Course code	Course Name	L-T-P - Credits	Year of Introduction
MR205	Science of Measurements	3-0-0-3	2016

Prerequisites : Nil

Course Objectives

- To understand the basic principles of measurements.
- To learn about various methods of measuring instruments

Syllabus

Mechanical measurement- direct comparison and indirect comparison-the generalized measurement system- types of input quantities'- calibration- uncertainty- systematic and random errors-common type of errors- terms used in rating instrument performance- propagation of uncertainty- Kline and Mclintock approach-Zero, First and Second order instruments- input output configuration of generalized measurement system-Sensors – primary and secondary transducers – active and passive transducers - Measurement of temperature – expansion thermometers-resistance thermometers– thermo electric thermometers-Pyrometers – optical, total radiation and photo electric pyrometers- Measurement of flow -Measurement of low pressure- measurement of high pressure – Linear and angular measurement- Measurement of surface roughness - Measurement of screw thread profiles – gear tooth measurement

Expected outcome.

- The students will pick up familiarity with basics of measurements, methods of measuring various parameters and dimensions in engineering applications.

Text Book:

1.Ernest O Doebelin, Measurement Systems Application and Design, Mc Graw- Hill Publishing Company

2. Jain R.K., "Engineering Metrology", Khanna Publishers.

3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education.

References:

1. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005
2. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications 2000
3. A.K Sawhney "A course in Mechanical Measurements and Instrumentation & Control"
4. Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985.
5. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Mechanical measurement- direct comparison and indirect comparison-the generalized measurement system- types of input quantities- calibration- uncertainty- systematic and random errors-common - type of errors- classification of errors- terms used in rating instrument performance- introduction to uncertainty analysis-propagation of uncertainty- Kline and Mclintock approach .	7	15%
II	Zero, First and Second order instruments –input output configuration of generalized measurement system-methods for correcting for spurious inputs- inherent insensitivity-high gain feedback-signal filtering and opposing input	7	15%
FIRST INTERNAL EXAMINATION			

III	Sensors – primary and secondary transducers – active and passive transducers - linear variable differential transformer – construction and characteristics– capacitance transducers – piezo electric transducers – photoelectric sensors – Hall Effect transducers – Resistance wire strain gauges-gauge factor-measuring circuits-calibration	7	15%
IV	Expansion thermometers – liquid in glass thermometer – partial and total immersion thermometers – resistance thermometers– thermistors – Thermo electric thermometers – laws of thermocouples –Pyrometers – optical, total radiation and photo electric pyrometers Measurement of flow – rotameter - magnetic flow meters – hotwire anemometers – Measurement of low pressure – McLeod gauge – thermal conductivity gauge – measurement of high pressure – bulk modulus gauge	7	15%
SECOND INTERNAL EXAMINATION			
V	Linear and angular measurement: slip gauges - Measurement of angles – sine bar – sine center – angle gauges – optical instruments for angular measurement- auto collimator – applications – straightness and squareness –angle dekkor – Measurement of surface roughness – surface texture – methods of measuring surface finish -the Talysurf instrument – the profilograph – Tomlinson surface meter – Tracer type profilograph	7	20%
VI	Measurement of screw thread profiles – errors in pitch– microscopic method – measurement of internal thread – measurement of effective diameter – two wire and three wire method – measurement of root diameter – gear tooth measurement – measurement of gear profile – tooth thickness – tooth spacing – pitch circle diameter – Parkinson s gear tester.	7	20%
END SEMESTER EXAM			

QUESTION PAPER PATTERN

Maximum Marks : 100 Exam Duration:3 hours

PART A: FIVE MARK QUESTIONS

8 compulsory questions –1 question each from first four modules and 2 questions each from last two modules (8 x 5= 40 marks)

PART B: 10 MARK QUESTIONS

5 questions uniformly covering the first four modules. Each question can have maximum of three sub questions, if needed. Student has to answer any 3 questions

(3 x10 = 30 marks)

PART C: 15 MARK QUESTIONS

4 questions uniformly covering the last two modules. Each question can have maximum of four sub questions, if needed. Student has to answer any two questions

(2 x15 = 30 marks)