

GANPAT UNIVERSITY									
FACULTY OF ENGINEERING & TECHNOLOGY									
Programme	Diploma Engineering				Branch	Mechatronics Engineering			
Semester	IV				Version	1.0.0.0			
Effective from Academic Year				2019-20		Effective for the batch Admitted in			June 2018
Subject code	1ME2405			Subject Name	METROLOGY & INSTRUMENTATION				
Teaching scheme					Examination scheme (Marks)				
(Per week)	Lecture(DT)		Practical(Lab.)		Total		CE	SEE	Total
	L	TU	P	TW					
Credit	3	0	1	0	4	Theory	40	60	100
Hours	3	0	2	0	5	Practical	30	20	50

Pre-requisites:

Course Learning Outcomes:
<p>The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes:</p> <ol style="list-style-type: none"> <li>1. Basic understanding of inspection and quality control.</li> <li>2. Measure the given mechanical elements and assemblies using linear and angular analog /digital measuring instruments.</li> <li>3. Check geometrical accuracy of given application.</li> <li>4. Explain surface roughness checking instruments.</li> <li>5. Measure and derive important dimensions of various thread forms and gears.</li> <li>6. Check the dimensions using the gauges.</li> <li>7. Select and use non destructive testing methods.</li> <li>8. Select and measure variables using appropriate sensors and transducers.</li> <li>9. Concept of recent measurement techniques.</li> </ol> <p>The practical should be carried out in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domain to demonstrate course learning outcomes.</p>

Course Content				
Name of UNIT	Unit Content	Unit Learning Outcomes	Marks	Hrs
UNIT – 1 <b>Basic Principle of Engineering Metrology</b>	1.1 Introduction 1.2 Objective of Metrology and measurement 1.3 Need of inspection 1.4 Accuracy and Precision 1.5 Calibration of measuring instruments 1.6 Error in measurements 1.7 Method of measurement 1.8 Standards of measurements 1.9 Surface plate	1a. Distinguish between accuracy, precision and error. 1b. Inspection, quality and quality control-definitions and differences. 1c. Standards/important sizes, applications and precautions in use. 1d. Surface plates-types, important features.	4	3

<p>UNIT – 2 <b>Linear and Angular Measurement</b></p>	<p>2.1 Introduction 2.2 Vernier instruments 2.3 Micrometer instruments 2.4 Slip gauges and its applications 2.5 Angular measuring devices</p>	<p>2a. Determine least count of given measuring instrument 2b. Select suitable linear measurement instrument and measure the linear dimension of given component. 2c. Describe the procedure for wring the slip gauge and set given dimension 2d. Select suitable angular measurement instrument 2e. Describe the measurement procedure for the angular dimension of given component.</p>	<p>12</p>	<p>8</p>
<p>UNIT – 3 <b>Measurement of Geometrical Tolerances</b></p>	<p>3.1 Concept and need 3.2 Various geometrical parameters and measuring methods. 3.3 Dial indicator and its applications.</p>	<p>3a. Select the measuring method and describe the measurement procedure for geometrical tolerance of given part/assembly. 3b. Explain working principle of dial indicator</p>	<p>6</p>	<p>4</p>
<p>UNIT – 4 <b>Metrology of Surface Finish</b></p>	<p>4.1 Concept and need 4.2 Terminology 4.3 Analysis of surfaces traces 4.4 Methods of measuring surface finish 4.5 Stylus probe instruments.</p>	<p>4a. Define various terminology used for surface roughness. 4b. Explain working of direct instrument methods. 4c. Determine surface roughness of given data.</p>	<p>4</p>	<p>4</p>
<p>UNIT – 5 <b>Metrology of Gear and Screw Threads</b></p>	<p>5.1 Introduction 5.2 Gear terminology 5.3 Screw thread terminology, 5.4 Methods of gear inspection 5.5 Measurements of screw thread elements.</p>	<p>5a. Define various terms used for gear nomenclature. 5b. Use gear tooth Vernier to measure gear tooth thickness. 5c. Define various terms used for thread nomenclature. 5d. Determine best wire size. 5d. Use two and three wire methods to determine effective diameter of thread. 5g. Describe method for measuring the pitch of given thread.</p>	<p>8</p>	<p>6</p>
<p>UNIT-6 <b>Limit Gauges</b></p>	<p>6.1 Introduction 6.2 Principle of interchange ability 6.3 System of limit and fits.</p>	<p>6a. Select and check the given dimension using limit gauge.</p>	<p>4</p>	<p>4</p>

<b>UNIT-7 Non Destructive Testing</b>	7.1 Introduction 7.2 Concept need and advantages. 7.3 Various methods of NDT. 1. Dye penetration test 2. Magnetic particle test 3. Ultrasonic test 4. X-ray radiography test	7a. Explain and sketch various non destructive testing methods.	6	4
<b>UNIT-8 Measurement Systems</b>	8.1 Concept and need 8.2 Static characteristics 8.3 Various types of Transducers and Sensors 8.4 Temperature measurement devices 8.5 Pressure measurement devices 8.6 Flow measurement devices	8a. Select and describe the method for using appropriate temperature measuring device to measure temperature of given hot body. 8b. Select and describe the method for using appropriate pressure and flow measuring device to measure pressure/flow.	10	8
<b>UNIT-9 Recent Trade in Measurement System</b>	9.1 Introduction 9.2 CMM 9.3 Automated inspection 9.4 Machine vision 9.5 Acceptance test for machine tools	9a. Basic ideas about new measurement techniques.	6	4

List of Practical		
No.	Unit	Name of Practical
1	2	Measure external, internal and depth dimensions with the help of Vernier calliper.
2	2	Measure external, internal dimensions with the help of micrometer.
3	2	To study slip gauges and its applications.
4	2	Measure internal dimension with the help of telescopic gauge.
5	2	Measure height & depth dimensions by using Vernier height & Vernier depth gauge.
6	2	Measure angle between different planes by using Bevel protector.
7	2	Measure angle between two planes by using sine bar and slip gauges.
8	3	Measure roundness of circular bar with V block and dial gauge.
9	4	To check surface roughness using surface tester.
10	5	Measure gear tooth thickness using gear tooth Vernier calliper.
11	6	To study limit gauges and their applications.
12	8	Demonstration of strain gauge, LVDT and RTD.

List of Instruments / Equipment / Trainer Board	
1	Vernier callipers, Micrometers, surface plate, telescopic gauge, slip gauge set
2	Bevel protector, sine bar
3	Limit gauges, surface tester, gear tooth Vernier calliper, thread pitch gauge
4	Dial indicator, v-block
5	Strain gauge, LVDT, RTD

List of Reference Books			
No	Title of Reference Books	Authors	Publication

1	Metrology & Instrumentation	D.A.Desai	Atul Prakashan
2	Engineering Metrology	R.K.Jain	Khanna Publications
3	Mechanical measurements & Instrumentation	R.K.Rajput	Katson
4	Mechatronics	W.Bolten	Pearson
5	Industrial Instrumentation & Control	S K Singh	Tata McGrawHill

Link of Learning Web Resource	
1	<a href="http://en.wikipedia.org/wiki/Metrology">http://en.wikipedia.org/wiki/Metrology</a> (metrology)
2	<a href="http://www.youtube.com/watch?v=_fQSMVf3hdM">http://www.youtube.com/watch?v=_fQSMVf3hdM</a> (calibration)
3	<a href="http://www.youtube.com/watch?v=ZymDMUuVuyY">http://www.youtube.com/watch?v=ZymDMUuVuyY</a> (geometrical Tol.)
4	<a href="http://www.youtube.com/watch?v=inLkCOwVgyM">http://www.youtube.com/watch?v=inLkCOwVgyM</a> (force sensors)
5	<a href="http://www.youtube.com/watch?v=V0R5GVCxBy4">http://www.youtube.com/watch?v=V0R5GVCxBy4</a> (NDT)