Ref No:

Sri krishna Institute of Technology, Bangalore

COURSE PLAN

Academic Year 2019-2020

Program:	B E – Mechanical Engineering
Semester :	4
Course Code:	18ME47B
Course Title:	MECHANICAL MEASUREMENTS AND METROLOGY LAB
Credit / L-T-P:	2 / 3-0-0
Total Contact Hours:	42
Course Plan Author:	Mr.SHANKAREGOWDA K C

Academic Evaluation and Monitoring Cell

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ME

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Note : Remove “Table of Content” before including in CP Book

A. LABORATORY INFORMATION

1. Lab Overview

Degree:	BE	*Program:*	ME
Year / Semester :	2 / III	*Academic Year:*	2019-2020
Course Title:	MECHANICAL MEASUREMENT & METROLOGY LAB	*Course Code:*	18MEL47B
Credit / L-T-P:	2 / 0-2-2	*SEE Duration:*	180 Minutes
Total Contact Hours:	42 Hrs	*SEE Marks:*	60 Marks
CIA Marks:	40	*Assignment*	1 / Module
Course Plan Author:	Mr. SHANKAREGOWDA K C	*Sign*	Dt :
Checked By:		*Sign*	Dt :

2. Lab Content

Unit	Title of the Experiments	Lab Hours	Concept	Blooms Level
1	Calibration of Pressure Gauge	3	Calibration	L3 Apply
2	Calibration of Thermocouple	3	Calibration	L3 Apply
3	Calibration of LVDT	3	Calibration	L3 Apply
4	Calibration of Load Cell	3	Calibration	L3 Apply
5	Determination of modulus of elasticity of a mild steel specimen using strain gauges	3	Strain gauge	L3 Apply
6	Measurement using Optical Projector/Toolmaker Microscope	3	Thread profiles	L3 Apply
7	Measurement of angle using Sine Center/Sine bar/bevel protractor	3	Angle Measurement	L3 Apply
8	Measurement of alignment using Autocollimator/Roller Set	3	Distance Measurement	L3 Apply
9	Measurement of cutting tool forces using a) Lathe Tool Dynamometer b) Drill Tool Dynamometer	3	Force analysis	L3 Apply
10	Measurement of screw threads Parameters using two wire or Three wire Methods	3	Thread Measurement	L3 Apply
11	Measurement of Surface roughness using Tally surf /Mechanical Comparator	3	Surface roughness	L3 Apply
12	Measurement of gear tooth profile using gear tooth Vernier/Gear Tooth micrometer	3	Gear tooth Measurement	L3 Apply
13	Calibration of Micrometer using slip gauges	3	Calibration	L3 Apply
14	Measurement using optical flats	3	Optical	L3

			flats	Apply

3. Lab Material

Unit	Details	Available
1	Text books	
	Manual	In dept
2	Reference books	
	T. Chandrashekar	In Lib,In dept
3	Others (Web, Video, Simulation, Notes etc.)	
		Not Available

4. Lab Prerequisites:

-	-	Base Course:		-	-
SNo	Course Code	Course Name	Topic / Description	Sem	Remarks
1	17ME36B	MECHANICAL MEASUREMENT & METROLOGY	MECHANICAL MEASUREMENT & METROLOGY	3	

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

5. General Instructions

SNo	Instructions	Remarks
1	Lab manual and record are compulsory.	
2	Students should report to the lab as per the time table.	
3	After completion of the experiment, calculation and graphs plotted should be shown to the concerned staff in-charge	
4	Student should bring manual should enter the readings /observations into the manual while performing the experiment.	
5	The record of observations along with the detailed experimental procedure of the experiment in the Immediate last session should be submitted and certified staff member in-charge.	
6	When the experiment is completed, should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.	
7	Any damage of the equipment or burn-out components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year	
8	Completed lab experiments should be submitted in the form of a Lab Record	

6. Lab Specific Instructions

SNo	Specific Instructions	Remarks
1	Make the electrical connections as per color codes	
2	Check for error by knob adjustments	

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3	Fill experimental observation in tabular column	
4	Conduction of the experiments	
5	Records the readings and calculate	
6	Draw the graph	
7	Write result/conclusion	

B. OBE PARAMETERS

1. Lab / Course Outcomes

#	COs	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	Understand Calibration of pressure gauge, thermometer, LVDT, load cell, micrometer	03	Calibration	Demo	Practical Record & IA	L2
2	Understand the concept of measured of surface roughness, and measurement of angle using Sine centering, sine bar, bevel procractor	03	Measurement	Demo	Practical Record & IA	L2
3	Demonstrate measurement using Optical flats, Optical projector, Tool maker microscope	03	Measurement	Demo	Practical Record & IA	L2
4	Analysis of tool force using Lathe/Drill tool dynamo meter.	03	Tool force	Demo	Practical Record & IA	L4
5	Analysis of Screw thread parameter and gear tooth profile.	03	Parameter	Demo	Practical Record & IA	L4
-	**Total**	**42**	-	-	-	-

Note: Identify a max of 2 Concepts per unit. Write 1 CO per concept.

2. Lab Applications

SNo	Application Area	CO	Level
1	Hydraulics	CO1	L3
2	Heat exchanger	CO2	L3
3	Servo Motors	CO3	L3
4	Weigh bridge	CO1	L3
5	Structural Loadings	CO5	L3
6	Thread Profile	CO2	L3
7	Angle profiles	CO4	L3
8	Linearity	CO2	L3
9	Cutting tool forces	CO4	L3
10	Screw parameters	CO5	L3
11	Grinding	CO2	L3
12	Gear profile	CO1	L3
13	Calibration	CO1	L3
14	Optical parameters	CO3	L3

Note: Write 1 or 2 applications per CO.

3. Articulation Matrix

(CO – PO MAPPING)

-	Course Outcomes	Program Outcomes												
#	COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	Level
18MEL47B.1	Understand Calibration of pressure gauge, thermometer, LVDT, load cell, micrometer	√	-	-	-	-	-	-	-	-	-	-	-	L2
18MEL47B.2	Understand the concept of measured of surface roughness, and measurement of angle using Sine centering, sine bar, bevel procractor	√	-	-	-	-	-	-	-	-	-	-	-	L2
18MEL47B.3	Demonstrate measurement using Optical flats, Optical projector, Tool maker microscope	√	-	-	-	-	-	-	-	-	-	-	-	L2
18MEL47B.4	Analysis of tool force using Lathe/ Drill tool dynamo meter.	√	-	-	-	-	-	-	-	-	-	-	-	L3
18MEL47B.5	Analysis of Screw thread parameter and gear tooth profile.	√	-	-	-	-	-	-	-	-	-	-	-	L3
18MEL47B	Average													

Note: Mention the mapping strength as 1, 2, or 3

4. Mapping Justification

Mapping		Mapping Level	Justification
CO	**PO**	-	-
CO1	PO1	L2	Apply the knowledge of measurement and metrology.
CO1	PO2	L2	Since it is basic science -No mapping
CO1	PO3	L2	Atudents will not be Designing/developing of solution-No mapping
CO1	PO4	L2	Since no conduction on investigations of complex Problems-No mapping
CO1	PO5	L2	No Modern tools are used -No mapping
CO1	PO6	L2	No inpact on engineers and society-No mapping
CO1	PO7	L2	Will not be affected on environment and sustainability-No mapping
CO1	PO8	L2	Since the study is limited to basics -No mapping
CO1	PO9	L2	Will not be working either Individual nor team work-No mapping
CO1	PO10	L2	NO instruction will be given -No mapping
CO1	PO11	L2	No application of management and finance principles involved -No mapping
CO1	PO12	L2	Due to change in technology-No mapping
CO2	PO1	L2	Apply the knowledge of limits, fit, tolerance’
CO2	PO2	L2	Since it is basic science -No mapping
CO2	PO3	L2	Students will not be Designing/developing of solution-No mapping
CO2	PO4	L2	Since no conduction on investigations of complex Problems-No mapping
CO2	PO5	L2	No Modern tools are used -No mapping
CO2	PO6	L2	Impact on engineers and society through improved productivity and efficiency
CO2	PO7	L2	Will not be affected on environment and sustainability-No mapping

CO2	PO8	L2	Since the study is limited to basics -No mapping
CO2	PO9	L2	Will not be working either Individual nor team work-No mapping
CO2	PO10	L2	NO instruction will be given -No mapping
CO2	PO11	L2	No application of management and finance principles involved -No mapping
CO2	PO12	L2	Due to change in technology-No mapping
CO3	PO1	L2	Apply the knowledge of leaner and angular measurement.
CO3	PO2	L2	Since it is basic science -No mapping
CO3	PO3	L2	Students will not be Designing/developing of solution-No mapping
CO3	PO4	L2	Since no conduction on investigations of complex Problems-No mapping
CO3	PO5	L2	No Modern tools are used -No mapping
CO3	PO6	L2	Impact on engineers and society through improved productivity and efficiency
CO3	PO7	L2	Will affect on environment and sustainability in utilizing resources
CO3	PO8	L2	Since the study is limited to basics -No mapping
CO3	PO9	L2	Will not be working either Individual nor team work-No mapping
CO3	PO10	L2	NO instruction will be given -No mapping
CO3	PO11	L2	No application of management and finance principles involved -No mapping
CO3	PO12	L2	Due to change in technology-No mapping
CO4	PO1	L2	Apply the knowledge of terminating and modifying devices.
CO4	PO2	L2	Since it is basic science -No mapping
CO4	PO3	L2	Students will not be Designing/developing of solution-No mapping
CO4	PO4	L2	Since no conduction on investigations of complex Problems-No mapping
CO4	PO5	L2	No Modern tools are used -No mapping
CO4	PO6	L2	Impact on engineers and society through improved driving mechanism
CO4	PO7	L2	Will affect on environment and sustainability in automation
CO4	PO8	L2	Since the study is limited to basics -No mapping
CO4	PO9	L2	Will not be working either Individual nor team work-No mapping
CO4	PO10	L2	NO instruction will be given -No mapping
CO4	PO11	L2	No application of management and finance principles involved -No mapping
CO4	PO12	L2	Due to change in technology-No mapping
CO5	PO1	L2	To know the knowledge of force, torque and temeperature measurement.
CO5	PO2	L2	Since it is basic science -No mapping
CO5	PO3	L2	Students will not be Designing/developing of solution-No mapping
CO5	PO4	L2	Since no conduction on investigations of complex Problems-No mapping
CO5	PO5	L2	Modern tools are used
CO5	PO6	L2	Impact on engineers and society through improved processing methods
CO5	PO7	L2	Will not be affected on environment and sustainability-No mapping
CO5	PO8	L2	Since the study is limited to basics -No mapping
CO5	PO9	L2	Will not be working either Individual nor team work-No mapping
CO5	PO10	L2	NO instruction will be given -No mapping
CO5	PO11	L2	No application of management and finance principles involved -No mapping
CO5	PO12	L2	Due to change in technology-No mapping

Note: Write justification for each CO-PO mapping.

5. Curricular Gap and Content

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping

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1					
2					

Note: Write Gap topics from A.4 and add others also.

6. Content Beyond Syllabus

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					

Note: Anything not covered above is included here.

C. COURSE ASSESSMENT

1. Course Coverage

Unit	Title	Teaching Hours	No. of question in Exam							CO	Levels
			CIA-1	CIA-2	CIA-3	Asg-1	Asg-2	Asg-3	SEE		
1	Calibration of Pressure Gauge	03	1	-	-	-	-	-	1	CO1	L2
2	Calibration of Thermocouple	03	1	-	-	-	-	-	1	CO1	L3
3	Calibration of LVDT	03	1	-	-	-	-	-	1	CO1	L3
4	Calibration of Load Cell	03	1	-	-	-	-	-	1	CO1	L3
5	Determination of modulus of elasticity of a mild steel specimen using strain gauges	03	-	1	-	-	-	-	1	CO5	L3
6	Measurement using Optical Projector/Toolmaker Microscope	03	-	1	-	-	-	-	1	CO3	L3
7	Measurement of angle using Sine Center/Sine bar/bevel protractor	03	-	1	-	-	-	-	1	CO2	L3
8	Measurement of alignment using Autocollimator/Roller Set	03	-	1	-	-	-	-	1	CO5	L4
9	Measurement of cutting tool forces using a) Lathe Tool Dynamometer b) Drill Tool Dynamometer	03	-	1	-	-	-	-	1	CO4	L4
10	Measurement of screw threads Parameters using two wire or Three wire Methods	03	-	-	1	-	-	-	1	CO5	L4
11	Measurement of Surface roughness using Tally surf /Mechanical Comparator	03	-	-	1	-	-	-	1	CO2	L3
12	Measurement of gear tooth profile using gear tooth Vernier/Gear Tooth micrometer	03	-	-	1	-	-	-	1	CO5	L4
13	Calibration of Micrometer using slip gauges	03	-	-	1	-	-	-	1	CO1	L3
14	Measurement using optical flats	03	-	-		-	-	-	1	CO3	L3
-	**Total**	**42**	**4**	**4**	**5**	**-**	**-**	**-**	**14**	**-**	**-**

Note: Write CO based on the theory course.

2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	CO	Levels
CIA Exam – 1	40	CO1, CO2	L3
CIA Exam – 2	40	CO3, CO4	L4
CIA Exam – 3	40	CO5	L3
Assignment - 1			
Assignment - 2			
Assignment - 3			
Seminar - 1			
Seminar - 2			
Seminar - 3			
Other Activities – define – Slip test			
Final CIA Marks	**40**	**-**	**-**

-

SNo	Description	Marks
1	Observation and Weekly Laboratory Activities	05 Marks
2	Record Writing	10 Marks for each Expt
3	Internal Exam Assessment	40 Marks
4	Internal Assessment	
5	SEE	60 Marks
-	**Total**	**100 Marks**

D. EXPERIMENTS

Experiment 01 : Calibration of Pressure Gauge

-	**Experiment No.:**	1	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Calibration of Pressure Gauge						
2	Course Outcomes	Calibration						
3	Aim	To calibrate the given dead weight pressure gauge or pressure cell						
4	Material / Material / Material / Equipment Required	Pressure cell, standard weights and Vernier caliper						
5	Theory, Formula, Principle, Concept	Calibration						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• step 1: Oil is poured into the piston cylinder arrangement • step 2: The diameter of the plunger is noted down • step 3: Standard weights are placed on the pan and the corresponding indicated pressure is noted down • step 4: The actual value of the pressure in each is calculated by dividing weight by area of the plunger • step 5:The actual pressure is compared with the indicated pressure and the percentage error is calculated						

7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	• Percentage of error =Pi~Pa x100 = Pi - Percentage Error v/s Pa
8	Observation Table, Look-up Table, Output	• Observations:- • Diameter of plunger = mm • Area of plunger = mm2
9	Sample Calculations	•
10	Graphs, Outputs	• - • -
11	Results & Analysis	• -Increase in actual pressure _____ the indicated pressure. -Increase in actual pressure _____ the percentage error
12	Application Areas	Hydraulics
13	Remarks	Viva-voice
14	Faculty Signature with Date	

Experiment 02 : Calibration of Thermocouple

-	**Experiment No.:**	2	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Calibration of Thermocouple						
2	Course Outcomes	Calibration						
3	Aim	To calibrate the given thermocouple using resistance thermocouple						
4	Material / Material / Equipment Required	Thermocouple, T-J-k Type, heating bath, resistance thermometer(R.T.D) and Digital temperature indicator.						
5	Theory, Formula, Principle, Concept	Calibration						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• step 1: Make the electrical connections as per color codes • step 2: Check for error by knob adjustments • step 3: Fill experimental observation in tabular column • step 4: Conduction of the experiments • step 5:if error then correct the errors • step 6:Records the readings and calculate • step 7:Draw the graph • step 8:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	Percentage Error = ((tm~ta)/ta) x100 •						
8	Observation Table, Look-up Table, Output	• Observations:- • RTD type = • Materials for thermocouple wires =						

9	Sample Calculations	•
10	Graphs, Outputs	• - • -
11	Results & Analysis	Increase in actual temperature the indicated temperature. Increase in actual temperature the percentage Error.
12	Application Areas	Heat exchanger
13	Remarks	Viva-voice
14	Faculty Signature with Date	

Experiment 03 : Calibration of LVDT

-	**Experiment No.:**	3	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Calibration of LVDT						
2	Course Outcomes	Calibration						
3	Aim	To calibrate the given LVDT						
4	Material / Material / Equipment Required	Linear variable differential transformer, digital displacement Indicator, Micrometer.						
5	Theory, Formula, Principle, Concept	Calibration						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• step 1:Make the electrical connections as per color codes • step 2: Connect the LVDT sensor to the displacement indicator. • step 3: Rotate the micrometer knob to clockwise or anti clockwise direction to bring the LVDT core to null position. • step 4: Conduction of the experiments • step 5:Records the readings and calculate • step 6:Draw the graph • step 7:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	• -Percentage of error =Sa~Sm x100 = Sa						
8	Observation Table, Look-up Table, Output	•						
9	Sample Calculations	•						
10	Graphs, Outputs	• - • -						

11	Results & Analysis	Increase in actual screw gauge reading ____ the indicate LVDT reading. Increase in actual screw gauge reading ___ the percentage Error
12	Application Areas	Servo Motors
13	Remarks	Viva-voice
14	Faculty Signature with Date	

Experiment 04 : Calibration of LOAD CELL

-	**Experiment No.:**	4	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Calibration of Load cell						
2	Course Outcomes	Calibration						
3	Aim	To calibrate the given Load cell						
4	Material / Material / Equipment Required	Load cell, up to 10 kg standard weights and digital strain indicator.						
5	Theory, Formula, Principle, Concept	Calibration						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• step 1: Make the electrical connections as per color codes • step 2: Check for error by knob adjustments • step 3: Fill experimental observation in tabular column • step 4: Conduction of the experiments • step 5:if error then correct the errors • step 6:Records the readings and calculate • step 7:Draw the graph • step 8:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	Percentage error = {(Wi~Wa)/Wa}x100						
8	Observation Table, Look-up Table, Output	•						
9	Sample Calculations							
10	Graphs, Outputs	Increase in actual load_____ the indicated load. Increase in actual load_____ the percentage Error						
11	Results & Analysis	Increase in actual load_____ the indicated load. Increase in actual load_____ the percentage Error						
12	Application Areas	Weigh bridge						
13	Remarks	Viva-voice						
14	Faculty Signature with Date							

Experiment 05 : Determination of modulus of elasticity of a mild steel specimen using strain gauges

-	**Experiment No.:**	5	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Determination of modulus of elasticity of a mild steel specimen using strain gauges						
2	Course Outcomes	Determination of modulus of elasticity						
3	Aim	To determine the young's modulus of a given plate subjected to bending using strain gauges.						
4	Material / Equipment Required	A fixed plate with concentrated end load arrangement, strain indicator and weights, digital strain indicator and slide caliper.						
5	Theory, Formula, Principle, Concept	Strain gauge						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: Make the electrical connections as per color codes • step 2: Keep the function switch to gauge factor and adjust the G.F • step 3: select the function switch to CAL and adjust the CAL. • step 4: Conduction of the experiments • step 5:Records the readings and calculate • step 6:Draw the graph • step 7:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	E=σ/Ms						
8	Observation Table, Look-up Table, Output	Width of the plate(b) = mm Thickness of the plate(h)= mm No. of active arms(i) = Length(l) = mm						
9	Sample Calculations	•						
10	Graphs, Outputs	• - • -						
11	Results & Analysis							
12	Application Areas	Structural Loadings						
13	Remarks	Viva-voice						
14	Faculty Signature with Date							

Experiment 06 :Measurement using Optical Projector/Toolmaker Microscope

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Measurement using Optical Projector/Toolmaker Microscope						
2	Course Outcomes	Determination of thread profile parameters						
3	Aim	To determine the major diameter, minor diameter, depth of the thread,pitch of he thread and the angle of the thread.						
4	Material / Equipment Required	Tool room microscope, screw thread, etc.						
5	Theory, Formula, Principle, Concept	Thread Profile						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: keep the objects on the table fitted with two micrometers and with the help of focusing system • step 2: Adjust X-Y direction micrometers to measure major,minor diameter,pitch and depth of thread • step 3: Using circular scale determine the angle of the thread • step 4:Records the readings and calculate • step 5:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	• Major Diameter =Initial~Final reading= • Minor Diameter =Initial~Final reading= • Depth of the thread=Initial~Final Reading= • Pitch of the thread= Initial~Final Reading= • Angle of thread=Initial~Final Reading=						
8	Observation Table, Look-up Table, Output	Least count of micrometer=pitch/No.of division on thimble=0.5/50=0.01mm Least count of circular scale= Major diameter=Initial~Final Reading= Minor diameter=Initial~Final Reading= Depth of the thread=Initial~Final Reading= Pitch of the thread=Initial~Final Reading= Angle of thread=Initial~Final Reading=						
9	Sample Calculations	•						
10	Graphs, Outputs	• - • -						
11	Results & Analysis							
12	Application Areas	Thread Profile						
13	Remarks	Viva-voice						
14	Faculty Signature with Date							

Experiment 07 :Measurement of angle using Sine Center/Sine bar/bevel protractor

-	**Experiment No.:**	7	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Measurement of angle using Sine Center/Sine bar/bevel protractor						

2	Course Outcomes	Determination of angles of given specimens
3	Aim	To measure angle of given component using Sine bar and Slip gauges.
4	Material / Equipment Required	Sine bar, slip gauge, vernier height gauge, Bevel protractor and dial teeth indicator with stand, surface plate
5	Theory, Formula, Principle, Concept	Slip gauge
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: Clean the surface plate. • step 2: Check the level of the surface plate • step 3: Select suitable slip gauges and place to compensate the taper by trial and error method • step 4:Calculate the taper angle by knowing the heights of the slip gauges and the center distance between the rollers • step 5:Write result/conclusion
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	sinΘ= H/L
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	• - • -
11	Results & Analysis	The taper angle of the given specimen is __ degree_____ minutes The taper angle of the given specimen is __ degree_____ minutes
12	Application Areas	Angle profiles
13	Remarks	Viva-voice
14	Faculty Signature with Date	

Experiment 08 :Measurement of alignment using Autocollimator/Roller set

-	**Experiment No.:**	8	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Measurement of alignment using Autocollimator/Roller set						
2	Course Outcomes	Linearity						
3	Aim	To measure angle of given component using Sine bar and Slip gauges.						
4	Material / Equipment Required	Autocollimator						
5	Theory, Formula, Principle, Concept	Distance Measurement						
6	Procedure, Program,	• Step 1: Set the mirror with magnetic base directly on the guides.						

	Activity, Algorithm, Pseudo Code	• step 2: Set the mirror on upper trueing seat and fix the mirror by switching on the magnet • step 3: Divide the specimen into uniform sections. Mark on it as 0,1,2,...etc • step 4:Move the mirror along the guide and note down the displacement • step 5:Write result/conclusion
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	Hi=Ai-BI (μM)
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	• - • -
11	Results & Analysis	
12	Application Areas	Linearity
13	Remarks	Viva-voice
14	Faculty Signature with Date	

Experiment 09:Measurement of cutting tool forces using a) Lathe tool Dynamometer OR Drill tool Dynamometer

-	**Experiment No.:**	9	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Measurement of cutting tool forces using a) Lathe tool Dynamometer OR Drill tool Dynamometer						
2	Course Outcomes	Calculation of Machining forces						
3	Aim	Measurement of cutting forces and power required in turning using Lathe tool						
4	Material / Equipment Required	Drill tool dynamometer, specimen, tachometer, Force indicator.						
5	Theory, Formula, Principle, Concept	Force Measurement						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: Fix the work piece between the centers of the lathe and cutting tool along with the dynamometer in the place of the tool post • step 2: Select the cutting parameters speed, feed and depth of cut step 3: Make the necessary electrical connections and switch on the lathe • step 4:Measure the various cutting forces • step 5:Determine the cutting speed Vin m/s by knowing the diameter of the work piece and the find the power required						

7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	Diameter = • Cutting speed(V)= • Power requried=Fx(V)/1000=
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	• - • -
11	Results & Analysis	Cutting speed(v)= m/sec Power requried = KW
12	Application Areas	Cutting tool forces
13	Remarks	Viva-voice
14	Faculty Signature with Date	

Experiment 10: MEASUREMENT OF EFFECTIVE DIAMETER USING 2/3-WIRE METHOD

-	**Experiment No.:**	10	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	MEASUREMENT OF EFFECTIVE DIAMETER USING 2/3-WIRE METHOD						
2	Course Outcomes	Thread profile parameters						
3	Aim	To determine the effective diameter of the given threaded specimen.						
4	Material / Equipment Required	Test specimen, micrometer and 3-wire set box						
5	Theory, Formula, Principle, Concept	Screw parameters						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: Fix the micrometer on the stand measure the diameter of the given specimen • step 2: Select the best wire diameter for a given pitch using the formula =0.577X pitch step 3: Insert the best wire in the crest of the given thread • step 4:Records the readings and calculate • step 5:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	• E=M-{d(1+cosec(x/2)-p/2cot(x/2))}						
8	Observation Table, Look-up Table, Output	GIVEN THREAD: M8 • Pitch= mm • Best wire diameter=0.577xpitch= mm • D= mm • Diameter over the rollers M= mm • E=M-{d(1+cosec(x/2)-p/2cot(x/2))}						

		• E= mm
9	Sample Calculations	
10	Graphs, Outputs	• - • -
11	Results & Analysis	Effective diameter for Screw thread M8 by two-wire method is____ mm Effective diameter for Screw thread M8 by three-wire method is___ mm
12	Application Areas	Screw parameters
13	Remarks	Viva-voice
14	Faculty Signature with Date	

Experiment 11:MEASUREMENT OF SURFACE ROUGHNESS USING TALLY SURF/MECHANICAL COMPARATOR

-	**Experiment No.:**	11	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	MEASUREMENT OF SURFACE ROUGHNESS USING TALLY SURF/MECHANICAL COMPARATOR						
2	Course Outcomes	Conformance of surface parameters						
3	Aim	Measurement of surface roughness using Tally surf.						
4	Material / Equipment Required	Test specimen, standard specimen, Surf test MST301.						
5	Theory, Formula, Principle, Concept	Surface roughness						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: Set the instrument to the standard Value • step 2: Make the electrical connection step 3: Move the stylus on the standard specimen and adjust the gain till the roughness value is displayed on the instrument • step 4:Records the readings and calculate • step 5:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	•						
8	Observation Table, Look-up Table, Output							
9	Sample Calculations							
10	Graphs, Outputs	• - • -						
11	Results & Analysis							
12	Application Areas	Grinding						

13	Remarks	Viva-voice
14	Faculty Signature with Date	

Experiment 12:Measurement of gear tooth profile using gear tooth Vernier/Gear Tooth micrometer

-	**Experiment No.:**	12	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Measurement of gear tooth profile using gear tooth Vernier/Gear Tooth micrometer						
2	Course Outcomes	Gear tooth parameters						
3	Aim	To determine the thickness of Spur gear tooth and its chordal diameter using Gear tooth vernier caliper						
4	Material / Equipment Required	Spur gear, gear tooth Veriner caliper.						
5	Theory, Formula, Principle, Concept	Gear tooth measurements						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: Note down the least point of gear tooth vernier caliper, the number of teeth N, on the gear to be tested • step 2: Using vernier caliper find the outer diameter of the gear blank step 3: Set the slide on the addendum vernier caliper to the height equal to the addendum • step 4:Records the readings and calculate • step 5:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	• Chordal thickness(Ct)=Nm sin(90/N)= • Chordal depth=(Nm)/2x[1+2/N-cos(90/N)]=						
8	Observation Table, Look-up Table, Output	Least count of gear tooth vernier caliper= • Number of teeth on the spur gear(N)= • Diameter of gear blank(Do)= • Module of gear(m)=Do/(N+2)=						
9	Sample Calculations							
10	Graphs, Outputs	• - • -						
11	Results & Analysis	• Thickness of teeth(theoretical)=_____mm • Chordial depth(Experimental)=_____mm • Chordial depth(theoretical)=_____mm • Thickness of teeth(Experimental)=_____mm						
12	Application Areas	Gear profile						
13	Remarks	Viva-voice						
14	Faculty Signature with Date							

Experiment 13:Calibration of Micrometer using slip gauges

-	**Experiment No.:**	13	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Calibration of Micrometer using slip gauges						
2	Course Outcomes	Calibration						
3	Aim	To calibrate the given micrometer using slip gauges.						
4	Material / Equipment Required	Slip gauges, Micrometer						
5	Theory, Formula, Principle, Concept	Calibration						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: Clean the anvils and check the micrometer for zero reading • step 2: Build the required dimension by stacking the slip gauges step 3: Note place down the slip gauges stack between the anvils and turn thimble using the ratchet clicks are heard • step 4:Records the readings and calculate • step 5:Write result/conclusion						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	• %Error={(Dm~Da)/Da}x100= •						
8	Observation Table, Look-up Table, Output							
9	Sample Calculations							
10	Graphs, Outputs	• Micrometer reading(Dm) v/s Slip gauge dimension • Percentage Error V/s Slip gauge dimension(Da)						
11	Results & Analysis	• Increase in Slip gauge dimension____the micrometer reading. • Increase in Slip gauge dimension____the percentage Error in Micrometer reading.						
12	Application Areas	Calibration						
13	Remarks	Viva-voice						
14	Faculty Signature with Date							

Experiment 14:Measurement using optical flats

-	**Experiment No.:**	14	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Measurement using optical flats						
2	Course Outcomes	Determination of concavity & convexity of the specimens						
3	Aim	To calibrate the given micrometer using slip gauges.						
4	Material / Equipment	Specimen, Monochromatic light source, optical flat, etc.						

	Required	
5	Theory, Formula, Principle, Concept	Optical Flats
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• Step 1: The monochromatic check light is switched on. • step 2: The specimen which is having a polished surface is placed on the worktable so that incident rays are reflected. step 3: The optical flat is placed on the specimen and the position is adjusted to obtain the fringes • step 4:Depending on the fringe patter, the type of surface can be determined by comparing it with standard fringe patterns
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	•
8	Observation Table, Look-up Table, Output	•
9	Sample Calculations	
10	Graphs, Outputs	•
11	Results & Analysis	
12	Application Areas	Optical parameters
13	Remarks	Viva-voice
14	Faculty Signature with Date	