Module (Course Syllabus) Catalogue

2023-2024

College/ Institute	Technology Institute in Erbil	
Department	Automotive Engineering Technology	
Module Name	Vehicle dynamics and Vibration	
Module Code		
Degree	**Technical Diploma** ☐ **Bachelor** ■ **High Diploma** ☐ **Master** ☐ **PhD** ☐	
Semester	**6th Semester, 3rd year.**	
Qualification	**PhD.**	
Scientific Title	**Lecturer**	
ECTS (Credits)		
Module type	**Prerequisite** ☐ **Core** ■ **Assist.** ☐	
Weekly hours		
Weekly hours (Theory)	**(4)hr Class**	**(100)Total hrs Workload**
Weekly hours (Practical)	**(0)hr Class**	**( )Total hrs Workload**
Number of Weeks	**12**	
Lecturer (Theory)	**Dr. Dler Abdullah Ahmed**	
E-Mail & Mobile NO.	**Dler.ahmad@epu.edu.iq**	
Lecturer (Practical)		
E-Mail & Mobile NO.		
Websites		

Course Book

Course Description	The course of vibration is designed to cover the fundamentals of free and forces vibration. This course aims students to understand the behaviour of vibration and how can reduce it. As well as the mathematical methods to solve vibration problems.
Course objectives	The main purposes of the vibration are to understand, analyze, and reduce vibration in engineering mechanisms. As well as students learn to connect this subject with other subjects and apply it to analyze problems in various mechanical systems.
Student's obligation	Missed classes will not be compensated including the quizzes and the scheduled assignments. The students will lose marks on unattended classes with quizzes unless a legal document or authorized leave is presented which should explain the excuse for the absence. However, the absent student should take responsibility for making up the missed lecture.
Required Learning Materials	

Evaluation

Task		Weight (Marks)	Due Week	Relevant Learning Outcome
Paper Review				
Assignments	Homework	10		
	Class Activity	2		
	Report	8		
	Seminar	8		
	Essay			
	Project			
Quiz		8		
Lab.				
Midterm Exam		24		
Final Exam		40		
Total		100		

Specific learning outcome:	1- Apply principles of vibration and mechanisms of motion. 2- Construct the equation of motion, velocity and acceleration. 3- Find the natural frequency of different mechanical systems.. 1- To construct the governing differential equation and its solution 2- for a vibrating mass subjected to an arbitrary force. 4. To decompose any periodic function into a series of simple harmonic motions using Fourier series analysis. 5. To solve for the motion and the natural frequency for forced vibration of a single degree of freedom damped or undamped system. 6. To obtain the complete solution for the motion of a single degree of freedom vibratory system (damped or undamped) that is subjected to non-periodic forcing functions. 7. To solve vibration problems that contains multiple degrees of freedom. 8. To obtain design parameters and indicate methods of solution for a complicated vibratory problem.
Course References:	1. Mechanical Vibrations by Sinirseu S. Rao Fifth Edition 2011 2- Mechanical Vibrations theory and applications , S Graham Kelly 3- Theory of Vibration with Application ,W.T. Thomson

Course topics (Theory)	Week	Learning Outcome
Introduction of vibration	1	1
Free vibration undamped vibration	2, 3	2, 3, 4, 5
Damped vibration , forced vibration	4, 5	2, 3, 4, 5
Fundamentals of Vehicle Dynamics	6	2, 3, 4, 5
Acceleration performance in vehicles	7, 8	2, 3, 4, 5
Break performance in vehicles	9	2, 3, 4, 5, 6
Road loads, mechanics of air flow around the vehicle	10, 11	2, 3, 4, 5
Aerodynamics forces, drag components	12	3, 4, 5, 6

Questions and Examples:

Example (1) :

A 1/4 kg mass is suspended by a spring having a stiffness of 0.1533 N/mm. Determine its natural frequency in cyc1es per second. Determine its statical deflection.

Solution: The stiffness is

$$k = 153.3 \text{ N/m}$$

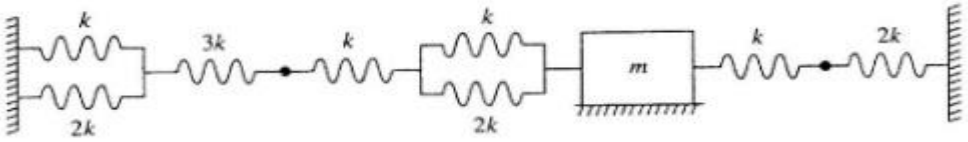
$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}} = \frac{1}{2\pi}\sqrt{\frac{153.3}{0.25}} = 3.941 \text{ Hz}$$

The statical deflection of the spring suspending the $\frac{1}{4}$-kg mass is obtained from the relationship $mg = k\Delta$

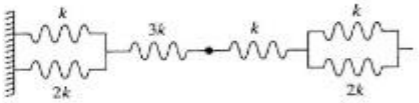
$$\Delta = \frac{mg}{k_{\text{N/mm}}} = \frac{0.25 \times 9.81}{0.1533} = 16.0 \text{ mm}$$

EXAMPLE:

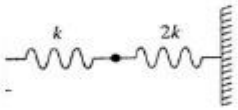
Model the system shown in figure below by a block attached to a single spring of an equivalent striffness

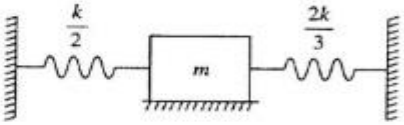


$$\frac{1}{\frac{1}{k+2k}+\frac{1}{3k}+\frac{1}{k}+\frac{1}{k+2k}} = \frac{k}{2}$$

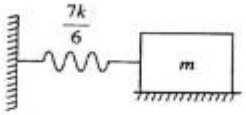


$$\frac{1}{\frac{1}{k}+\frac{1}{2k}} = \frac{2k}{3}$$





$$\frac{k}{2}+\frac{2k}{3} = \frac{7k}{6}$$



Extra notes:
External Evaluator **Assist. Prof. Dr. Muhammedtahir Malapoor** **mohammedtaher.mulapeer@su.edu.krd**