Course No.	Course Name	L-T-P-Credits	Year of Introduction
IC208	Mechanical Instrumentation	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

1. To have the basic concepts of errors in measurement
2. To learn the principles of fluid mechanics and measuring devices for flow
3. To Familiarize with the devices for measuring force, sound ,vibration etc
4. To familiarize with the devices for angular and linear measurements

Syllabus

Measurement standards, calibration, errors and uncertainty. Fluid properties, Laws for fluid statics and dynamics, flow measuring devices. Principles and devices for measurement of force, sound and vibration. Measuring devices for linear and angular measurements.

Expected Outcome

Students who successfully complete this course will be

(i) familiar with errors and uncertainty associated with mechanical measuring devices.

(ii) familiar with laws related to fluid statics and dynamics.

(iii) acquainted with modern flow measuring systems.

(iv) introduced to the principles and different type of measuring systems for force, sound and vibrations.

(v) introduced to the linear and angular measuring devices.

Text Books:

Thomas G. Beckwith and N. Lewis Buck, Mechanical Measurements, Oxford and IBH pub. house

References:

1. Ernest O. Doeblin, Measurement systems, application and design, McGrawGill Publishing Company
2. Holman J.P., Experimental Methods for Engineers, McGrawHill Publishing Company
3. Jain R.K., Engineering Metrology, Khanna Publishers, Delhi

Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	Mechanical measurement – direct comparison and indirect comparison – the generalized measurement system – types of input quantities –classifications of errors– *propagating uncertainty Kline and Mclintock approach* – .Simple problems in uncertainty	6	**15%**
II	**Measurement of Gear parameters** Terminology Gear tooth, *Sources of errors during production of gears*, Measurement of tooth thickness: Gear tooth vernier, Constant chord method, Addendum comparator method and Base tangent method, Measurement of tooth profile: Tool maker's microscope Involute tester, Measurement of pitch, Measurement of run out, Lead and Backlash checking. Measurement of concentricity, *Alignment of gears.Terminologies of screw threads*	6	**15%**
FIRST INTERNAL EXAM			
III	**Fluid Mechanics & meausrements**: *Fluid properties- density, surface tension, capillarity and viscosity*. Newton's law of viscosity. Fluid Statics- Pascal's law, Centre of pressure, Buoyancy, Metacentre. Basic equations of fluid flow- continuity, momentum and energy equations	6	**15%**
IV	Applications of Bernoulli's equations- venturimeter, orifice meter, *flow nozzles and Pitot-tube.* Use of LDA and PIV in flow measurement. Hot wire anemometer-CTA and CCA-Type of probes. Zero, first and second order instruments	6	**15%**
SECOND INTERNAL EXAM			
V	Measurement of force, torque and other parameters-Principle of dynamometers mechanical and *hydraulic dynamometers. Basic acoustical parameters.* Sound measuring apparatus and techniques. Basic theory of seismic instrument-Vibrometers and accelerometers-elementary and practical type	8	**20%**

VI	Linear and angular measurement – slip gauges stack of slip gauge – method of selecting slip gauges – adjustable slip gauge – Measurement of angles – sine bar checking unknown angles- sine center – sources of error – angle gauges –– *measurement of surface roughness* surface texture – primary texture – secondary texture and the lay specification for surface textures – methods of measuring surface finish . *The Talysurf instrument – the profilograph*	10	**20%**
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks : 100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions from Module 1 and 2 together. Each question carries 15 marks and can have not more than four sub divisions. (15 x 2 = 30 marks)

Part B

Answer any two out of three questions from Module 3 and 4 together. Each question carries 15 marks and can have not more than four sub divisions. (15 x 2 = 30 marks)

Part C

Answer any two out of three questions from Module 5 and 6 together. Each question carries 20 marks and can have not more than four sub divisions. (20 x 2 = 40 marks)

Total 100 Marks

Note: Each part shall have questions uniformly covering both the modules in it.