Academic Course Description

> **BHARATH UNIVERSITY**
> Faculty of Engineering and Technology
> Department of Mechanical Engineering
> **BME003 - MECHANICAL VIBRATIONS**
> **Fifth Semester, 2015-16 (Odd Semester)**

Course (catalog) description

The student will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components

Compulsory/Elective course : **Core Elective-I**

Credit & contact hours : 3&45
Course Coordinator : Mr.S.Nakkeeran
Instructors **:**

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Mr.Jeswin Arputha Balan	Third year MECH			.mech:@ bharathuniv.ac.in	9.00-9.50AM

Relationship to other courses

Pre –requisites **:** KINEMATICS OF MACHINES, DYNAMICS OF MACHINES

Assumed knowledge : By understanding about mechanical knowledge in various fields

Following courses : Mechanical Engineering

Syllabus Contents

UNIT I PRINCIPLES OF VIBRATION   9
Vibration principle- Equilibrium & Energy methods- Free vibrations-Viscous & coulomb damping- Forced vibration EXCITATION- Transmissibility –Resonance -Characteristics.

UNIT II TWO DEGREES OF FREEDOM   9
Two degrees of freedom –Matrix form – Undamped free vibration – Principal modes – Co-ordinate coupling – Principal co-ordinates – Torsional vibrations – Holzer method – Work &Energy approach.

UNIT III TRANSIENT VIBRATION   9
Transient vibration – Time dependency – Laplace transforms – Step inputs – Pulse inputs – Duhamel's integral – Phase plane method – Shock spectrum

UNIT IV MULTI DEGREES OF FREEDOM   9
Multi degrees of freedom – Equations of motion – Solution –Orthogonality of normal modes – Continuous system – Free & forced vibrations – Vibration analysis by FEM.

Vibration instruments – Vibration absorber –Elastically supported dampers – Seismic instruments – Vibrometers – Pickups – Accelerometers – Mounting instruments – Amplitude & phase distortions.

Total : 30 hr

TEXTBOOKS

1. G.K.Grover – Mechanical Vibrations – Namchand & Bros. 2001.

2. V.P.Singh - Mechanical Vibrations –Dhanpat Rai & Co, 2005.

REFERENCES:

1.W.T.Thomson – Theory of vibrations,Uniwin Hyman Ltd/CBS Publishers,1998.

2.Francis S.Tse, Iran E. Morse, Rolland T. Hinkle- Mechanical vibrations - CBS Publishers, 1983.

3. S.P.Timoshenko – Vibration Problems in Engineering – CBS Publishers, 1985.

4. booksformech.blogspot.com/.../mechanical-vibrations-by-vpsingh-pdf.ht..

Computer usage: YES

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	100%
Professional subject	-	0%

Broad area: Mechanical

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	August 1st week	Session 1 to 15	2 Periods
2	Cycle Test-2	September 2nd week	Session 16 to 30	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination		All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

Familiarize the students with the Basics and fundamental concepts of Mechanical Vibration and to highlight the approaches in organization behavior	Correlates to program outcome		
	H	**M**	**L**
Understand in detail about principles of vibration	a	h	k
Will able to understand undamped free vibration	a,c,h,i	g	k,l
Will understand in detail about transient vibration	a.c.d	e,g	j,k
Will update the knowledge in multi degrees of freedom	a	e,g,i	k,l
Understand the different vibration absorber	a	e	
Study about vibrometers	a,g	f,h	l

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

Session	Topics	Problem Solving (Yes/No)	Text / Chapter
	UNIT I PRINCIPLES OF VIBRATION ATION		
1.	Vibration principle	Yes	
2.	Equilibrium & Energy methods	Yes	**Unit I**
3.	Free vibrations	Yes	**T1/R1**
4.	Free vibrations	Yes	
5.	Viscous & coulomb damping	Yes	
6.	Forced vibration	Yes	
7.	Forced vibration	Yes	
8.	Transmissibility	Yes	
9.	Resonance, Characteristics.	Yes	
	UNIT II TWO DEGREES OF FREEDOM		
10.	Two degrees of freedom ,Matrix form	Yes	
11.	Two degrees of freedom ,Matrix form	Yes	**Unit II**
12.	Undamped free vibration	Yes	**T1/R1**
13.	Principal modes	Yes	
14.	Co-ordinate coupling	Yes	
15.	Principal co-ordinates	Yes	
16.	Torsional vibrations	Yes	
17.	Holzer method	Yes	

18.	Work &Energy approach.	Yes	
UNIT III TRANSIENT VIBRATION			
19.	Transient vibration	Yes	**Unit III T1/R1,2**
20.	Time dependency	Yes	
21.	Laplace transforms	Yes	
22.	Laplace transforms	Yes	
23.	Step inputs	Yes	
24.	Pulse inputs	Yes	
25.	Duhamel's integral	Yes	
26.	Phase plane method	Yes	
27.	Shock spectrum	Yes	
UNIT IV MULTI DEGREES OF FREEDOM			
28.	Multi degrees of freedom	Yes	**Unit IV T1,T2/R5**
29.	Multi degrees of freedom	Yes	
30.	Equations of motion, Solution	Yes	
31.	Orthogonality of normal modes	Yes	
32.	Continuous system	Yes	
33.	Free & forced vibrations	Yes	
34.	Free & forced vibrations	Yes	
35.	Vibration analysis by FEM	Yes	
36.	Vibration analysis by FEM	Yes	
UNIT V VIBRATION INSTRUMENTS			
37.	Vibration instruments	Yes	**Unit V T1,T2/R1,2**
38.	Vibration absorber	Yes	
39.	Elastically supported dampers	Yes	
40.	Elastically supported dampers	Yes	
41.	Seismic instruments	Yes	
42.	Vibrometers, Pickups, Accelerometers	Yes	
43.	Vibrometers, Pickups, Accelerometers	Yes	
44.	Mounting instruments	Yes	
45	Amplitude & phase distortions	Yes	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures

- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.

- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.

- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Assignment / Seminar / Online Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by   Mr.Jeswin Arputha Balan

Addendum

ABET Outcomes expected of graduates of B.Tech / MECH / program by the time that they graduate:

a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) The ability to identify, formulate and solve engineering problems.

c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) The ability to design and conduct experiments, as well as to analyze and interpret data

e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

f) The ability to apply reasoning informed by the knowledge of contemporary issues.

g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

h) The ability to understand professional and ethical responsibility and apply them in engineering practices.

i) The ability to function on multidisciplinary teams.

j) The ability to communicate effectively with the engineering community and with society at large.

k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) The ability to recognize the need for, and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION:
Mechanical Engineering graduatesare enthusiastic to provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Mechanical Engineering.

PEO2: CORE COMPETENCE:
Mechanical Engineering graduates have competence to enhance the skills and experience in defining problems in the field of Mechanical Engineering and Technology design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:
Mechanical Engineering graduates made competence to enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: PROFICIENCY:
Mechanical Engineering graduates became skilled to afford training for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS:
Mechanical Engineering graduates are morally merged to apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

BME003 - MECHANICAL VIBRATIONS

Course Teacher	Signature
Mr.Jeswin Arputha Balan	

Course Coordinator   **HOD/MECH**
Mr.S.Nakkeeran