

**Academic Course Description**

**BHARATH UNIVERSITY**  
Faculty of Engineering and Technology  
Department of Mechanical Engineering  
**BGE001 – VIBRATION CONTROL & CONDITION MONITORING**  
**Sixth Semester, 2015-16 (EvenSemester)**

**Course (catalog) description**

To presents fundamentals to a modern treatment of vibrations, placing the emphasis on analytical developments and computational solutions. This course will provide the detail knowledge about nonlinear and random vibration with fault diagnosis of machinery using vibration signature analysis.

**Compulsory/Elective course** : Elective for Mechanical students

Credit& contact hours : 3 & 45

Course Coordinator : Dr.Bachshumiyan

Instructors : Mr.Jeswin Arputha Raj

<b>Name of the instructor</b>	<b>Class handling</b>	<b>Office location</b>	<b>Office phone</b>	<b>Email (domain:@bharathuniv.ac.in)</b>	<b>Consultation</b>
Mr.Jeswin Arputha Raj	VI Sem Mech	Seminar Hall		jeswinarputharaj.mech@bharathuniv.ac.in	Karthikeyan S

**Relationship to other courses:**

Pre –requisites : KOM,DOM

Assumed knowledge : Dynamics of machine tools

Following courses :

## **UNIT I INTRODUCTION**

**9**

Review of fundamentals of single degree of freedom systems- Two degree of freedom systems- Multi degree freedom systems- Continuous system- Determination of Natural frequencies and mode shapes. Numerical methods in vibration analysis.

## **UNIT II VIBRATION CONTROL**

**9**

Introduction – Reduction of vibration at source- Control of vibration- By structural Design- Material selection- Located Additions- Artificial Damping- Resilient Isolation, Vibration Isolation- Vibration Absorbers.

## **UNIT III ACTIVE VIBRATION CONTROL**

**9**

Introduction - Concepts and Applications- Review of Smart Materials- Types and Characteristics Review of Smart Structures- Characteristic Active Vibration in Smart Structures.

## **UNIT IV CONDITION BASED MAINTANENCE PRINCIPLES AND APPLICATION 9**

Introduction- Condition Monitoring methods- The design of Information system, Selecting Methods of Monitoring, Machine Condition Monitoring and Diagnosis- Vibration Severity Criteria Machine Maintenance Techniques- Machine Condition Monitoring Techniques- Vibration Monitoring Techniques- Instrumentation Systems- Choice of Monitoring Parameter.

## **UNIT V DYNAMIC BALANCING AND ALIGNMENT OF MACHINERY 9**

Introduction, Dynamic Balancing of Robots, Field Balancing in one Plane, Two Planes and in Several Planes Machinery Alignment, “Rough” Alignment methods- The face Periphery Dial Indicator Method- Reverse indicator method

**Total : 45 Hours**

### **TEXTBOOKS:**

1. Singiresu S.Rao. “Mechanical Vibration”. Addison- Wesley Publishing Co.2004
2. 2. Rao J.S. “Vibratory Condition Monitoring of Machines” CRC Press. 2000.

### **REFERENCES:**

- 1.J.O. Den Hartog- “Mechanical Vibrations” McGraw Hill New York.1985.
- 2.Science Elsevier-“Hand book of Condition Monitoring” ELSEVIER SCIENCE,1996.
- 3.<https://www.overdrive.com/media/118481/vibration-with-control>

### **Computer usage:**

### **Professional component**

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

**Broad area:** Dynamics

## Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	Feb 1 <sup>st</sup> week	Session 1 to 14	2 Periods
2	Cycle Test-2	March 2 <sup>nd</sup> week	Session 15 to 28	2 Periods
3	Model Test	April 2 <sup>nd</sup> week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

## Mapping of Instructional Objectives with Program Outcome

To presents fundamentals to a modern treatment of vibrations, placing the emphasis on analytical developments and computational solutions. This course will provide the detail knowledge about nonlinear and random vibration with fault diagnosis of machinery using vibration signature analysis.	Correlates to program outcome		
	H	M	L
Understand the principles of vibration	a		
Learn the types of vibration	a,c,i,l	d	
Gain knowledge in vibration control	c,l	f	
Gain knowledge in vibration monitoring	a,c	h	k,l
Undergo derivations related to vibrations	a		l
Learn dynamic balancing and alignment of machinery	a		

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

## Draft Lecture Schedule

Session	Topics	Problem Solving (Yes/No)	Text/Chapter
<b>Unit I: Introduction</b>			
1	Review of fundamentals of single degree of freedom systems	No	[T1] Chapter 1,3 [R1]
2	Review of fundamentals of single degree of freedom systems	No	
3	Two degree of freedom systems	No	
4	ems	No	
5	Multi degree freedom system	No	
6	Multi degree freedom system	No	

7	Continuous system	No	
8	Determination of Natural frequencies and mode shapes.	No	
9	Numerical methods in vibration analysis.	Yes	
<b>UNIT II :</b>			
10	Introduction – Reduction of vibration at source	No	[T1] Chapter 3,4 [R1],[R2]
11	Control of vibration	No	
12	By structural Design	No	
13	Material selection	No	
14	Located Additions	Yes	
15	Artificial Damping	No	
16	Resilient Isolation	Yes	
17	Vibration Isolation	No	
18	Vibration Absorbers	No	
<b>UNIT III :</b>			
19	Introduction	No	
20	Concepts and Applications	No	
21	Review of Smart Materials	No	
22	Review of Smart Materials	No	
23	Types and Characteristics Review of Smart Structures	No	
24	Types and Characteristics Review of Smart Structures	No	
25	Types and Characteristics Review of Smart Structures	No	
26	Characteristic Active Vibration in Smart Structures	No	
27	Characteristic Active Vibration in Smart Structures	No	
<b>UNIT IV :</b>			
28	Introduction	No	[T1] Chapter 4,5
29	Condition Monitoring methods	No	
30	The design of Information system	No	
31	Selecting Methods of Monitoring	No	
32	Machine Condition Monitoring and Diagnosis	No	
33	Vibration Severity Criteria Machine Maintenance Techniques	No	
34	Machine Condition Monitoring Techniques- Vibration Monitoring Techniques	Yes	
35	Instrumentation Systems	No	
36	Choice of Monitoring Parameter	Yes	
<b>UNIT V :</b>			
37	Introduction	No	[T1] Chapter 4,5
38	Dynamic Balancing of Robots	No	
39	Field Balancing in one Plane, Two Planes and in Several Planes	No	
40	Field Balancing in one Plane, Two Planes and in Several Planes	No	
41	Machinery Alignment, “Rough” Alignment methods	No	
42	Machinery Alignment, “Rough” Alignment methods	No	
43	The face Periphery Dial Indicator Method	No	
44	The face Periphery Dial Indicator Method	No	
45	Reverse indicator method	No	

## 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%

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**Prepared by** Mr.Jeswin Arputha Raj

## 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 graduates are 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.

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## BGE001 – VIBRATION CONTROL & CONDITION MONITORING

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<b>Course Teacher</b> Mr.Jeswin	<b>Signature</b>
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**Course Coordinator**  
Dr.Bachusmiyan

**HOD/MECH**