NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF INDUSTRIAL AND MANUFACTURING ENGINEERING

DYNAMICS II

TIE 2206

Second Semester Main Examination Paper

May 2015

This examination paper consists of four (4) printed pages

Time Allowed: **3 hours**

Total Marks: **100**

Examiner's Name: Mr. W. Tumbudzuku

<u>INSTRUCTIONS AND INFORMATION TO THE CANDIDATE:</u>

1. Answer any five(5) questions
2. Each question carries 20 marks
3. Use of calculators is permissible

Question 1

Undervibration and time response define the following terms:

(i)	Wave,	[2]
(ii)	Period,	[2]
(iii)	Simple harmonic motion,	[2]
(iv)	Crest Troughs,	[2]
(v)	Amplitude,	[2]
(vi)	Wavelength,	[2]
(vii)	Frequency,	[2]
(viii)	Transverse waves,	[2]
(ix)	Longitudinal waves,	[2]
(x)	Interference.	[2]

Question 2

(a) Explain the basic properties of oscillatory motion. [4]

(b) With refer to the diagram shown in Figure Q2b, explain the terms in phase and out of phase. [4]

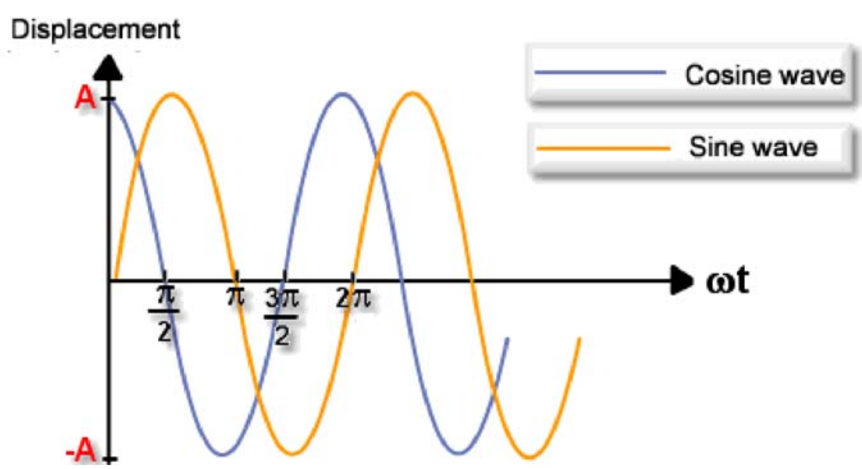

Figure Q2bSinusoidal waves

© Solve the differential equation: $\boldsymbol{mx + cx + kx(\ddot{t}) = Fo \sin wt}$ describing the motion of a damped single degree of freedom system subjected to a harmonic force and derive expressions for X and Ψ. [12]

Type equation here.

Question 3

The vibration analysis of physical systems, may be summarized by the following steps: Mathematical modeling of the physical system, Formulation of governing equations, Mathematical Solution of the governing equations and Physical interpretation of the results. Explain these steps in detail. [20]

Question 4

(a) With the aid of the diagram shown in Figure Q4explain what is meant by vibration isolation. [4]

(b) Differentiate between passive and active vibration isolation. [6]

(c) Given that Ma=2kG,M=5kG and that k_a=2kN, k=6kN/m and c=6Ns/m, derive an expression for the displacement of the system shown. [10]

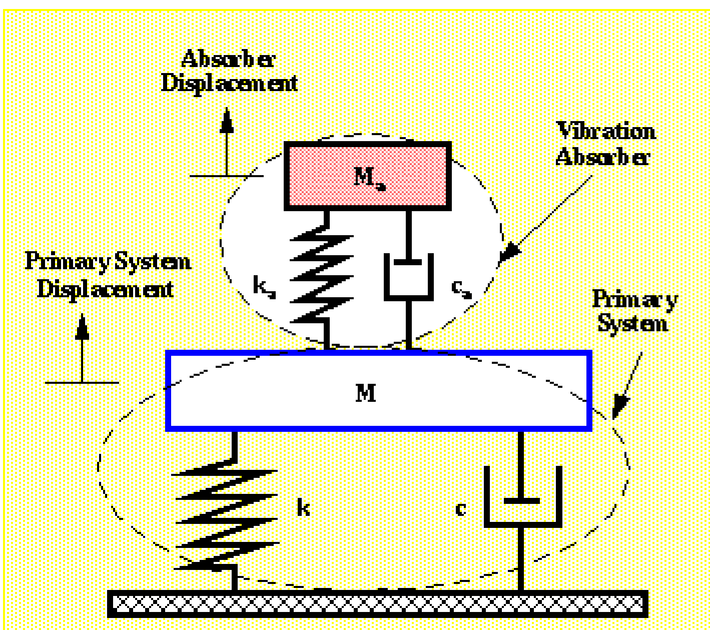

Figure Q4Vibration absorber

Question 5

With the aid of diagrams and equations differentiate between damped rectilinear forced vibrations and damped torsional forced vibrations. [20]

Question 6

With the aid of diagrams and equation s differentiate between the following, Angular oscillations controlled by torsion of an elastic rod, Torsional oscillations of a flywheel at the end of a uniform shaft and fixed at the other end, A single flywheel at the end of a series of shafts, Flywheel bolted/welded of shaft, and Two loads at the end of a shaft free to revolve, the shaft having sections of different diameters (stepped shafts). [20]

Question 7

(a) Differentiate between the types of gear trains, depending upon the arrangement of their wheels. [10]

(b) A rotor has a mass of 10kG and is mounted midway on a 30mm diameter horizontal shaft supported at the ends by two bearings. The bearings are 1.5m apart and the mass of the shaft is 3kG. The center of mass of the rotor is 0.15mm away from the geometric center of the rotor due to operational problems, find the amplitude of steady state vibration and the dynamic force transmitted to the bearing. Take€ $=$0.002 and E=150GN/m^2. [10]

End of examination!!!