of these

j) During transverse vibrations, shaft is subjected to which type of stresses?
(a) Bending stresses (b) Torsional shear stress
(c) Tensile stresses (d) All of the above

k) Which of the following instruments measure amplitude of a vibrating body?
(a) Vibrometers (b) Seismometer (c) Both a. and b. (d) None of the above

l) The motion of a system executing harmonic motion with one natural frequency is known as
(a) principal mode of vibration (b) natural mode of vibration
(c) both a. and b. (d) none of the above

m) What is meant by node point?
(a) The point at which amplitude of vibration is maximum
(b) The point at which amplitude of vibration is zero
(c) The point at which amplitude of vibration is minimum
(d) None of the above

n) Longitudinal vibrations are said to occur when the particles of a body moves
(a) parallel to its axis (b) perpendicular to its axis (c) in a circle about its axis

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

Q-2 **Attempt all questions**

(a) Discuss with neat sketches the longitudinal, transverse and torsional free vibrations. **(07)**

(b) The four masses m1, m2 m3 and m4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m. Use Analytical Method. **(07)**

Q-3 **Attempt all questions**

(a) Explain the method of balancing a number of masses rotating in different planes. **(07)**

(b) Derive the following expressions, for an uncoupled two cylinder locomotive engine: (07)
1) Variation in tractive force; 2) Swaying couple; and 3) Hammer blow.

Q-4 **Attempt all questions**

(a) Write short note on Primary and secondary balancing. **(07)**

(b) Explain in detail the working principle of any vibration measuring instruments. **(07)**

Q-5 **Attempt all questions**

(a) Explain the terms: (1) Under damping (2) critical damping (3) Over damping. **(07)**

(b) A cantilever shaft 50 mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The Young's modulus for the shaft material is 200 GN/m^2. Determine the frequency of longitudinal and transverse vibrations of the shaft. **(07)**

Q-6 **Attempt all questions**

(a) Define force & motion transmissibility and derive an expression for it. **(07)**

(b) A shaft 50 mm diameter and 3 metres long is simply supported at the ends and carries three loads of 1000 N, 1500 N and 750 N at 1 m, 2 m and 2.5 m from the left support. The Young's modulus for shaft material is 200 GN/m^2. Find the frequency of transverse vibration by using Dunkerley's method **(07)**

Q-7 **Attempt all questions**

(a) Describe the method of finding the natural frequency of torsional vibrations for a two rotor system **(07)**

(b) Explain the term 'Whirling speed' of a shaft. Prove that the whirling speed for a rotating shaft is same as the frequency of natural transverse vibration. **(07)**

Q-8 **Attempt all questions**

(a) Derive an expression for logarithmic decrement. **(07)**

(b) Explain Holzer's method to determine natural frequencies of multi-rotor system. **(07)**