

Government Polytechnic Mumbai

Department of Instrumentation Engineering

P-19R Curriculum

Semester- I

(Course Contents)

GOVERNMENT POLYTECHNIC MUMBAI
(Academically Autonomously Institute, Government of Maharashtra)
Teaching and Examination Scheme (P19R)
With effect from AY 2022-23

Programme: Diploma in Instrumentation Engineering (Sandwich Pattern)

Term / Semester - I

Course Code	Course Title	Teaching Hours/Contact Hours				Credits	Examination Scheme (Marks)						
		L	P	TU	Total		Theory			PR	OR	TW	Total
							TH	TS1	TS2				
HU19R105	Business Communication	2	2	--	4	4	60	20	20	--	--	50	150
SC19R101	Basic Physics	3	2	--	5	5	60	20	20	25*	--	25	150
SC19R109	Basic Mathematics	4	--	--	4	4	60	20	20	--	--	--	100
IS19R201	Principles of measurement	3	2	--	5	5	60	20	20	50	--	25	175
IS19R202	Instrumentation Workshop Practice	--	4	--	4	4	--	--	--	--	--	50	50
WS19R201	Workshop Practice	--	4	--	4	4	--	--	--	--	--	50	50
UV19R101	Universal Human Values-I	--	--	--	--	2	--	--	--	--	--	--	--
IS19R310	Libre office suite writer and draw (Spoken Tutorial)	--	4#	--	4#	4	--	--	--	--	--	--	--
	Total	12	18	--	32	32	240	80	80	100	--	175	675
Student Centered Activity(SCA)					03								
Total Contact Hours					35								

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR-Practical, OR-Oral, TW: Term Work (progressive assessment)

* Indicates assessment by External Examiner else internal assessment, # indicates Self, on- line learning Mode, @ indicates on line examination

Note: Duration of Examination--TS1&TS2 -1 hour , TH- 2:30 hours, PR/OR – 3 hours per batch , SCA- Library - 1 hour, Sports- 2 hours, Creative Activity-2 hours
Self, on- line learning Mode through MOOCS /Spoken Tutorials / NPTEL / SWAYAM / FOSSEE etc.

Coordinator,
Curriculum Development
Department of Instrumentation Engg.

In-Charge
Curriculum Development Cell

Head of Department
Department of Instrumentation Engineering

Principal

Programme : Diploma in CE/ME/IT/CO/IS/EE/EC/LG/LT/RT (Sandwich Pattern)										
Course Code: HU19R105				Course Title: Business Communication						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2 Hrs. 30 Min.)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
02	02	-	04	60	20	20	-	-	50	150

Abbreviations: TH- Theory; PR-Practical; TU-Tutorial; TS1 and TS2- Term Tests; OR-Oral Exam; TW: Term Work (progressive assessment), * Indicates assessment by External Examiner else internal assessment

Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale: Communication plays a vital and decisive role in career development. It is very important for the smooth functioning of any business or organization. Effective business communication is how employees & Management interact with each other to reach organizational goals & be more aligned with the core company / business values. This course introduces not only basic concepts of communication like types of communication, barriers in communication, group discussion, interview skills, presentation skills but also Business Correspondence which will well equip students to express themselves effectively in all forms of communication especially in written form. It will enhance the skills to communicate effectively and skillfully at workplace. It will guide and direct students to develop a good personality and improve communication skills.

Course Outcomes: Student should be able to

CO1	Apply proper communication technique to cope up with the challenges of the modern world.
CO2	Interpret feedback at various situations by using appropriate body language and avoid the barriers in effective communication.
CO3	Able to participate in Group Discussion and Acquire the practical knowledge of an interview.
CO4	Able to develop PowerPoint Presentation and Business correspondence.
CO5	Write letters, circulars, memos, notices, reports and communicate effectively in written communication.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Introduction to Communication</p> <p>1.1 Elements of Communication</p> <p>1.2 Communication Cycle</p> <p>1.3 Types of communication</p> <p>1.4 Definition and Types of Barriers-</p> <p>a) Mechanical</p> <p>b) Physical</p> <p>c) Language</p> <p>d) Psychological</p> <p>1.5 Ways to overcome Barriers</p> <p>Course Outcome: CO1 Teaching Hours :6 hrs Marks: 14 (R- 2, U-4, A-8)</p>
2	<p>Non- verbal Communication</p> <p>2.1 Meaning and Importance of Non-verbal Communication</p> <p>2.2 Body Language</p> <p>2.3 Aspects of Body Language</p> <p>2.4 Graphic language</p> <p>Course Outcome: CO2 Teaching Hours :6 hrs Marks: 12 (R- 4, U-4, A-4)</p>

	<p>Group Discussion And Interview Skills</p> <p>3.1 Need and Importance of Group Discussion</p>
3	<p>3.2 Use of Knowledge and Logical sequence of ideas in Group Discussion</p> <p>3.3 Types of Interview</p> <p>3.4 Preparing for an Interview</p> <p>Course Outcome: CO3 Teaching Hours :6 hrs Marks: 10 (R-2, U-4, A-4)</p>
4	<p>Presentation Skills</p> <p>4.1 Presentation Skills - Tips for effective presentation</p> <p>4.2 Guidelines for developing PowerPoint presentation</p>
	<p>4.3 Business Etiquette</p> <p>Course Outcome: CO4 Teaching Hours :4 hrs Marks: 08 (R- 2, U-2, A-4)</p>
5	<p>Business Correspondence</p> <p>5.1 Office Drafting – a) Notice b) Circular c) Memo d) Email-writing – Email etiquette, drafting formal / informal email</p> <p>5.2 Personal Letter</p> <p>5.3 Job Application with resume.</p> <p>5.4 Business Letters – a) Enquiry b) Order c) Complaint</p> <p>5.5 Report Writing – a) Fall in Production b) Accident Report</p> <p>Course Outcome: CO5 Teaching Hours: 8 hrs Marks: 16 (R- 4, U-4, A-8)</p>

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to Communication	2	4	8	14
2	Non- verbal Communication	4	4	4	12
3	Group Discussion And Interview Skills	2	4	4	10
4	Presentation Skills	2	2	4	8
5	Business Correspondence	4	4	8	16
Total		14	18	28	60

List of Assignments Sr.No.	List of Experiments	COs	Hours
1	Listening Practice	CO1	03
2	Reading Practice	CO1	03
3	Writing Practice and E-Note	CO5	03
4	Communication Practice and Impromptu Communication.	CO4	03
5	Introduction to Vocabulary	CO5	03
6	Conversation between students on various situations.	CO2	03
7	Non- Verbal Communication.	CO2	03
8	Group Discussion	CO3	03
9	Mock Interview	CO3	03
10	Grammar <ul style="list-style-type: none"> • Tenses • Transformation of sentences • Articles • Subject Pronoun - Singular & Plural • Verbs 	CO5	03
	Total		30

Note: .Students should complete all assignments & activities of Basic & Level 1 of Online course – “Business Communication Excellence” on Infosys Springboard. At the end of term, it is mandatory to submit certificates of Basic and Level 1 of Online course –“Business Communication Excellence”, on Infosys Springboard. Only after that their Term Work will be granted.

References / Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Communication Skills	Joyeeta Bhattacharya - Reliable Series	9780000176981, 0000176982
2	Communication Skills	Sanjay Kumar, PushpaLata- Oxford University Press	13: 978-0199488803
3	Successful presentation Skills	Andrew Brad bury- The Sunday Times	13: 9780749456627
4	Business Communication Using Computers	Dr.Yogesh T.Malshette Sonali Malshette Nirali Prakashan	

E-References:

1. Website: www.mindtools.com/page8.html-99k
2. Website: www.inc.com/guides/growth/23032.html-4
3. Website: www.khake.com/page66htm/-72k

4. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-English>5. Website: www.letstak.co.in6. <https://infyspringboard.onwingspan.com/>7. <http://10s://learnenglishteens.britishcouncil.org/skills>**CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	1	2	3	2	----	2	----	----
CO2	1	2	2	2	2	3	2	----	2	----	----
CO3	2	2	2	2	2	3	2	----	2	----	----
CO4	2	3	2	2	2	3	2	----	2	----	----
CO5	1	1	2	2	3	3	3	----	2	----	----

CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	2	1	----	----	1	3	3	----	----
CO2	2	1	----	----	1	3	3	----	----
CO3	----	1	1	----	----	2	3	----	----
CO4	----	2	2	----	----	3	2	----	----
CO5	----	2	2	----	----	3	2	----	----

CO Vs PO and CO Vs PSO Mapping (ELECTRONICS ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	----	2	----
CO2	3	3	2	3	2	3	2	----	----	2
CO3	3	2	2	1	2	3	2	----	2	----
CO4	3	3	2	1	2	3	2	----	----	----
CO5	3	3	2	1	2	3	2	----	----	----

CO Vs PO and CO Vs PSO Mapping (ELECTRICAL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	1	2	2
CO2	3	3	2	3	2	3	2	2	2	2
CO3	3	2	2	1	2	3	2	----	1	1
CO4	3	3	2	1	2	3	2	1	3	3
CO5	3	3	2	1	2	3	2	2	2	2

CO Vs PO and CO Vs PSO Mapping (INSTRUMENTATION ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	1	1	----	2	2	1	1	1
CO2	1	1	1	----	2	2	1	1	1
CO3	1	1	1	----	2	2	2	1	1
CO4	1	1	1	----	2	2	2	1	1
CO5	1	1	1	----	2	2	2	1	1

CO Vs PO and CO Vs PSO Mapping (COMPUTER ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	1	2	1
CO2	3	3	2	3	2	3	2	1	2	1
CO3	3	2	2	1	2	3	2	1	2	1
CO4	3	3	2	1	2	3	2	----	2	----
CO5	3	3	2	1	2	3	2	----	2	---

CO Vs PO and CO Vs PSO Mapping (INFORMATION TECHNOLOGY)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	2	2	2
CO2	3	3	2	3	2	3	2	1	1	1
CO3	3	2	2	1	2	3	2	1	2	2
CO4	3	3	2	1	2	3	2	2	2	1
CO5	3	3	2	1	2	3	2	1	2	1

CO Vs PO and CO Vs PSO Mapping (LG/LT ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3	2	1	----	2
CO2	3	3	2	3	2	3	2	1	----	2
CO3	3	2	2	1	2	3	2	1	1	2
CO4	3	3	2	1	2	3	2	1	----	2
CO5	3	3	2	1	2	3	2	1	----	2

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Neelamkumar R. Sawant	State Head, Technical Services	JSW Cement Ltd. Mumbai Head Office
2	Shri. Ritesh Bharambe	Manager-Sales	JAI Instruments and Systems Pvt.Ltd
3	Shri. Aniket Mhala	Global Head – Technology & Innovation Hub	Oracle financial services and software
4	Mrs. S. S. Kulkarni	Lecturer in English	Government Polytechnic Pune
5	Mrs. K.S.Pawar	Lecturer in English	Government polytechnic Mumbai
6	Ms. N. N. Dhake	Lecturer in English	Government polytechnic Mumbai

Coordinator,

Head of the Department

Curriculum Development,

Department of Science and Humanities_____

I/C, Curriculum Development Cell

Principal
Government Polytechnic, Mumbai

Programme : Diploma in EE/IS (Sandwich pattern)										
Course Code: SC19R101				Course Title: Basic Physics						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2Hrs.30 minutes)	TS1 (1Hr.)	TS2 (1Hr)	PR	OR	TW	Total
3	2	--	5	60	20	20	25*	--	25	150

Abbreviations: L- Theory; P-Practical; TU-Tutorial; TS1 and TS2- Term Tests; OR-Oral Exam; TW: Term Work (progressive assessment), * Indicates assessment by External Examiner else internal assessment

Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale:

The subject is included under the category of science. The special feature of the subject is to develop the laboratory skill using principles of scientific phenomenon. This course will serve to satisfy the need of the technical students for their development in technical field. The course is designed by selecting the topics which will develop intellectual skills of the students and will guide students to solve broad based engineering problems. Ultimately the focus of the course is to develop psychomotor skills in the Students

Course Outcomes: Student should be able to

CO1	State the different physical quantities, identify the proper unit of it and to estimate error in the measurement of physical quantities.
CO2	Apply laws of motion in various engineering applications .
CO3	Create awareness about the properties and application of light, LASER, Ultrasonic waves, sound waves and nanotechnology in engineering field.
CO4	Identify the physical properties of the various materials such as elasticity, viscosity..

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Units and Measurements</p> <p>1.1 Fundamental Physical quantities, examples. 1.2 Derived physical quantities, examples. 1.3 Definition and requirements of unit 1.4 System of units, C. G. S., M. K. S. and S. I. units. 1.5 Rules to write the unit and conventions of units and Significant figures, rules to write significant figures. 1.6 Error – Definition, types of errors and estimation of errors. 1.7 Numerical</p> <p>Course Outcome: CO1 Teaching Hours : 6 hrs. Marks: 08 (R- 2, U-2, A-4)</p>
2	<p>Motions</p> <p>2.1 Linear motion –Definition – distance, displacement, velocity, acceleration, retardation, equation of motions, acceleration due to gravity and equation motion under gravity, numerical 2.2 Periodic motions: a) Oscillatory motion, b) Vibratory motion, c) S.H.M. d) Circular motion. (only definition and examples) , terms related to S.H.M. :Definition: Time period, frequency, amplitude, wavelength, and phase 2.3 Angular motion: a) Definition: angular motion, Uniform circular motion, Radius vector, linear velocity, Angular velocity , Angular acceleration, b) Relation between linear velocity and angular Velocity(derivation), Radial or centripetal acceleration , Three equations of motion (no derivations) , Centripetal and Centrifugal force, examples and applications.</p> <p>Course Outcome: CO2 Teaching Hours : 10 hrs, Marks: 10 (R- 2 , U- 4 , A- 4)</p>
3	<p>Modern Physics</p> <p>3.1 Photo Electricity Concept of quantum theory of light, Einstein’s Photoelectric equation, Characteristics of photo electric effect, application of photo electric effect</p> <p>3.2 LASER</p> <p>3.2.1 LASER introduction 3.2.2 Properties of laser 3.2.3 Spontaneous and stimulated emission, 3.2.4 Population inversion, Optical pumping. 3.2.5 Applications of LASER</p> <p>Course Outcome: CO3 Teaching Hours : 8 hrs, Marks: 10 (R- 2 , U- 4 , A- 4)</p>
4	<p>4 Optics and Ultrasonic Waves</p> <p>4.2 Optics :</p> <p>4.2.1 Revision of reflection and refraction of light. 4.2.2 Laws of refraction, Snell’s law. 4.2.3 Determination of refractive index. 4.2.4 Dispersion, dispersive power, Prism formula (derivation) 4.2.5 Numerical</p> <p>4.3 Ultrasonic Waves</p> <p>4.3.1 Ultrasonic waves and infrasonic waves. 4.3.2 Audible range of soundwave 4.3.3 Properties of ultrasonic wave. 4.3.4 Applications</p> <p>Course Outcome: CO3 Teaching Hours :6 hrs Marks: 10 (R- 2 , U- 4 , A-4)</p>

5	<p>Nanotechnology 5.1 Introduction to nanotechnology. 5.2 Definition of nanoscale, nanometer and nanoparticles, nanotechnology. 5.3 Definition and examples of nanostructured materials. 5.4 Applications of nanotechnology in different fields - a) electronics, b) automobile, c) medical, d) textile, e) cosmetics, f) environmental, g) space and defense</p> <p>Course Outcome: CO3 Teaching Hours :4 hrs Marks: 8 (R- 2 , U-2 , A-4)</p>
6	<p>General Properties of Matter 6.1 Elasticity: 6.1.1 Deformation, deforming force, internal restoring force, Elastic, plastic and rigid substances, their examples. 6.1.2 Definition of elasticity, stress, strain and its types. 6.1.3 Hooke's Law and elastic limit. 6.1.4 Stress versus Strain diagram, yield point, breaking point 6.1.5 Definition Young's Modulus, bulk modulus and modulus of rigidity relation among them. 6.1.6 Factor of safety. 6.1.7 Applications of elasticity. 6.1.8 Numerical 6.2 Viscosity : 6.2.1 Concept and Definition of viscosity, velocity gradient. 6.2.2 Newton's law of viscosity, Co-efficient of viscosity, unit of viscosity 6.2.3 Stoke's law, terminal velocity, derivation of Stoke's formula. 6.2.4 Streamline flow, turbulent flow, critical velocity, examples. 6.2.5 Reynold's number and its significance. 6.2.6 Applications of viscosity 6.2.7 Numerical</p> <p>Course Outcome: CO4 Teaching Hours : 11 hrs Marks: 14 (R- 4 , U- 4 , A-6)</p>

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Units and Measurements	2	2	4	8
2	Motion	2	4	4	10
3	Modern Physics	2	4	4	10
4	Optics and Ultrasonic	2	4	4	10
5	Nanotechnology	2	2	4	8
6	General Properties of Matter	4	4	6	14
Total		14	20	26	60

List of experiments: Total 10 experiments (or turns) out of 15 experiments (or turns)

Sr. No.	Unit No	CO	List of Experiments	Hours
1	1	CO 1	To know your Physics laboratory and Use of Scientific Calculator	2
2	1	CO 1	To measure the dimensions of given objects and to determine their volume using Vernier caliper.	2
3	2	CO 2	To determine Acceleration due to gravity by simple pendulum	2
4	3	CO 3	To study photoelectric effect by using photo cell	2
5	4	CO 3	To determine refractive index by pin method	2
6	6	CO4	To determine coefficient of viscosity of liquid by Stokes' method	2
7	3	CO1	To measure the dimensions of given objects and to determine their volume using micrometer screw gauge.	2
8	2	CO 2	To determine stiffness constant by using helical spring	2
9	3	CO 3	To study projectile motion	2
10	4	CO 3	To plot the characteristics of photo cell.	2
11	4	CO 3	Experiments on LASER	2
12	3	CO 3	Demonstration on spectrometer	2
13	5	CO 4	To study Engineering applications of Nanotechnology	2
14	6	CO 4	To determine Young's modulus of elasticity of wire using Young's apparatus.	2
15	ALL	CO 1	Showing Video on different applications related to units,	2
Total				30

Note: Experiments No. 1 to 5 (or 6) are compulsory and should map all units and Cos. Remaining 4 experiments are to be perform on the importance of topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Applied Physics	Manikpure&Deshpande ,S.Chand& Company	10:8121919541 13:9788121919548
2	Applied Physics	B.G.Bhandarkar, Vrinda Publication	0071779795
3	Optics & Optical Fibers	Brijlal Subhramanyan	978-3-662-52764-1
4	Engineering Physics	Gaur and S.L.Gupta S.Chand& Company	0-07-058502
5	Physics	Resnick and Halliday Tata McGraw Hills	978-0-07-1755487-3
6	Physics part I & II	H.C.Varma	9788177091878
7	Properties of Matter	D.S.Mathur	13: 978-8121908153

E-References:

1. www.physics.org
2. www.physicsclassroom.com
3. www.youtube.com/physics
4. www.ferrophysics.com
5. <http://hperphysics.phastr.gsu.edu/hbase/hph.htm>
6. www.sciencejoywagon.com/physicszone
7. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-physics>
8. MYCBSEGUIDE
9. <https://ndl.iitkgp.ac.in/>

CO Vs PO and CO Vs PSO Mapping (ELECTRICAL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	1		1
CO2	3						1			
CO3	3				1		1		1	1
CO4	3			2	1		1	1	1	1

CO Vs PO and CO Vs PSO Mapping (INSTRUMENTATION)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			2			1	2	
CO2	3						1	1	
CO3	3				1		1	2	
CO4	3			2	1		1	1	

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Mr. Rajesh Masane	Sr. Engineer	L&T Mumbai
2	Mrs. B. J. Choudhary	Lecturer in Physics	Govt. Polytechnic Thane
3	Mrs S.A. Thorat	Lecturer in Physics	Govt. Polytechnic Mumbai
4	Dr. D.S. Nikam	Lecturer in Physics	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Sci. & Humanities

Head of Departments
Department of Sci. & Humanities

I/C, Curriculum Development Cell

Principal



Programme : Diploma in CE/ME/IT/CO/EC/IS/EE(Sandwich Pattern)										
Course Code: SC19R109				Course Title: Basic Mathematics						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2:30 Hrs)	TS1 (1Hr)	TS2 (1Hr)	PR	OR	TW	Total
04	-	-	04	60	20	20	-	-	-	100

Abbreviations: L- Theory Lecture,P-Practical,TU-Tutorial,TH- Theory Paper TS1&TS2- Term Tests,PR-Practical,OR-Oral,TW: Term Work (progressive assessment),* Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination. Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill tests are to be conducted. First skill test at midterm and second skill test at the end of the term.

Rationale:

This subject is kept under the branch of sciences. This subject intends to teach student basic facts ,concepts, principles, and procedure of mathematics as a tool to analyze engineering problems and as such lays down foundation for understanding the engineering and core technology subject.

Course Outcomes: Student should be able to

CO1	Identify the basic principles of mathematics about the field analysis of any engineering problem.
CO2	Apply rules , concept and properties to solve the basic problems.
CO3	Establish relation between two variables.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Trigonometry:</p> <p>1.1 Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), Sub multiple angles</p> <p>1.2 Factorization and De-factorization Formulae</p> <p>1.3 Inverse Circular function (definition and simple problems).</p> <p>Course Outcome: CO1 Teaching Hours : 10 hrs Marks: 10 (R- 4, U-4, A-2)</p>
2	<p>Vectors:</p> <p>2.1 Definition of vector , position vector</p> <p>2.2 Algebra of vectors(Equality, addition ,subtraction and scalar multiplication)</p> <p>2.3 Dot (Scalar) product & Vector (Cross) product with properties.</p> <p>Course Outcome: CO3 Teaching Hours : 10 hrs Marks: 10 (R- 2 , U-4 , A-4)</p>

3	<p>Logarithms:</p> <p>3.1 Definition of logarithm 3.2 Laws of logarithm 3.3 simple examples based on laws.</p> <p>Course Outcome:CO2 Teaching Hours : 10hrs Marks:10(R-4 , U- 4 , A-2)</p>
4	<p>Probability :</p> <p>4.1 Definition of random experiment , sample space, event, occurrence of event and types of event (Impossible , mutually exclusive , exhaustive ,equally likely) 4.2 Definition of Probability 4.3 Addition & Multiplication Theorems of probability without proof , simple examples</p> <p>Course Outcome: CO1 Teaching Hours :10hrs Marks:10 (R-4, U- 4 , A-2)</p>
5	<p>Determinants:-</p> <p>5.1 Definition of Determinant 5.2 Expansion of Determinant of order 2X3 5.3 Cramer's rule to solve simultaneous equations in 3 unknowns</p> <p>Course Outcome: CO2 Teaching Hours :10 hrs Marks:10 (R- 2 , U-4 , A-4)</p>
6	<p>Matrices:</p> <p>6.1 Definition of a matrix of order m x n 6.2 Types of matrices 6.3 Algebra of matrices - equality, addition, subtraction ,multiplication & scalar multiplication. 6.4 Transpose of matrix. 6.5 Minor , co-factor of an element. 6.6 Adjoint & inverse of a matrix by adjoint method. 6.7 Solution of a simultaneous equations by matrix inversion method.</p> <p>Course Outcome: CO3 Teaching Hours : 10 hrs Marks: 10 (R- 2 , U- 4 , A- 4)</p>

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total
1	Trigonometry	04	04	02	10
2	Vectors	02	04	04	10
3	Logarithms	04	04	02	10
4	Probability	04	04	02	10
5	Determinants	02	04	04	10
6	Matrices	02	04	04	10
Total		18	24	18	60

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Mathematics for Polytechnic Students	S.P.Deshpande, Pune Vidyavardhini Graha Prakashan	-
2	Mathematics for Polytechnic Students (Volume I)	H.K.Dass, S.Chand Prakashan	9788121935241
3	Companions to Basic Maths	G.V.Kumbhojkar, Phadke Prakashan	10-B07951HJDQ 13-B07951HJDQ
4	Applied Mathematics	N.Raghvendra Bhatt late, Tata McGraw Hill Publication Shri R Mohan Singh	9789339219567, 9339219562

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5. <https://www.khanaacademy.org/math?gclid=CNqHuabCys4CFdoJaAoddHoPig>
6. www.dplot.com/-Dplot
7. www.allmathcad.com/-Math CAD
8. www.easycalculation.com
9. <https://www.vedantu.com/ncert-solutions/ncert-solutions-class-12-maths>
10. MYCBSEGUIDE

CO Vs PO and CO Vs PSO Mapping (CIVIL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	1		1
CO2	3	2					1	1		1
CO3	3			2			1	1		1

CO Vs PO and CO Vs PSO Mapping (MECHANICAL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			2			1	1	
CO2	3	2					1	1	
CO3	3			2			1	1	

CO Vs PO and CO Vs PSO Mapping (COMPUTER ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	1		
CO2	3	2					1	1		
CO3	3			2			1	1		

CO Vs PO and CO Vs PSO Mapping (INFORMATION TECHNOLOGY)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1	1		1
CO2	3	2					1	1		1
CO3	3			2			1	1		1

CO Vs PO and CO Vs PSO Mapping (ELECTRONICS ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1		1	1
CO2	3	2					1		1	1
CO3	3			2			1		1	1

CO Vs PO and CO Vs PSO Mapping (ELECTRICAL ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3			2			1		1	
CO2	3	2					1		1	
CO3	3			2			1		1	

CO Vs PO and CO Vs PSO Mapping (INSTRUMENTATION ENGINEERING)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3			2			1	1	1
CO2	3	2					1	1	1
CO3	3			2			1	1	1

Industry Consultation Committee:

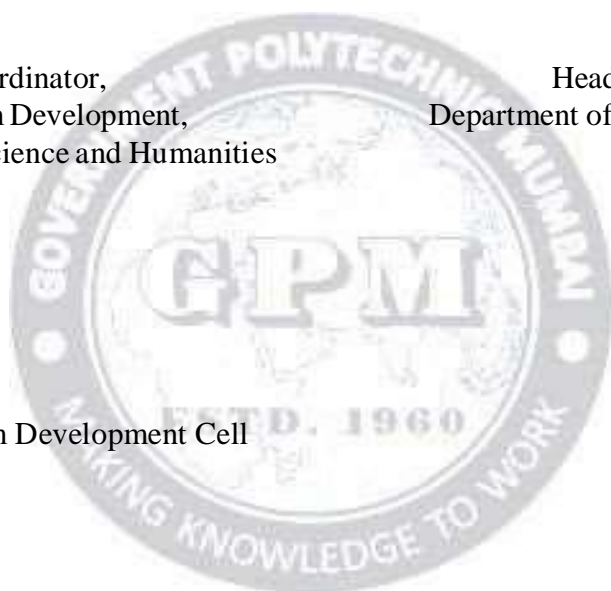
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I/C, Curriculum Development Cell

Principal



Programme : Diploma in Instrumentation Engineering (Sandwich Pattern)										
Course Code: IS19R201				Course Title: Principles of Measurement						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2:30 Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
3	2	-	5	60	20	20	50	-	25	175

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

Instrumentation is defined as the art and science of measurement and control of physical variables within a production or manufacturing area. The physical variables like temperature, pressure, flow rate, level, displacement, force, pH, humidity, and etc. are measured in industries to monitor and control the overall operation of plant. For conversion of these physical quantities into electrical forms, various types of transducers are used. Hence it is essential to study the conversion/ transduction principles. This course mainly deals with study of various transduction principles as well as characteristics of measuring instruments.

Course Outcomes: Student should be able to

CO1	Define the performance characteristics of measuring instruments.
CO2	Demonstrate the transduction principles of different transducers.
CO3	Explain principles of measurement of pressure, flow, and temperature transducers.
CO4	Understand the concept of advance sensors.

Course Content Details:

UnitNo	Topics / Sub-topics
1	<p>Fundamental of Measurement and Metrology-</p> <p>1.1 Definition of Measurement , Instrumentation</p> <p>1.2 Define Metrology, types of Metrology.</p> <p>1.3 Significance of Measurement, Methods of Measurements, Generalized Block diagram of Instrumentation System, Applications of Measurement system.</p> <p>1.4 Classification of Instruments - Active and Passive instruments ,Null-type and Deflection-type instruments , Analogue and Digital instruments, , Smart instruments & non smart instruments</p> <p>Types of Performance Characteristics-</p> <p>1.4 Definitions-Static Characteristics of Instruments: Accuracy, Precision, calibration, Range and span ,Linearity, Sensitivity , Repeatability & Reproducibility, Resolution & Threshold,</p> <p>1.5 Drift,Hysteresis band, Dead zone.(Definition only)</p> <p>1.6 Definitions-Dynamic Characteristics of Instruments: Speed of Response, Dynamic Error, Fidelity.</p>

	<p>1.7 Errors in Measuring Instruments</p> <ul style="list-style-type: none"> • Types of Errors • Sources of Errors • Reduction of Errors <p>Course Outcome: CO1, Teaching Hours : 12 hrs Marks: 12 (R-4 , U-4, A-4)</p>
2	<p>Transduction Principles of Sensors & Transducers</p> <p>2.1 Different Physical Variables Measured in Industries, Definitions of Sensor & Transducer and their difference, Classification of Transducers.</p> <p>2.2 Principle of operation</p> <p>Resistive transducers Capacitive transducers Inductive transducers-</p> <p>2.3 Self-generating type- Electromagnetic type, Electrodynamic type, and Eddy current type Passive type- Variable Inductance type, Mutual Inductance type</p> <p>2.4 Hall-effect sensors, Piezoelectric transducers</p> <p>2.5 Photoelectric sensors - Photo emissive, Photo conductive and Photovoltaic</p> <p>2.6 Ultrasonic transducers, Radar sensors.</p> <p>Course Outcome: CO2 Teaching Hours : 08 hrs Marks: 10 (R-2 , U-4 , A-4)</p>
3	<p>Principles of Pressure Measurement</p> <p>3.1 Pressure -Definition, Units of Pressure, Pascal's Law Absolute, Gauge, Atmospheric, Vacuum, and Differential Pressures.</p> <p>3.2 Principles of Operation and Applications of –</p> <p>Barometer Manometers- Piezometer, U-tube manometer, Single limb manometer Bourdon tube- C type, Bellows & Diaphragm</p> <p>Course Outcome: CO3 Teaching Hours : 6 hrs Marks: 8 (R-0 , U-4 , A-4)</p>
4	<p>Principles of Flow Measurement</p> <p>4.1 Types of fluid flows, Rate of flow or discharge(Q), Continuity equation Bernoulli's equation for ideal and real fluids and applications</p> <p>4.2 Principle of Operation and Applications of – Venturimeter, Orifice Meter, Rotameter</p> <p>Course Outcome: CO3 Teaching Hours : 06hrs Marks: 12 (R-2 , U-6 , A-4)</p>
5	<p>Principle of Temperature Measurement</p> <p>5.1 Difference between heat and temperature, temperature Scale. Different units of temperature measurement and their conversion, Modes of heat transfer, Thermal conductivity</p> <p>5.2 Principle of Operation of –</p> <p>Thermal expansion thermometers (liquid thermometer, Bimetallic Strip) Thermoelectric thermometers – (Seebeck, Peltier, and Thomson effects)- Principle of Thermocouple</p> <p>Course Outcome: CO3 Teaching Hours : 8 hrs Marks: 10 (R-2 , U-4 , A-4)</p>

6	Advance Sensors 6.1 IOT Smart sensors – working principle, construction 6.2 MEMS sensors- working principle, construction, block diagram & applications in area. 6.3 Analytical sensors –working principle, construction, diagram & applications in area of PH electrode & gas electrode.
	Course Outcome:CO4 Teaching Hours : 5 hrs Marks: 8 (R- 2 , U-4 , A-2)

Suggested Specifications Table (Theory):

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Fundamentals of Measurement & Metrology	04	04	04	12
2	Transduction Principles of Sensors & Transducers	02	04	04	10
3	Principles of Pressure Measurement	--	04	04	08
4	Principles of Flow Measurement	02	06	04	12
5	Principles of Temperature Measurement	02	04	04	10
6	Advance Sensors	02	04	02	08
Total		12	26	22	60

List of experiments: Total 10 experiments (or turns) out of 15 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	To identify direct and indirect measuring instruments in the given lab	2
2	2	CO2	To verify the resistive transduction principle of transducer.	2
3	3	CO3	To measure gauge pressure and differential pressure using U- tube manometer.	2
4	6	CO4	To study MEMS sensor	2
5	1	CO1	To find an accuracy, precision, range and span of mechanical instruments (e.g. Level indicator).	2
6	2	CO2	To verify the inductive transduction principle by converting displacement / velocity into voltage.	2
7	4	CO3	To measure liquid flow rate using rotameter.	2
8	6	CO4	To study IOT sensor	2
9	1	CO1	To find an accuracy, precision, range and span of electrical instruments (e.g. DMM-voltage, current and resistance)	2
10	2	CO2	To verify the capacitive transduction principle by converting liquid level into change in capacitance.	2

11	5	CO3	Measurement of temperature by using temperature sensor.	2
12	2	CO2	To verify the Resistive transduction Principle (RTD, Thermistor) converting temperature in to change in Resistance.	2
13	4	CO3	To measure liquid flow rate using orifice & venturi meter.	2
14	2	CO2	To verify the piezoelectric transduction principle applicable for only dynamic measurement.	2
15	3	CO3	Identify different pressure mechanical pressure transducer in lab.	2

Note: Experiments Sr. No. No. 1 to 6 are compulsory and should map all units and Cos. Remaining 4 experiments are to be performing on the importance of topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	A Course in Electrical and Electronic Measurements and Instrumentation	A.K. Sawhney Dhanpat Rai and co, New Delhi.2015	9788177001006
2	Measurement-And-Instrumentation-Principles-3rd-Edition1	Alan S. Morris Butterworth-Heinemann, Oxford. 2001	9780750650816
3	A TextBook of Fluid Mechanics and Hydraulic Machines (in S.I. Units)	Dr. R. K. Bansal Laxmi Publication, New Delhi. 2018	9788131808153
4	A Textbook on Heat Transfer	Dr. S.P. Sukhatme Universities Press (India) Fourth edition (2005)	9788173715440
5	Instrumentation System and devices	Rangan Mani Sharma Tata McGraw Hill	9780074633502
6	Industrial instrumentation and controls	S.K. Singh Tata McGraw Hill, New Delhi	9780070262225
7	MEMS and Microsystems: Design and Manufacture	Tai Ran Hsu Mc Graw Hill	978-0072393910
8	IOT Based Applications	Nidhisindhvani Rohit Anand Mniranjan murthy Dinnesh chander verma Valentina Editors	9781032108544
9	Smart sensors for industrial internet of things	Deepak Gupta Ashish Khanna Purnimal lala Mehta Editors Springer	9783030526238

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2. <http://www.vlab.co.in/>
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4. <https://nptel.ac.in/course.html>
5. <https://www.slideshare.net/nsihag/transducers-17950953>
6. <https://en.wikipedia.org/wiki/Transducer>
7. <http://doi.org/10.1016/j.future.2016.06.003>
14. [https://doi.org/10.1016/S09244247\(99\)00368-4](https://doi.org/10.1016/S09244247(99)00368-4)

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	-	-	-	2	1	-
CO2	3	-	-	-	-	-	3	2	-
CO3	-	-	2	2	-	-	2	3	-
CO4	1	-	2	2	2	1	2	3	2

Industry Consultation Committee:

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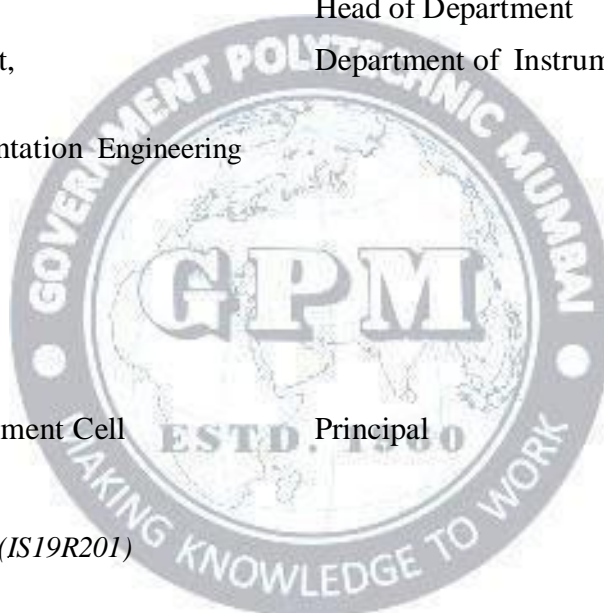
Department of Instrumentation Engineering

Head of Department

Department of Instrumentation

I/C, Curriculum Development Cell

Principal



Programme : Diploma in Instrumentation Engineering (Sandwich Pattern)										
Course Code: IS19R202				Course Title: Instrumentation Workshop Practice						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2:30 Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	4	--	4	--	--	--	--	--	50	50

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Rationale:

Instrumentation workshop practice will provide real industrial environment which helps students to develop technician skills related to instrumentation field. The course is designed to impart hands-on-skills in the field of electronics & instrumentation such as testing of electronic components, cables, connectors, soldering and de-soldering techniques, PCB making etc. This course is useful for students to build, test, maintain and troubleshoot simple electronic circuits on PCB.

Course Outcomes: Student should be able to

CO1	Select appropriate tools, components and instrument.
CO2	Test the given electronic components.
CO3	Perform the soldering and de-soldering with utmost safety.
CO4	Develop PCB, assemble components and test the circuit.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Tools</p> <p>1.1 Tools: Nose pliers, wire stripper, screwdrivers, allen keys, cutter, hand hacksaw, soldering iron, de-soldering pump, crimping tools (for RJ-45, RJ-11), and cable testers. (Free hand constructional sketches may be drawn on drawing sheet)</p> <p>1.2 Multimeters: Need of Multimeter, Analog and digital Multimeter, Measurement of parameter using multimeter.</p> <p>Course Outcome: CO1</p>
2	<p>Switches, Cables and Connectors</p> <p>2.1 Types of switches: SPST, SPDT, Toggle, thumbwheel, rotary, slide, micro switch, membrane switch.</p> <p>2.2 Cable: Flat, Ribbon, Co-axial, twisted pair, UTP, Fiber optic.</p> <p>2.3 Connector Types: PCB edge connector, Berg (strip) connector, FRC connector, D-type, BNC, TNC, MCB, RJ-45, RJ-11, USB (A, B, mini, micro).</p> <p>Course Outcome: CO1</p>

3	<p>Component Testing</p> <p>3.1 Identification and testing of following components. Resistors, Capacitors, Inductors, Transformers, PN Junction Diode, Bipolar Junction Transistors (BJT), Field Effect Transistors (FET), Unijunction Transistor (UJT), Metal Oxide Semiconductor FET (MOSFET), LED, 7- Segment Displays, SCR, DIAC, TRIAC.</p> <p>3.2 Terminal identification and major specifications of component from its data sheet.</p> <p>Course Outcome: CO2</p>
4	<p>Soldering and De-soldering</p> <p>4.1 Soldering Basics: Solder joint: Dry solder joint, cold solder joint, Good and Bad solder joint, Soldering material, Soldering tools: Soldering Iron, soldering station.</p> <p>4.2 De-soldering Technique: Tools used for de-soldering, De-solder Wick, De-solder Pump</p> <p>4.3 Precaution during soldering and de-soldering.</p> <p>Course Outcome: CO3</p>
5	<p>PCB Making</p> <p>5.1 Types of PCB's: Glass Epoxy, paper phenolic, Single Sided, double sided, Selection and application of PCB's. Drawing electronic circuit, designing PCB layout and artwork. Use of paint, Templates, Pen.</p> <p>5.2 Demonstration of PCB making equipments: Deep coating machine, UV exposure unit, Etching machine, dryer (oven) and scanner with lens. Drilling machine, Shearing machine. Developing negative film and making PCB.</p> <p>Course Outcome: CO4</p>
6	<p>Mini Project</p> <p>6.1 Selection and testing of components to be used in the mini project.</p> <p>6.2 PCB layout and artwork design: Transfer the artwork on copper clad, Etching and drilling, mounting and soldering components.</p> <p>6.3 Testing and fault finding of circuit, Wire harnessing and final assembly along with enclosure.</p> <p>Course Outcome: CO4</p>

Suggested Specifications Table (Theory): --NA---

List of experiments: Total 10 experiments (or turns) out of 15 experiments (or turns)

Sr. No.	Unit No	COs	Title of the Experiments	Hours
1	1	CO1	To know Instrumentation Workshop Lab: A) Demonstration for identification and use of tools. (Nose pliers, wire stripper, screwdrivers, allen keys, allen screw, cutter, hand hacksaw, soldering iron, de-soldering pump, crimping tools (for RJ-45, RJ-11), and cable testers.(4 Hours) B) Prepare the sheet of free hand sketch of various tools used in Instrumentation Workshop and write their uses. (4 Hours)	8
2	1	CO1	Multimeters: (A) To identify analog and digital multimeters and to identify different range selection for AC/DC voltage/Current, Resistance, continuity, diode, transistor. (B) To measure resistance, voltage and current using analog and digital multimeter.	4
3	2	CO1	To identify and test various types of switches, cables and connectors (Lead identification, testing, uses).	8

			(A) SPST, SPDT, Toggle, thumbwheel, rotary, slide, micro switch, membrane switch. (2 Hours) (B) PCB edge connector, FRC connector, D-type, BNC, TNC, MCB, RJ-45, RS-232, USB connectors. (2 Hours) (C) Flat, Ribbon, Co-axial, twisted pair, UTP. (2 Hours) Prepare the chart for symbols with terminal identification, uses and testing procedures. (2 Hours)	
4	3	CO2	To identify and test passive components available in your lab: Resistors: Thick film and Thin film resistors, Network and Surface Mount Resistors, Variable Resistors, Special resistors e.g. thermistor, LDR. Capacitors: Dielectric, Variable, Electrolytic: aluminium/tantalum, Film: radial/axial lead, Ceramic. Inductors: Iron core, Ferrite core, Air core, bobbin based, torroidal, multilayer, film, variable, coupled. (by color codes and with multimeter/LCR meter)	4
5	4	CO3	Demonstration and practice of soldering and de-soldering technique.	4
6	5&6	CO4	Mini project: To prepare PCB (with layout, artwork designed by the student) for small electronic circuits. <u>Note:</u> Mini project group may consist of 3-4 students. Student has to demonstrate the project and submit the project report.	8
7	3	CO2	To identify and test Diode, LED, BJT, FET, UJT, MOSFET and 7- Segment display using multimeter.	4
8	3	CO2	To identify and test DIAC, SCR and TRIAC using multimeter.	2
9	4	CO3	To identify Solder joint, Dry and cold solder joint, good and bad solder joint, soldering material, soldering tools	2
10	4	CO3	To perform soldering by soldering material & soldering tools. Precaution to be taken during de-soldering	2
11	4	CO3	To perform De-soldering by De-solder Wick, De-solder Pump. Precaution to be taken during de-soldering	2
12	5	CO4	Draw circuit schematic, layout and artwork using one of the PCB making software mentioned below. (Express PCB, Free PCB, EAGLE PCB, workbench etc).	4
13	5	CO4	To identify different types of PCB. Teacher shall explain artwork design rules, types of PCB's: Glass Epoxy, Selection of PCB's, PCB layout and artwork design, Use of paint, Templates, Pen etc paper phenolic, Single Sided, double sided, Selection of PCB's, PCB layout and artwork design, Use of paint, Templates, Pen etc.	4
14	5	CO4	To search information on different PCB making equipments.	2
15	5	CO4	To identify different instruments/ equipments used in making PCB.	2
Total				60

Note: Experiments No. 1 to 5 (or 6) are compulsory and should map all units and Cos. Remaining 4 experiments are to be performing on the importance of topic.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Electronic Devices and Circuit: An Introduction	Mottershead Allen PHI Learning, New Delhi	9788120301245
2	Electronic Devices and Circuit Theory	Boylestead Robert, Louis Neshelsky Pearson Education, 10 th edition	9788131727003
3	The Art of Electronics	Paul Horowitz Winfield Hill Cambridge University Press, New Delhi	9780521370950
4	Electronics Principles	Malvino, Albert Paul, David McGraw Hill Education	9780073222776
5	Principles of Electronics	Mehta V.K., Mehta Rohit S. Chand and Company	9788121924504
6	Basic Electronic Engineering	Baru V., Kaduskar R. , Gaikwad S.T. Dreamtech Press	9789350040126
7	Fundamentals of Electronic Devices and Circuits	David A. Bell Oxford University Press	9780195425239
8	A text book of Applied Electronics	Sedha R.S. S. Chand	9788121904209

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3. <http://www.techniks.com>
4. <http://www.aplab.com>
5. <https://electronicsclub.info>

CO Vs PO and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	3	-	-	1	-	1	2	3	-
CO2	3	-	1	3	-	-	2	2	-
CO3	1	-	-	-	-	-	3	1	-
CO4	-	2	3	-	-	-	2	2	-

Industry Consultation Committee:

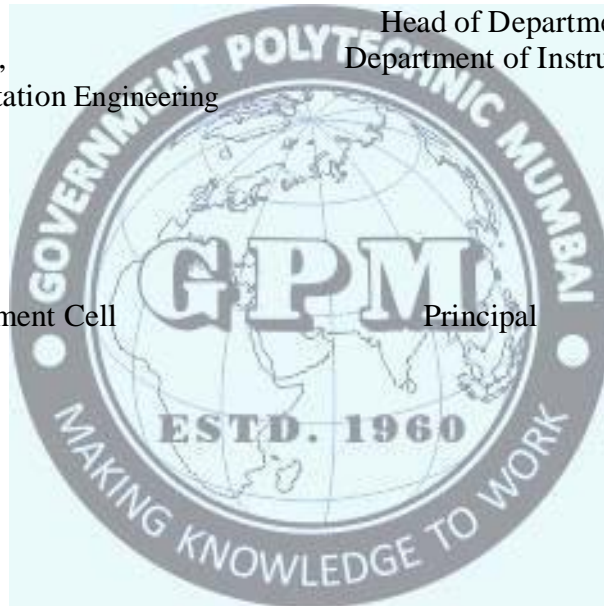
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4	Mr. K.U.Dawane	Lecturer in Instrumentation Engineering	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of Instrumentation Engineering

Head of Department
Department of Instrumentation Engineering

I/C, Curriculum Development Cell

Principal



Programme : ME/CE/IS (Sandwich Pattern)										
Course Code: WS19R201				Course Title: Workshop Practice						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total	TH (2:30Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
0	4	0	4	0	0	0	0	0	50	50

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination

Note: For Minimum passing marks under various heads, refer, examination rule AR26.

Rationale:

Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. The knowledge of basic shops like Wood working, Fitting, Welding, Plumbing and Sheet Metal shop is essential for technicians to perform their duties in industries. Irrespective of engineering stream, the use of workshop practices in day to day industrial as well domestic life helps to solve various minor but critical problems. Working in workshop develops the attitude of working in a group and the basis for safety awareness is created. This foundation course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. The students are advised to undergo each skill experience with remembrance, understanding and application with special emphasis on attitude of enquiry to know why and how for the various instructions and practices imparted to them in each hop. Furthermore, the demonstration of CNC Machine will give feel of advancement in industry.

Course Outcomes: Student should be able to

CO1	Lay-outing of shop & Sketching of jobs, tools & equipment.
CO2	Select appropriate tools, machinery, equipment and consumables for given application.
CO3	Use & Operate hand tools, equipment and machinery in different shops.
CO4	Prepare the simple jobs as per specification & drawing.
CO5	Maintain workshop related tools, equipment and machineries.

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Introduction to workshop: -</p> <p>1.1 Workshop layout, Importance of various sections/shop of workshop, Types of jobs done in each shop.</p> <p>1.2 Causes of accidents, general safety rules and work procedure in workshop, Safety signs and symbols, First Aid.</p> <p>1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire. Classification of fire, Firefighting</p>

	<p>equipment, fire Extinguishers and their types. 1.5 Issue and return system of tools, equipment and consumables.</p> <p>Course Outcome: CO1,CO2 Teaching Hours : 06</p>
2	<p>Smithy and Forging:- 2.1 Sketching, understanding the specifications, materials, various applications and methods used in Smithy and Forging shop along with use of tools like anvil, hammers, Swage block, tongs, chisels, flatters etc; 2.2 Demonstration of Smithy and Forging operations like bending, setting down, bulging, Upsetting etc; 2.3 Preparation of smithy & forging, job. 2.4 Safety precautions & Personal Protective Equipments.</p> <p>Course Outcome: CO1,CO2,CO3,CO4,CO5 Teaching Hours :10</p>
3	<p>Carpentry Section :- 3.1 Types of wood and their applications. 3.2 Types of carpentry hardware's and their uses. 3.3 Sketching, understanding the specifications, materials, various applications and Methods used in Carpentry shop along with use of tools like saws, planner, chisels, Hammers, mallet, marking 3.4 Demonstration of carpentry operations such as marking, sawing, planning, chiseling, gauge, Vice, try square, rule, etc; Grooving, boring, joining, etc; 3.5 Preparation of wooden joints. 3.6 Safety precautions & Personal Protective Equipments.</p> <p>Course Outcome: CO1,CO2,CO3,CO4,CO5 Teaching Hours: 10</p>
4	<p>Welding Section: - 4.1 Types, sketching, understanding the specifications, materials and applications of arc & Gas welding, Accessories and consumables. 4.2 Demonstration of metal joining operations like arc welding, soldering and brazing. Show effect of Current and speed. Also demonstrate various welding positions. 4.3 Demonstrate gas cutting operation. 4.4 Preparation of metal joints. 4.5 Safety precautions & Personal Protective Equipments.</p> <p>Course Outcome: CO1,CO2,CO3,CO4,CO5 Teaching Hours: 10</p>
5	<p>Fitting Section 5.1 Sketching, understanding the specifications, materials, various applications and methods used in fitting, Marking, measuring, work holding, cutting & finishing tools. 5.2 Demonstration of various fitting operations such as chipping, filing, scraping, grinding, Sawing, marking, Drilling, tapping, etc; 5.3 Preparation of male, female joint. 5.4 Safety precautions & Personal Protective Equipments</p> <p>Course Outcome: CO1,CO2,CO3,CO4,CO5 Teaching Hours :12</p>
6	<p>Plumbing Section 6.1 Types, specification, material , applications and demonstration of pipe fitting tools 6.2 Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, Dismantling etc. 6.3 Types and application of various spanners such as flat, fix, ring, box, adjustable etc. 6.4 Preparation of pipe fitting jobs. 6.5 Concept and conversions of SWG and other gauges in use. Use of wire gauge. 6.6 Safety precautions & Personal Protective Equipments</p> <p>Course Outcome: CO1,CO2,CO3,CO4,CO5 Teaching Hours : 06</p>

7	Lathe and CNC Operations :-	
	7.1 Working principle of lathe along with sketch and procedure for its general maintenance.	
	7.2 Demonstration of Lathe machine operation like plain turning, taper turning, threading, Chamfering, etc.	
	7.3 Simple job demonstration for a group on CNC Machine.	
	Course Outcome:CO5	Teaching Hours : 06

List of experiments:

Sr. No.	Unit No	CO	List of Experiments	Hours
1	1	CO1	Causes of accidents, general safety rules and work procedure in workshop, Safety signs and symbols, First Aid. Perform mock drill session in group of minimum 10 students for Extinguishing fire.	06
2	2	CO1,CO2,C O3,CO4,CO5	Prepare job involving operations like bending, setting down, bulging, upsetting etc; e.g. Pegs (Square/round), Hook, Hammer tongue, Agro equipment etc. (Individually)	10
3	3	CO1,CO2,C O3,CO4,CO5	Prepare two wooden joints as per given drawings. (Individually)	10
4	4	CO1,CO2,C O3,CO4,CO5	Prepare lap joint/butt joint using either arc / gas welding as per given drawing.(Individually)	10
5	5	CO1,CO2,C O3,CO4,CO5	Prepare one Male- Female type fitting job as per given drawing. (Individually)	12
6	6	CO1,CO2,C O3,CO4,CO5	Prepare two pipe joints as per given drawings. (Individually)	06
7	7	CO5	Demonstration of Lathe machine & CNC machine operations.	06
Total				60

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Workshop Technology - 1	Hazra and Chaudhary Media promoters & Publisher private limited.	9788185099149
2	Workshop Technology - 1	W.A.J.Chapman Taylor & francis.	9780713132694
3	Workshop Practice Manual for Engineering Diploma & ITI Students	Hegde.R .K Sapna Book House, 2012,	9798128005830
4	Workshop familiarization.	E. Wilkinson Pitman engineering craft series. 1972	978 0273 3167 56
5	Mechanical workshop practice.	K.C.John PHI. 2010	978 812 03416 61
6	Workshop practice manual	K. Venkata Reddy,B. S. Publications. 6 th ed ,2015	978 8178 0030 78

E-References:

1. <http://www.asnu.com.nu> b.c.
2. <http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf> d.
3. <http://www.weldingtechnology.org> e.<http://www.newagepublishers.com>
4. <http://www.youtube.com/watch?v=TeBX6cKKHWY> g
5. <http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related> h
6. <http://www.youtube.com/watch?v=KvIzo9CAxt4&feature=relmfu> i.
7. <http://sourcing.indiamart.com/engineerig/articles/materials-used-hand-tools/>

CO Vs PO and CO Vs PSO Mapping(Mechanical)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	1	2	1	2	2	1	2	2
CO2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	2	2	2
CO4	3	3	3	3	3	3	3	2	2
CO5	2	2	2	2	2	2	2	2	2

CO Vs PO and CO Vs PSO Mapping(Civil Engineering)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	1	1	2	1	2	2	1	2	1	--
CO2	2	2	2	2	2	2	2	2	1	--
CO3	2	2	2	2	2	2	2	2	1	--
CO4	3	3	3	3	3	3	3	2	1	--
CO5	2	2	2	2	2	2	2	2	1	--

CO Vs PO and CO Vs PSO Mapping(Instrumentation)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1	1	1	2	1	2	2	1	2	1
CO2	2	2	2	2	2	2	2	2	1
CO3	2	2	2	2	2	2	2	2	1
CO4	3	3	3	3	3	3	3	2	1
CO5	2	2	2	2	2	2	2	2	1

Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Shri S. V. Joshi	Lecturer	G. P. Mumbai
2	Shri N. M. Ambadekar	Workshop Superintendent,	G. P. Thane
3	Shri D. B. Jadhav	Senior Manager	Auto. Division, Mahindra and Mahindra Ltd., Kandivali

Coordinator,
Curriculum Development,
workshop Department of Mechanical Engineering

Workshop superintendent
Department of

I/C, Curriculum Development Cell

Principal



Programme : Diploma in ME/CE/EE/CO/IF/IS/EC/RT/LT/LG (Sandwich Pattern), AIML										
Course Code: UV19R101				Course Title: Universal Human Values-I						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
L	P	TU	Total (Credit)	TH (2 Hrs 30min)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	--	-	02	-	-	-	--	--	--	--

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR26.Two practical skill tests are to be conducted. First skill test at mid-term and second skill test at the end of the term.

Rationale:

Human beings have materially developed to a great extent through technological development. Still the scarcity of happiness and satisfaction result in personal and social conflicts. The value system develops the frame of reference of the individual to benchmark his/ her behavioral pattern respecting the righteousness during life. The appreciation and inculcation of a value system can develop a person as a creative contributor for society, nation and by-large the world.

By inculcating universal values, not only can a person resolve the personal, social and professional situations positively but also can lead toward an enriched life. Once these values are inculcated in a student's personality, it will result in the sustainable development of a student.

This course is designed to make the student think that by observing the universally accepted human values, it is easy to become a good human being, a good citizen and make their own life goal-oriented, cladded with happiness and satisfaction. The core universal values to be inculcated: personal values, social values and professional values. The aspirations and concerns to be explored at the level of individual, at the level of family, at the level of society and at the level of nature.

Course Outcomes: On completion of this course, student should be able to

CO1	Appreciate universal human values to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.
CO2	Develop a holistic approach to environment, family and society.
CO3	Develop more confidence in self .
CO4	Derive joy of giving .
CO5	Improve understanding and perform acts of kindness.

Course Content Details:

Sr. No	Activity	Related Value/s	Methodology of Implementation	Student's Role	Mentor's role	Resources Required
01	Prepare a self-introduction sheet i) Name, School passed from, achievements upto 10 th standard <ul style="list-style-type: none"> ● What are your goals in your life ● What are your expectations from institute, Family, Society ● Information of family members ● Most happy moments and difficult moments in your life, Special trips, Hobbies, Sports, Music, etc 	Honesty, Self-exploration	Preparing a note and presenting in front of peers	Thoughtfully answer the questions in an honest manner.	Provide information about the institute and motivate students to honestly express themselves.	Official website of the institute
02	List behavioral characteristics and analyse self, friend, family members, <ul style="list-style-type: none"> ● Do you like these characters yes/no – why 	Self-exploration, Honesty	Preparing a presentation	Honestly and sincerely analyse self and others	Create a stress-free environment and see that there will be no conflict of expression.	Provide a list of character traits by referring to various resources like internet, books, etc. For e.g. https://www.teachervision.com/writing/character-traits-list-examples

03	Identify your needs and desires	Honesty Self-exploration	Making a list of needs and desires	Reflect and identify needs and desires.	Stay wary of controversial subjects	list of historical personalities who set the example.
04	Singing a patriotic song in group <ul style="list-style-type: none"> Make group, select song, explain meaning, use music/karaoke and demonstrate to class 	Patriotism	Forming group of interested students Students will rehearse the activity and will perform in groups	Diligently practice and cooperate with others.	Manage the logistics of creating groups and assigning roles.	Music system, list of patriotic songs.
05	Essay writing <ul style="list-style-type: none"> My dreams as an Engineer India a Super power in my views Society & I Indian culture and values My role models in life 	Self – exploration Patriotism Accountability	Selecting a topic from the list and writing an essay on it	Thoughtfully write the essay on a selected topic.	Display the best essays on the notice board.	notice board, panel of judges
06	Play Music instruments/ Singing/ Drawing/Any stage performance/ photography/any creative art	Derive the joy	Present to peers (Two days competition)	Pursue your creative interest	Identify and categorize students. Create groups accordingly	logistical support
07	Visit a nature park, identify the flora & fauna, ecological factors & their role in our life. (e.g Maharashtra nature park society, Dharavi, Mumbai)	Environment Conservation	Students to arrange visit under supervision of mentor	Study various flora & fauna in a disciplined manner.	Assure safety of students and manage activities.	https://maharashtranaturepark.org/

08	Tree plantation and caring for it.	Environment Conservation	Students to arrange activity under supervision of mentor	Plant the appropriate saplings according to instructions.	Assure safety of students and provide adequate instructions.	saplings, soil, shovels, fertilizer
09	List the distracters which are responsible to deviate you from integrity and find out the solution	Integrity, Righteousness	Observation and identification of common distracters.	Identify distracters like TV shows, movies and bad habits	Provide historical case studies of previous students.	Case studies
10	Prepare the chart DOs and DONTs for different situations like local trains, travel, public place, classroom, examination, etc.	Conscientiousness, honesty, social gratitude	Preparing the chart	Identify DOs and DONTs and prepare various charts	Create groups and assign topics.	Official websites of respective administrations like railways, Municipal corporation, etc.,
11	Beach cleaning, institute cleaning	Environment conservation, Health consciousness	Organizing a visit to clean the venue.	Clean the venue as per instructions.	Assure safety and aid in organization.	https://www.unitedwaymumbai.org/cleanshores

Methodology:

1. The course is Non Examination, Credit Course.
2. The course will be introduced during the student induction programme (orientation programme). Most of the activities are to be completed during induction programme and to be continued throughout the term under the guidance of mentor.
3. The mentor will be assigned to the student for a group of 20 students each.
4. In consultation and under supervision of a mentor, the student/ Group of students has to complete the activity.
5. The mentor will work as a facilitator/ advisor.
6. The strategies to learn the course is "Self- Exploratory" and "Experiential Learning"
7. The onus of responsibility for completing the activities is with students.
8. The student has to complete at least **seven** no. of activities throughout the term to earn the credits.

References/ Books:

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, New Delhi, 2010	978-8-174-46781-2
2	Human Values	A.N. Tripathy, New Age International Publishers, 2003	978-8-122-42589-5
3	Teacher's Manual - A Foundation Course in Human Values and Professional Ethics	R.R. Gaur, R. Sangal, G.P. Bagaria, Excel Books, New Delhi, 2010	-
4	Science and Humanism, Towards a Unified World View	PL Dhar, RR Gaur, Commonwealth Publications, 1992	978-8-171-69222-4
5	Education for values in schools- a framework	NCERT	
6	Value oriented education	E N Gawande	

E-References:

- 1) https://youtu.be/k0Ju1vj_BVk (The 10 Most Important Human Values)
- 2) Dr. Prakash Baba Amte- Movie
- 3) <https://youtu.be/QeogOlzG2ls> (Value of Education -short film)

E-References for mentors:

- 1) <https://www.edutopia.org/>
- 2) <https://sdgs.un.org/goals>

Consultation Committee:

Sr. No	Name	Designation	Institute/Organisation
1	Dr. L.A. Patil	Principal (Retired)	Pratap College, Amalner
2	Dr. Nitin Deshpande	Lead Consulatnt	Dnyanpeeth Academy, Pune
3	Dr. Chandrakant Shahasane	Founder Trustee	Karnala Charitable Trust, Pune
4	Mr. Sunil V. Joshi	Ex- Sr. Lecturer, Mechanical Engineering,	Government Polytechnic, Mumbai
5	Mrs. Swati D. Deshpande	Principal	Government Polytechnic, Mumbai
6	Mr. U.A. Agnihotri	Lecturer, Mechanical Engineering	Government Polytechnic, Mumbai
7	Mr. K. V. Patil	Lecturer, Mechanical Engineering	Government Polytechnic, Mumbai

Institute Coordinator,
Curriculum Development,

Principal
Government Polytechnic, Mumbai

Programme : Diploma in Instrumentation Engineering										
Course Code:IS19R310				Course Title: Libre Office Suite (Writer and Draw)						
Compulsory / Optional: Compulsory										
Teaching Scheme and Credits				Examination Scheme						
TH	PR	TU	Total	TH (2:30 Hrs)	TS1 (1 Hr)	TS2 (1Hr)	PR	OR	TW	Total
--	4#	--	4	--	--	--	--	--	--	--

Abbreviations: L- Theory Lecture, P-Practical, TU-Tutorial, TH- Theory Paper TS1 & TS2- Term Tests, PR- Practical, OR-Oral, TW: Term Work (progressive assessment) , * Indicates assessment by External Examiner else internal practical skill test , # indicates Self, on- line learning Mode, @ indicates on line examination
 Note: For Minimum passing marks under various heads, refer, examination rule AR 26. Two practical skill test are to be conducted. First skill test at mid term and second skill test at the end of the term

Course Content Details:

Unit No	Topics / Sub-topics
1	<p>Libre office suite writer</p> <ol style="list-style-type: none"> Promo of LibreOffice Suite Outline: - LibreOffice promo - Features of LibreOffice - Uses of LibreOffice - LibreOffice formats - LibreOffice tutorials in Spoken Tutorial - Applications of LibreOffice, Libre Office tutorials in various languages Introduction to LibreOffice Writer Outline: Introduction to LibreOffice Writer Basic Features Toolbars How to open, close and save a document Save in MS Office, PDF and other formats Open MS Office Documents Change Bold icon Change Font Size , Change Font Name. Typing text and basic formatting Outline: Typing text and basic formatting Aligning Text in writer Bullet points and Numbering Cut Copy and Paste option Bold/Underline/Italics Font name/Font size/Font color in Writer, Other important and popularly used formatting features. Inserting pictures and objects Outline: Inserting pictures and other objects in a document Inserting pictures Inserting Tables Hyperlinks (within, across documents, from web) Creating tables AutoFormat Optimal Column Width option Viewing and printing a text document Outline: Viewing and printing a text document Viewing Documents Printing Documents Print Layout, Web Layout, Zoom factor , View layout. Page Preview bar Printer functions Quick Printing Print in ,reverse page order Using search replace auto correct Outline: Using search replace auto correct Find, Search, replace for select text Auto-correct feature Spell check Language Settings Typing in local languages Outline: Typing in local languages Using SCIM to type in Indian languages Bilingual typing Using track changes

	<p>Outline: Using track changes as a peer review / collaborative constructivist tool, accepting and rejecting changes How to use record changes to peer review documents, accept/reject these</p> <p>9. Headers Footers and notes Outline: Headers, Footers and notes, Page format – header footer, how these can change within the same document (first page without header footers), Useful footer information (page number, title), Insert Footnotes and endnotes Insert/Remove Header and Footer</p> <p>10. Creating newsletter Outline: Creating newsletter Advanced use as a desktop tool to create a note with multiple columns use features like word count, Spell check, create newsletters in LibreOffice Writer and few operations that can be performed on them.</p>
2	<p>Libre office suite Draw</p> <p>1. Promo of LibreOffice Suite Outline: - LibreOffice promo - Features of LibreOffice - Uses of LibreOffice - LibreOffice formats - LibreOffice tutorials in Spoken Tutorial - Applications of LibreOffice.</p> <p>2. Introduction Outline: Introduction to LibreOffice Draw LibreOffice Draw Create and save an Impress Draw file LibreOffice Draw Workspace Graphics - Bitmap or raster image - Vector graphics.</p> <p>3. Create simple drawings Outline: Create simple drawings Basic shapes (lines, arrows, rectangles and squares, circles) (How to improve upon a water cycle diagram by adding shapes and so on.) Geometric shapes</p> <p>4. Basics of working with objects Outline: Basics of working with objects Cut, copy, paste objects Resize objects dynamically using handles Object Arrangement Adding a new page to a file Group and ungroup objects</p> <p>5. Fill objects with color Outline: Fill objects with color, gradients, hatching and bitmaps Making outlines invisible Adding a shadow to the objects Creating new colors How to import a bitmap into Draw.</p> <p>6. Insert text in drawings Outline: Insert text in drawings Insert text directly inside an object Changing the text color Working with text boxes and formatting text in objects Making the line wider.</p> <p>7. Common editing and print functions Outline: Common editing and print functions Set the draw page for page size and margins Paper size, page count, page numbers, date, and time Undo and redo actions Rename a page Print.</p> <p>8. Polygons and Curves Outline: Curves and Polygons Various types of Polygons Draw directions using arrows Flow charts Insert tables and graphs Page Margins and Orientation Font Type and Size modification</p> <p>9. Edit Curves and Polygons Outline: Use the Edit Points toolbar Insert new points Move existing points Using control lines to change the shape of the objects Group the objects together</p> <p>10. Flow Charts Connectors Glue Points Outline: Draw Flowcharts To Draw Beizer curve Insert text in flow charts Various text insertion options -Resizing shape to fit text width -Word wrap text in shape What is Flowchart.</p>

	<p>11. Working with Objects Outline: What are Grids? What are Guides? What are Snap Lines? Position objects with grids, guides and snap lines Resize objects exactly and duplicate objects Distribute objects.</p> <p>12. Import and Export Images Outline: Import images into a Draw page *as a link * as an embedded image Edit Links Remove links Automatic embedding of images Delete the picture Export the whole Draw file or one or one page of the Draw file Export to a PDF, HTML, JPEG or a bitmap file , Edit Raster images using the Format Picture tool</p> <p>13. Basics of Layers Password Encryption PDF Outline: Basics-of-Layers-Password-Encryption-PDF Layers -Layout -Controls - Dimensions</p> <p>14. Working with 3D objects Outline: Enable the grids and the guide lines How to create 3D objects Extrusion(Creating 3D objects, using 2D objects) 3D Toolbar 3D Rotation Object Typing text in 3D objects using Text tool, Ready-made 3D shapes.</p> <p>15. Set Draw preferences Outline: Learn how to set the following preferences: **Properties **Create versions **View in color/grayscale/black-and-white Setting Title, Subject, Keywords and Comments of a file.</p>
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Coordinator,
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Department of Instrumentation

Head of Department
Department of Instrumentation

I/C, Curriculum Development Cell

Principal

