

BME404-ENGINEERING METROLOGY & INSTRUMENTATION

Academic Course Description
BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Mechanical Engineering
BME404-ENGINEERING METROLOGY & INSTRUMENTATION
Fourth Semester, 2015-16 (Even Semester)

Course (catalog) description

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

Compulsory/Elective course : Core Subject for mechanical Engineering

Credit & hours : 03 & 45 Hrs

Course Coordinator : Mr.Hariharan

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@bharathuniv.ac.in)	Consultation
Dr.Shanmuganandham	III Year A,B	SR001,2		shanmuganandham.mech@bharathuniv.ac.in	11.40 to 12.30 pm
Mrs.Suchitra	III Year C,E	SR003,4		suchitra.mech@bharathuniv.ac.in	2.20 to 3.10 pm
Mr.Hariharan	III Year D	SR005		hariharan.mech@bharathuniv.ac.in	10.50 to 11.30 am

Relationship to other courses:

Pre –requisites : Manufacturing Technology I

Assumed knowledge : Basic properties of materials & chemistry

Following courses : Nil

Syllabus Contents

UNIT I INTRODUCTION TO MEASUREMENTS – LINEAR, ANGULAR 9

Basic concepts of measurement–need of measurement–precision and accuracy –Reliability–Errors in measurement–causes–types, Engineering component measurements – comparators – mechanical & pneumatic–Limit gauges – slip gauges – Sine bar – dial gauge – Rollers – Design – Applications – Angle dekkor – Auto collimator – Alignment telescope.

UNIT II FORM MEASUREMENT AND LASER IN METROLOGY 9

Form measurement – Measurement of tooth thickness – gear tooth vernier – Surface finish measurement – radius measurement – flatness and roundness measurement – Screw thread and gear Measurement.

Laser Metrology: Precision instrument based on laser – Principle – Application of laser – Laser interferometer – Applications in linear measurement and angular measurement – Application in testing of machine tools by Laser interferometer.

UNIT III RECENT ADVANCEMENT AND DEVELOPMENT METROLOGY 9

Coordinate Measuring Machine – constructional features – types – Applications of CMM – CNC. CMM applications – Inspection by computer aided – machine vision – Applications in Metrology.

UNIT IV MECHANICAL INSTRUMENTATION AND INSTRUMENTS 9

Generalized measurement system and its functional elements, primary, secondary and working standards. Instrument characteristics, static and dynamic characteristics classification – zero, first and second order instruments and responses, problems. Sensors and transducers – mechanical detector – transducer elements, electrical transducers – Thermoelectric transducer – variable inductance transducers – capacitor transducers – preamplifiers – charge amplifiers – Piezo electric transducers – strain gauges – bridge circuits (quarter, half and full activated), sensitivity – filters – attenuators – D’arsonval – CRO – Oscillographs – recorders – microprocessor based data logging.

UNIT V MEASUREMENT SYSTEMS 9

Force measurement – Torque measurement – Pressure measurement – Flow measurement – Temperature measurement – Vibration Measurement.

TEXT BOOKS:

1. R.K.Jain Engineering Metrology , Khanna Publishers, 2005
2. Kumar D.S Mechanical Measurement and Control – Metropolitan Book company Pvt. Ltd. – 1989

REFERENCES:

1. T.G.Beckwith and N.Lewis Buck, Mechanical Measurements, Addison Wesley, 2001
2. Sirohi, R.S. and Radhakrishnan, H.C.Mechanical Measurements, New Age, 1994.

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	20%
Engineering sciences & Technical arts	-	0%
Professional subject	-	80%

Broad area : Materials & Metallurgy

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 2 nd week	Session 1 to 14	2 Periods
2	Cycle Test-2	March 2 nd week	Session 15 to 28	2 Periods
3	Model Test	April 3 rd week	Session 1 to 45	3 Hrs
5	University Examination	TBA	All sessions / Units	3 Hrs.

Co To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.	Correlates to program outcome		
	H	M	L
Upon completion of this course, the Students can demonstrate different measurement techniques			f
Learn form measurement	b		i,l
Use of different measuring methods in Industrial environment.	d		
Understand the application of sensors & transducers	f	i,k	
Student will know the advance measuring systems	i	k	
Understand principles of Laser	k	i	

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

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I			
1.	Basic concepts of measurement	No	T1,T2,R1
2.	need of measurement	No	
3.	precision and accuracy –Reliability	No	
4.	Errors in measurement–causes–types	No	
5.	Engineering component measurements – comparators – mechanical & pneumatic	No	
6.	Limit gauges – slip gauges – Sine bar	No	
7.	dial gauge – Rollers – Design	No	
8.	Applications – Angle dekkor – Auto collimator	No	
9.	Alignment telescope.	No	

UNIT II			
10.	Form measurement – Measurement of tooth thickness – gear tooth vernier	No	T1,T2,R1,R2
11.	Surface finish measurement	Yes	
12.	Measurement of tooth thickness – gear tooth	Yes	
13.	gear tooth vernier – Surface finish measurement – radius measurement –	No	
14.	flatness and roundness measurement – Screw thread and gear Measurement	No	
15.	Laser Metrology: Precision instrument based on laser – Principle	No	
16.	Application of laser –Laser interferometer	No	
17.	Applications in linear measurement and angular measurement	No	
18.	Applications in linear measurement and angular measurement	No	

UNIT III			
19.	Types of fracture	No	T1,T2,R1,R3
20.	Griffth Theory for fracture metals	No	
21.	Ductile and Brittle Properties for alloys and metals	No	
22.	Toughness in fracture	No	
23.	Fracture defects – Cup and Cone	No	
24.	Creep - curves	No	
25.	Factors affecting creep resistant materials	No	
26.	Mechanism of creep fracture	Yes	
27.	Problems based on fracture	Yes	

UNIT IV			
28.	Generalized measurement system and its functional elements, primary, secondary and working standards.	No	

29.	Instrument characteristics, static and dynamic characteristics classification – zero, first and second order instruments and responses	No	T1,T3,R1,R2
30.	Problems	Yes	
31.	Sensors and transducers – mechanical detector – transducer elements	No	
32.	Sensors and transducers – mechanical detector – transducer elements	No	
33.	Thermoelectric transducer – variable inductance transducers – capacitor transducers	No	
34.	Full annealing, stress relief, recrystallisation and spheroidizing	No	
35.	Normalising, hardening and tempering of steel	No	
36.	Isothermal transformation diagrams	No	
UNIT V			
37.	Force measurement	No	T1,T2,R1,R2
38.	Torque measurement	No	
39.	Pressure measurement	No	
40.	Flow measurement	No	
41.	Flow measurement	No	
42.	Temperature measurement	No	
43.	Temperature measurement	No	
44.	Vibration Measurement	No	
45.	Vibration Measurement	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%

Prepared by : Mrs.Meenakshi

Dated :

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.

BME404-ENGINEERING METROLOGY & INSTRUMENTATION

Course Teacher	Signature
Dr.Shanmuganandham	
Mrs.Suchitra Mr.Hariharan	

Course Coordinator
Mrs.Suchitra

HOD/MECH