GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (PRODUCTION ENGINEERING) (28)

METROLOGY & COMPUTER AIDED INSPECTION

SUBJECT CODE: 2722809

SEMESTER: II

Type of course: MAJOR ELECTIVE - III

Prerequisite: NIL

Rationale: This course provides the knowledge and practice regarding Quality Assurance through different Computer Aided Inspection and Newest Metrology Precision Instruments. Other more Fundamental application of LASER technology and Sensors used in Computer Aided Inspection Practice for Digitizing the Production Time.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2#	0	4	70	30	30	0	10	10	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Metrology and Techniques:** Standards in metrology-definition, Traceability, Characteristics Length & Angular measurements-Review of standard instruments, GD and tolerance procedure-Review of dimension & form tolerance and methods of measurement, Tolerance analysis.	**04**	**11**
2	Surface and form metrology - flatness, roughness, waviness cylindricity, etc., Methods of improving accuracy & surface finish, Influence of forced vibration on accuracy, Dimensional wear of cutting tools and its influences on accuracy.	**04**	**11**
3	Standards for length measurement standards and their calibration – Light interference - Method of coincidence - Measurement errors. Various tolerances and their specifications, gauging assembly, comparators. Angular measurements - principles and measuring instruments.	**05**	**14**
4	**Laser Applications in Metrology:** LASER light source, LASER interferometer, LASER alignment telescope, LASER micrometer, On-line and in-process measurements of diameter, Roundness and surface roughness using LASER, Micro holes and topography measurements, straightness and flatness measurement.	**05**	**14**
5	**Special Measuring Instruments and Techniques:** Optoelectronic devices, contact and non-contact types, Applications in on-line and in-process monitoring systems, Tool wear measurement, Surface measurement, Machine vision, shape identification, Edge detection techniques, Normalization, gray scale correlation, Template Techniques, Surface roughness using vision system, Interfacing robot and image	**06**	**18**

	processing system.		
6	**Sensors in Inspection:** Manufacturing applications of photo detectors, deflection methods-beam detection, Reflex detection, & Proximity detection, Applications of Inductive and Capacitive proximity sensors, Understanding microwave sensing applications laser sensors and limit switches. Advanced sensor technology-Bar code systems, Principles and applications of Colour sensors, electro-magnetic identifier, Tactile sensors, Ultrasonic sensors, Odour sensors	**06**	**18**
7	Computer Aided Metrology - Principles and interfacing, soft metrology - Application of lasers in precision measurements- laser interface, laser scanners, Coordinate measurement machine (CMM), Type of CMM & applications.	**05**	**14**

Reference Books:

1. Fundamentals of dimensional Metrology T. Busch and R. Harlow Delmar, 3e
2. Engineering Metrology G. Thomas and G. Butter Worth PUB
3. Sensors and Control systems in Manufacturing Sabne Soloman McGraw Hill Book
4. Measurement systems: Applications & Design Doebelin International Student Edition
5. Optoelectronics for Technology and Engineering Robert G. Seippel Prentice Hall India
6. Interface Technology for Computer Controlled Ulrich-Rembold, Armbruster Marcel Dekker Publications,Manufacturing processes and Ulzmann NY
7. study manual on tolerance stacks,vol.1 Second edition ASME. 1994
8. Dimensioning and tolerancing of mass Spotts Prentice Hall, 1983 Production

Course Outcome:

After learning the course the students should be able

1. to acquire the basic knowledge and practice regarding Quality Assurance through different Computer Aided Inspection and Newest Metrology Precision Instruments.
2. Basic information and real time applications of LASER technology in the field.
3. Get knowledge of Sensors and their application in Computer Aided Inspection Practice for Digitizing the Production Time.

List of Tutorials:

1. Performance of Standard Length Measurements using Instruments
2. Performance of Standard Angle Measurements using Instruments
3. Performance Surface and form metrology
4. To study about Laser Applications in Metrology
5. To study about Special Measuring Instruments and Techniques
6. To study about Sensors in Inspection
7. To study about Computer Aided Metrology

Major Equipments:

1. Machine Vision System
2. CMM machine
3. LASER Micrometer

4. Velocity Sensor Instrument

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.