K.K. Wagh Institute of Engineering Education and Research, Nashik

Curriculum

F.Y. B.Tech

Robotics and Automation

w.e.f.: AY 2023-2024

F.Y. B.Tech Electrical Engineering wef AY 202324															
SEM-I															
Course Code	**Couse Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
			TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU**	**PR**	**TOTAL**
2300101A	**BSC**	Linear Algebra	3	1	0	20	60	20	25	0	**125**	3	1	0	**4**
2300103A	**BSC**	Applied Chemistry	3	0	2	20	60	20	50	0	**150**	3	0	1	**4**
2300105A	**ESC**	Fundamentals of Electrical Engineering	3	0	2	20	60	20	50	0	**150**	3	0	1	**4**
2300110A	**ESC**	Engineering Drawing	1	0	2	20	30	0	50	0	**100**	1	0	1	**2**
2300112A	**AEC**	Communication Skills	1	0	2	0	0	25	50	0	**75**	1	0	1	**2**
2300117H	**VSEC**	Introduction to Matlab	1	0	2	0	0	25	25	0	**50**	1	0	1	**2**
2300115A	**CC**	Liberal Learning, Sports, Yoga, Art	0	2	0	0	0	0	50		**50**	0	2	0	**2**
Total			**12**	**3**	**10**	**80**	**210**	**110**	**300**	**0**	**700**	**12**	**3**	**5**	**20**

SEM-II															
Course Code	**Couse Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
			TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU**	**PR**	**TOTAL**
2300102A	**BSC**	Differential Calculus	3	1	0	20	60	20	25	0	**125**	3	1	0	**4**
2300104A	**BSC**	Applied Physics	3	0	2	20	60	20	50	0	**150**	3	0	1	**4**
2300107A	**ESC**	Fundamentals of Electronics Engineering	3	0	2	20	60	20	50	0	**150**	3	0	1	**4**
2300108A	**ESC**	Programming in C	1	0	2	20	30	0	50	0	**100**	1	0	1	**2**
2300118H	**PCC**	Fundamentals of Robotics	2	0	0	20	60	20	0	0	**100**	2	0	0	**2**
2300116A	**IKS**	Indian Knowledge System	0	2	0	0	0	0	50	0	**50**	0	2	0	**2**
2300111A	**VSEC**	Workshop Practices	1	0	2	0	0	25	25	0	**50**	1	0	1	**2**
2300136A	**CC**	Engineering Exploration	0	2	0	0	0	0	75	0	**75**	0	2	0	**2**
Total			**13**	**5**	**8**	**100**	**270**	**105**	**325**	**0**	**800**	**13**	**5**	**4**	**22**

Department Specific Exit Courses (To award Certificate)															
Course Code	**Couse Type**	**Title of Course**	**Teaching Scheme**			**Evaluation Scheme and Marks**						**Credits**			
			TH	**TU**	**PR**	**INSEM**	**ENDSEM**	**CCE**	**TUT /TW**	**PR /OR**	**TOTAL**	**TH**	**TU**	**PR**	**TOTAL**
2300119A	**EXIT**	Internship*	0	0	0	0	0	0	100	0	**100**	0	2	0	**2**
2300126A	**EXIT**	Robot operating and Programming	2	0	2	20	30	0	50	0	**100**	2	1	0	**3**
2300127A	**EXIT**	Robotic welding	2	0	2	20	30	0	50	0	**100**	2	1	0	**3**
Total			**4**	**0**	**4**	**40**	**60**	**0**	**200**	**0**	**300**	**4**	**4**	**0**	**8**

*Internship in industry for 2weeks

→To get certificate student should get following credits

Internship →2 credits

Exit course-1 (Option A or Option B) →3 credits

Exit course-2 (Option A or Option B). →3 credits

Total credits →8 credits

F. Y. B. Tech.
Pattern 2023
2300101A: Linear Algebra

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :03hrs/week **Tutorial:01hr/week**	**03** **01**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks** **Tutorial / Termwork: 25Marks**

Prerequisite Courses: -

Course Objectives:
To introduce concepts of Matrices and system of linear Equations, linear and orthogonal transformations.
To introduce concepts of Eigen values and Eigen Vectors.
To introduce concepts of Partial Differentiation.
To introduce concepts of Jacobians, Maxima and Minima, errors and Approximations.
To introduce fundamental concepts of probability.
To introduce computational tools for solving mathematical problems.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Interpret the concepts of Jacobians, rank, quadratic form, canonical form, transformations, Eigen values, Eigen vectors and probability.	2-Understanding
CO2	Solve problems on linear algebra, partial derivatives and probability.	3- Apply
CO3	Apply concepts of linear algebra, differential calculus and probability to engineering problems.	3- Apply
CO4	Use computational tools for solving mathematical problems.	3- Apply
CO5	Analyze the nature of quadratic forms, extreme values of the function, error and approximations.	4 -Analyze

COURSE CONTENTS

Unit I	**Matrices and Linear System of Equations**	**(07hrs+2hrsTutorial)**	**COs Mapped - CO1, CO2, CO3**

Rank of a matrix, system of linear Equations, Linear Dependence and Independence of vectors, Linear and orthogonal transformations, Application to system of linear equations.

Unit II	**Eigen Values and Eigen Vectors**	**(08hrs+ 2hrsTutorial)**	**COs Mapped - CO1, CO2, CO3, CO5**

Eigen values &Eigen vectors, diagonalization, quadratic forms and reduction of quadratic forms to canonical forms, applications of Eigen values and Eigenvectors.

Unit III	Partial Differentiation	(07hrs+ 2hrsTutorial)	COs Mapped –CO2, CO3

Introduction to functions of two or more variables, Partial Differentiation, Euler's Theorem on Homogeneous Functions, Partial differentiation of Composite and Implicit functions, Total derivatives.

Unit IV	Application of Partial Differentiation	(07hrs+ 2hrsTutorial)	COs Mapped - CO1, CO2, CO3, CO5

Jacobians, Functional Dependence & Independence, Errors and Approximation, Maxima and Minima of Functions of two variables, Lagrange's method of undetermined multipliers.

Unit V	Introduction to Probability and Counting	(07hrs+ 2hrsTutorial)	COs Mapped - CO1, CO2, CO3

Interpreting probabilities, Relative frequency and classical definition of probability, sample spaces and Events, mutually exclusive events, Permutations and Combinations, Axioms of probability, Addition rule, conditional probability, multiplication rule, Independent Events, Bayes' Theorem.

TextBooks

1. B.V. Ramana, " Higher Engineering Mathematics", Tata McGraw-Hill.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi.

Reference Books

1. Erwin Kreyszig ,"Advanced Engineering Mathematics" ,Wiley Eastern Ltd.
2. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics" (Volumes I and II), Pune Vidyarthi Griha Prakashan, Pune.

Strength of CO-PO Mapping

	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	1	-	-	-	-	-	-	-	-	-	2
CO2	3	1	1	-	-	-	-	-	-	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	-	2
CO4	1	-	-	-	3	-	-	-	-	-	-	2
CO5	3	3	2	2	2	-	-	-	-	-	-	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Alloted**
1	Assignments (Total 3 Assignment, Unit I and II 20 marks, Unit III and IV 20 marks and Unit V 10 marks &50 marks will be converted to 10 Marks)	10
2	Tests on each unit using LearniCo (Each test for 15 M and total will be converted out of 10 M)	10

List of Tutorial Assignments		
Sr. No.	**Title**	**CO Mapped**
1	Examples on rank of a matrix, system of linear Equations	CO1, CO2
2	Examples on linear dependence and Independence of vectors, application to system of linear equations.	CO1, CO2, CO3
3	Examples on Eigen values & Eigen Vectors.	CO1, CO2, CO3
4	Examples quadratic forms to canonical forms.	CO1, CO2, CO3,CO5
5	Solve problems on matrices using Matlab.	CO1, CO2, CO4
6	Solve system of equations using Matlab.	CO1, CO2, CO4
7	Examples on partial differentiation, Euler's Theorem on homogeneous functions	CO2, CO3
8	Examples on partial differentiation of composite and implicit functions, total derivatives.	CO2, CO3
9	Examples on Jacobians, functional dependence & independence, errors and approximation	CO1, CO2, CO3 , CO5
10	Examples on maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.	CO1, CO2, CO3, CO5
11	Examples on fundamental concepts of probability.	CO1, CO2
12	Examples on conditional probability, Bayes' Theorem.	CO1, CO2, CO3

Guidelines for Tutorial / Termwork Assessment		
Sr. No.	**Components for Tutorial / Termwork Assessment**	**Marks Allotted**
1	Assignment on computational software	5
2	Tutorial (Each tutorial carries 15 marks)	15
3	Attendance (Above 95 % : 05 Marks, below 75% : 0 Marks)	5

F. Y. B. Tech.
Pattern 2023
2300104A: Applied Chemistry

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory : 03hrs/week **Practical : 02hrs/week**	**03** **01**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks** **TermWork: 50Marks**

Prerequisite Courses, if any: -

Course Objectives:
To acquire the knowledge of electro-analytical techniques that facilitates rapid and precise understanding of materials.
To understand structure, properties and applications of speciality polymers, nano material and alloys.
To study conventional and alternative fuels with respect to their properties and applications
. To understand technology involved in analysis and improving quality of water as commodity.
. To understand corrosion mechanisms and preventive methods for corrosion control.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Describe different techniques used for chemical entities present in fluids, fuel, polymer, alloys.	1-Knowledge
CO2	Select appropriate technology involved in determination of purity and properties of material.	2- Understand
CO3	Illustrate causes and preventive measures of ill effect of hard water and corrosion	3-Apply
CO4	Analyse the fluids, fuels and selection of appropriate purification methods.	3-Apply
CO5	Compare composition of fuels, purity of water and mitigation for corrosion control	4-Analyze

COURSE CONTENTS

Unit I	**Cells, Batteries and Electro analytical Techniques**	**(8hrs)**	**CO1,CO4**

Introduction: Dry cell, alkaline battery, Ni-Cd battery, H_2O_2 fuel cells, Lithium ion battery. Reference electrode (calomel electrode), ion selective electrode (combined glass electrode).
Conductometry: Introduction, conductometric titrations of acid versus base with titration curves (SA-SB).
pH metry: Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve.
UV-Visible Spectroscopy: Introduction, interaction of electromagnetic radiation with matter, statement of Beer's law and Lambert's law, different electronic transitions, terms involved in UV-visible

Spectroscopy.

Unit II	Fuels	(8hrs)	CO1, CO4, CO5

Introduction, classification, Calorific value (CV): Gross calorific value (GCV) and Net calorific value (NCV), Determination of Calorific value: Bomb calorimeter, Solid fuel: Coal: Analysis of Coal-Proximate and Ultimate analysis, Liquid fuel: Petroleum: Refining of petroleum, CNG, Hydrogen gas as a fuel. Alternative fuels: Power alcohol, biodiesel and Rocket propellants, Knocking in engines, octane number and cetane number.

Unit III	Introduction to Engineering Materials	(8hrs)	CO1, CO2

Solid: crystalline and amorphous solids, Polymorphism, unit cell, crystal system-cubic, APF. Metallurgy-Ores and Minerals, Alloys- classification. Composition, woods metal, brass, Bronze, Ti-alloys. Preparation of alloys by fusion and powder method. Introduction of polymer: Terms- Speciality polymers: Introduction, structure, properties and applications of the polymers:
1. Bio-degradable polymers: Poly (hydroxybutyrate-hydroxyvalanate),
2. Conducting and doped conducting Polymer: Polyacetylene
3.Polymer Composite,
Nanomaterials: Introduction, definition, classification of nanomaterials based on dimensions, properties and general applications.

Unit IV	Analytical Aspects of Fluids	(8hrs)	CO1, CO2, CO3, CO4, CO5

Properties of Fluids-Surface Tension, Capillary action , Viscosity, Vapour Pressure, Types of Fluid Liquid Fluid- Water and Oil
Water: hardness of water: Types, Determination of hardness by EDTA method, Chloride content in water by Mohr's method, Ill effects of hard water in boiler, External Treatment of water i) Zeolite method ii) Demineralization method. Purification of water: Reverse osmosis.
Oil: Aniline point, Flash Point, Fire point.
Gaseous fluids: Gas Sensors, Types of Gas sensors

Unit V	Corrosion Science	(8hrs)	CO3, CO5

Introduction, Types of corrosion – Dry and Wet corrosion, mechanism, nature of oxide films and Pilling-Bedworth's rule, hydrogen evolution and oxygen absorption, Factors influencing rate of corrosion. Methods of corrosion control: cathodic protection, Metallic coatings and its types, Galvanizing and Tinning, Electroplating, Powder coating.

Text Books

1. O .G. Palanna, "Engineering Chemistry", Tata Magraw Hill Education Pvt. Ltd.
2. Dr. S. S. Dara, Dr. S. S. Umare, "Textbook of Engineering Chemistry", S. Chand & Company Ltd.

Reference Books

1. Wiley Editorial, “Engineering Chemistry”, Wiley India Pvt.Ltd
2. Shriver and Atkins, “Inorganic Chemistry”, 5ed, Oxford University Press,
3. S. M. Khopkar, “Basic Concept of Analytical Chemistry”, 2ed, New Age-International Publisher

Strength of CO-PO Mapping												
	PO											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3	1	--	--	--	--	--	--	--	--	--	2
CO2	3	1	--	--	--	2	--	--	--	--	--	2
CO3	3	1	--	--	--	1	1	--	--	--	--	2
CO4	3	1	1	--	--	1	2	--	--	--	--	2
CO5	3	1	1	--	--	1	2	--	--	--	--	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment on Unit 1 & 2	**05**
2	Group presentations on Unit 3/4/5	**10**
3	LearnCo test on each unit	**05**

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Daniel Cell	**CO1**
2	To determine strength of strong acid using conductometer.	**CO2**
3	To determine maximum wavelength of absorption and find unknown concentration of given sample by colorimeter.	**CO4**
4	Determine the calorific value of given solid fuel by using Bomb calorimeter.	**CO2**
5	Proximate analysis of coal.	**CO5**
6	To determine hardness of water by EDTA method	**CO4**
7	Estimation of chloride content by Mohr's method	**CO4**
8	Estimation of Cu from given brass alloy	**CO4**
9	ECE - To coat copper and zinc on iron plate using electroplating.	**CO1**
10	Preparation of nanomaterials.	**CO1**
11	Preparation of biodiesel from oil.	**CO1**
12	To determine alkalinity of water	**CO5**

Guidelines for Laboratory Conduction

1. Teacher will brief the given experiment to students its procedure, observations calculation, and outcome of this experiment.
2. Apparatus, chemicals, solutions and equipments required for given experiment will be provided by the lab assistants using SOP.
3. Students will perform the same experiment in a group (two students in each group) under the supervision of faculty and lab assistant. After performing the experiment students will check their readings, calculations from respective teacher.

Guidelines for Student's Lab Journal

Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.

Guidelines for Term work Assessment

Each experiment from lab journal is assessed for thirty marks based on three rubrics.
Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

F. Y. B. Tech. (All Branches)
Pattern 2023
2300105A: Fundamentals of Electrical Engineering
(Branch: AIDS, Comp, CSD, IT, Electrical, R&A)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory:03hrs/week **Practical: 02hrs/week**	**03** **01**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam:60Marks** **Termwork: 50Marks**

Prerequisite Courses: -

Course Objectives:
To make students aware of the fundamentals of electrical circuits
. To explain the working principles of electrical machines and batteries
. To introduce the components of low voltage electrical installations

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Define terminologies and laws related to AC-DC circuits, machines and batteries.	1-Remember
CO2	Demonstrate the need for safety precautions and procedures, components and instruments in the laboratory.	2-Understand
CO3	Elaborate construction, working and performance characteristics of electrical machines and protective devices.	2-Understand
CO4	Solve problems on AC-DC circuits, work, power and energy using relevant laws and theorems.	3-Apply
CO5	Select appropriate machines, protective devices for a given applications.	3-Apply
CO6	Calculate and analyze transformer efficiency, regulation and LT, HT electricity bill.	4-Analyze

COURSE CONTENTS

Unit I	Work, Power, Energy, Batteries and Supplies	(8hrs)	COs mapped - CO1, CO4

Work, Power, Energy: Effect of temperature on resistance, resistance temperature coefficient, insulation resistance, conversion of energy from one form to another in electrical, mechanical, and thermal systems.
Batteries and Power Supply: Charging and discharging of batteries, the concept of depth of charging, maintenance of batteries, series-parallel connection of batteries, Introduction to UPS, SMPS

Unit II	DC circuits	(8hrs)	COs mapped - CO1, CO4

Types of electrical circuits, KVL and KCL, sources and source transformations, star-delta connection, Superposition, and Thevenin's theorem

Unit III	AC Circuits	(8hrs)	COs mapped - CO1, CO4
Representation of sinusoidal waveforms, peak and RMS values, Phasor representations, real power, reactive power, apparent power, power factor, analysis of single-phase AC circuits consisting of pure R, L, C, series R-L, R-C, R-L-C combinations, parallel AC circuit, series, and parallel resonance			
Unit IV	**Three-phase circuits and Electrical Installations**	**(8hrs)**	**COs mapped - CO3, CO4, CO5**
Three-Phase Circuit: Three-phase balanced circuits, voltage and current relations in star and delta connections, and power calculations. **Electrical Installations:** Components of LT Switchgear: fuse MCB, ELCB, types of wiring, earthing.			
Unit V	**Electrical Machines**	**(8hrs)**	**COs mapped - CO1, CO3, CO5, CO6**
Transformers: Construction, principle, e.m.f. equation, ideal and practical transformer, vector diagram for ideal transformer, losses, regulation and efficiency, Introduction to Auto-transformer. **Electrical machines:** Construction, working principle and types of DC generator and motor, construction, working principle and applications of stepper motor.			

Text Books

1. B.L. Theraja, A. K. Theraja, "A Textbook of Electrical Technology" - Volume I: Basic Electrical Engineering: Part 1 and 2. S Chand Publication.
2. Bharti Dwivedi, Anurag Tripathi, "Fundamentals of Electrical Engineering", 2nd Edition, Wiley Publication.

Reference Books

1. D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
3. H. Cotton, "Electrical Technology", 7th Edition, CBS Publications and distributors.

Strength of CO-PO Mapping												
Course Outcomes	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	--	--	--	--	--	--	--	--	--	--	1
CO2	3	--	--	--	--	2	--	--	2	3	--	3
CO3	3	--	--	--	--	--	--	--	2	3	--	3
CO4	3	3	--	--	--	--	--	--	2	3	--	2
CO5	3	--	2	--	--	--	--	--	2	3	--	3
CO6	3	3	--	--	2	2	--	--	2	3	--	3

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignment 1 – (Units 1 to 2, before the in-semester exam)	4 Marks
2	Assignment 2 – (Units 3 to 4, after in-semester exam)	4 Marks
3	Minimum 10 LearniCo sessions (taking best 5)	4 Marks
4	Class Test – (Units 3 to 5, before end-semester exam)	8 Marks

List of Laboratory Experiments		
Sr. No.	**Laboratory Experiments**	**COs Mapped**
1	To introduce basic safety precautions, introduction and use of measuring instruments, like voltmeter, ammeter, multi-meter, oscilloscope, etc., the practical relevance of resistors, capacitors and inductors.	**CO2**
2	To analyze the effect of temperature on resistance of conducting material and measure the insulation resistance of cable/equipment using Megger	**CO2**
3	To study LT and HT electricity bills and energy conservation	**CO6**
4	To demonstrate different types of electrical protection equipment such as fuses, MCB, MCCB, ELCB	**CO3, CO5**
5	To verify Thevenin's Theorem on DC supply	**CO1, CO4**
6	To analyze series RL and RC circuits on single phase AC supply.	**CO4**
7	To find efficiency and regulation of single-phase transformer at different loading conditions.	**CO6**
8	To determine the relationship between phase and line quantities for a three-phase AC circuit when the load is star and delta connected.	**CO4**
9	To demonstrate the construction and working of electrical machines.	**CO3, CO5**

Guidelines for Laboratory Conduction

- In each laboratory session, four to five students will perform the experiment in a group.
- Students should do connections under the supervision of the teachers and get the results by following safety precautions and procedures.

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain the following -

- Apparatus with their detailed specifications.
- Connection diagram /circuit diagram.
- Observation table/ simulation waveforms.
- Sample calculations for one/two readings.
- Result table, Graph and Conclusions.
- Few short questions related to the experiment.

Guidelines for Term Work Assessment

1. The student's termwork will be through continuous assessment.
2. Each experiment from lab journal is assessed for thirty marks based on three rubrics. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

F. Y. B. Tech.
Pattern 2023
2300110A: Engineering Drawing

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory:01hr/week Practical: 02hrs/week	01 01	In-Sem Exam: 20Marks End-Sem Exam: 30Marks Term Work: 50 Marks

Prerequisite Courses: -

Course Objectives:

. To explain the fundamental concepts of engineering drawing and its standards.
. To improve visualization skills of physical objects on paper.
. To develop interpretation and drawing skills by manual and computerized graphical techniques.

Course Outcomes: On completion of the course, students will be able to–

COs	Course Outcomes	Bloom's Level
CO1	Explain the need of engineering drawing and its standards.	2-Understand
CO2	Interpret engineering drawing by visualization.	2-Understand
CO3	Draw projections of 2D and 3D objects.	3-Apply
CO4	Apply manual and computerized graphical tools to solve practical problems.	3-Apply

COURSE CONTENTS

Unit I	**Projections of a Point and Line**	**(03hrs)**	**COs Mapped – CO2, CO4**
Projections of a point, projections of a line located in first quadrant only.			
Unit II	**Projections of Plane**	**(02hrs)**	**COs Mapped – CO2, CO3, CO4**
Types of planes, projections of plane inclined to both the reference planes			
Unit III	**Orthographic Projections**	**(03hrs)**	**COs Mapped - CO1, CO2, CO3, CO4**
Principle of projections, types of projections, introduction to first and third angle methods of projection, basic rules of orthographic projection, orthographic and sectional orthographic projection of simple objects and machine elements/parts. Applications of orthographic drawing in industries.			
Unit IV	**Isometric Projections**	**(02hrs)**	**COs Mapped – CO2, CO3, CO4**
Introduction to isometric projection and isometric scale. Construction of isometric view from given orthographic views. Applications of isometric drawing in industries.			
Unit V	**Development of Lateral Surfaces of Solids and Introduction to Computer Aided Drafting**	**(03hrs)**	**COs Mapped - CO1, CO2, CO3, CO4**
Types of solids, projection of solids resting on HP only. Methods of development: parallel line development and radial line development. Development of simple solids like cone, cylinder, prism, tetrahedron and pyramid. Introduction to CAD and basic commands to draw simple 2D and 3D objects.			

TextBooks

1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication, Anand, India
2.Jolhe, D. A., (2015), "Engineering Drawing with introduction to AutoCAD", Tata McGraw Hill, New Delhi

Reference Books

1. Bhatt, N. D., "Machine Drawing", Charotar Publishing house, Anand, India.

Strength of CO-PO Mapping

	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	--	--	--	--	--	--	--	--	--	--	1
CO2	2	--	--	--	--	--	--	--	--	1	--	1
CO3	2	--	--	--	2	--	--	--	--	1	--	1
CO4	2	--	--	--	2	--	--	--	--	1	--	1
Average	**2**	**--**	**--**	**--**	**2**	**--**	**--**	**--**	--	**1**	**--**	**1**

List of Laboratory Assignments

Sr. No.	Laboratory Assignments	CO Mapped
1	Projection of lines and Projection of Planes (One problem each)	CO2, CO3, CO4
2	Orthographic Projection of given objects including sectional view. (Two Problems)	CO1, CO2, CO3, CO4
3	Isometric view / projection for the given set of two-dimensional views. (Two Problems)	CO2, CO3, CO4
4	Development of Lateral Surfaces of solids. (Two Problems)	CO1, CO2, CO3, CO4
5	Orthographic Projection of given object using any drafting software (One Problem)	CO1, CO2, CO3, CO4
6	Isometric view / projection of given object using any drafting software (One Problem)	CO2, CO3, CO4

Guidelines for Laboratory Conduction

Students will solve six laboratory assignments on A2 size drawing sheet.

Guidelines for Tutorial Conduction

Students will solve four tutorial assignments by using any drafting software.
Drawing limits for all drawings to be made in drafting software should be set to A2 Size.
At the end of semester students shall submit all soft copies of all assignments to a concerned faculty.

Guidelines for Termwork and Tutorial Assessment

Each laboratory and tutorial assignments will be assessed for 30 Marks according to following rubrics:
R1- Timely completion of assignments (10 Marks)
R2- Understanding of assignment (10 Marks)
R3 – Presentation/Clarity of journal writing (10 Marks)
For all six drawing sheets total marks of 180 will be converted into 25 Marks.
For all four tutorial assignments total marks of 120 will be converted into 25 marks.

F. Y. B. Tech.
Pattern 2023
2300112A: Communication Skills

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory: 01hr/week Practical: 02hrs/week	01 01	Continuous Comprehensive Evaluation: 25Marks Termwork: 50Marks

Prerequisite Courses, if any: ----

Course Objectives:
1. To highlight the need to improve soft skills among engineering students so as to become good professionals.
2. To facilitate a holistic development of students by enhancing soft skills.
3. To develop and nurture the soft skills of the students through individual and group activities.
4. To expose students to right attitudinal and behavioural aspects and assist in building the same through activities.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Develop effective communication skills including Listening, Reading, Writing and Speaking	**3-Apply**
CO2	Practice professional etiquette and present oneself confidently.	**3-Apply**
CO3	Function effectively in heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.	**3-Apply**
CO4	Evaluate oneself by performing SWOC Analysis to introspect about individual's goals and aspirations.	**4-Evaluate**
CO5	Constructively participate in group discussion, meetings and prepare and deliver Presentations.	**4-Evaluate**

Text Books

1. Gajendra Singh Chauhan, Sangeeta Sharma, "Soft Skills – An Integrated Approach to Maximize Personality", Wiley India, ISBN:13:9788126556397
2. Simon Sweeney, "English for Business Communication", Cambridge University Press, ISBN 13:978- 0521754507

Reference Books

1. Indrajit Bhattacharya, "An Approach to Communication Skills", Delhi, Dhanpat Rai, 2008
2. Sanjay Kumar and Pushpa Lata, "Communication Skills", Oxford University Press, ISBN 10:9780199457069
3. Business Communication & Soft Skills, McGraw Hill Education.
4. Atkinson and Hilgard, "Introduction to Psychology", 14th Edition, Geoffrey Loftus, ISBN-10:0155050699, 2003.
5. Kenneth G. Mcgee, "Heads Up: How to Anticipate Business Surprises & Seize Opportunities First", Harvard Business School Press, Boston, Massachusetts, 2004, ISBN 10:1591392993
6. Krishnaswami, N. and Sriraman T., "Creative English for Communication," Macmillan

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	-	-	-	-	-	-	-	-	3	3	-	-
CO2	-	-	-	-	-	-	-	-	3	3	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-
CO4	-	-	-	-	-	-	-	-	3	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-

List of Laboratory Experiments / Class Assignments		
Sr. No.	**Laboratory Experiments / Class Assignments**	**COs Mapped**
1	**English Language Basics – Class Assignments** Fundamentals of English grammar, Vocabulary Building, Developing basic writing skills and Identifying Common Errors in Writing	**CO1**
2	**Listening and Reading Skills** **a. Listening Worksheets using Language Lab Software** Each student will be given specifically designed worksheets that contain blanks / matching / MCQs that are designed to an audio (chosen by the faculty). Students have to listen to the audio (only once) and complete the worksheet as the audio plays. This will help reiterate active listening as well as deriving information (listening to information between the lines) **b.** Reading Comprehension Worksheets to be distributed/displayed to students. – **Class Assignments** Teacher will choose reading passages from non-technical domains, design worksheets with questions for students to answer. This will enhance student's reading skills by learning how to skim and scan for information.	**CO1**
3	**Writing Skills** **a. Letter / Email Writing – Lab Experiment** After explaining to the students the highlights of effective writing, students can be asked to write (using digital platforms / paper-based) letter to an organization with the following subject matter, **i.** Requesting opportunity to present his/her product. **ii.** Complaining about a faulty product / service. **iii.** Apologizing on behalf of one's team for the error that occurred. **iv.** Providing explanation for a false accusation by a client. **b.** Abstract Writing – **Class Assignment** Teacher will choose a newspaper article / short stories and ask students to write an abstract.	**CO1**
4	**Speaking Skills / Oral Communication – Part A** **a. One minute Self Introduction – Class Assignment** Explain how to introduce oneself in a professional manner and presenting oneself positively Name, Academic Profile, Achievements, Career Aspirations, Personal Information (hobbies, family, social). **b. Presentations – Lab Experiment**	**CO5, CO2**

	Every student will have to choose a topic of his/her choice and make a 5-minute presentation using audio-video aids / PPT. Every student will make two presentations on – one technical and other non-technical topic. Focus and evaluation of each presentation should be the depth of knowledge about the topic, originality of perspective on the topic, well-researched or not, verbal and non-verbal skills and ability to answer questions effectively. Plagiarism should be discredit and students should be instructed about it.	
5	**Speaking Skills / Oral Communication – Part B** **a. Group Discussion – Lab Experiment / Class Assignment** The class will be divided into groups of 5-6 students for a discussion lasting 15 minutes. Topics should be provided by teachers. After each group finishes its discussion, the teacher will give critical feedback including areas of improvement. The teacher should act as a moderator / observer only	**CO1, CO5, CO2, CO3**
6	**Extempore** Various topics will be laid out in front of the audience and each student is to pick one topic and speak about the topic for 5 minutes followed by Q&A from audience. Teacher will evaluate each student based on thinking ability, content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively	**CO1, CO2**
7	**SWOC Analysis** **a.** Focus on introspection and become aware of one's Strengths, Weakness, Opportunities and Challenges. Students can write down their SWOC in a matrix and the teacher can discuss the gist personally. **b. Resume Writing** The teacher should conduct a brief session outlining the importance of a CV / Resume and students can write / type out their own resumes i. Share various professional formats. ii. Focus on highlighting individual strengths. iii. Develop personalized professional goals / statement at the beginning of the resume.	**CO4**

Guidelines for Laboratory Conduction

The teacher may design specific assignments that can highlight the learning outcomes of each unit. Each activity conducted in the lab should begin with a brief introduction of the topic, purpose of the activity from a professional point of view and end with the learning outcomes as feedback from students. Most of the lab sessions can be designed to be inclusive; allowing students to learn skills experientially; which will benefit them in the professional environment. Every student must be given sufficient opportunity to participate in each activity and constructive feedback from the instructor / facilitator at the end of the activity should learn towards encouraging students to work on improving their skills. Activities should be designed to respect cultural, emotional and social standing of students. Some of the activities can be designed to cater to enhancement of multiple skills – e.g. Team Building Activity can highlight 'open communication', 'group discussion', 'respecting perspectives', 'leadership skills', 'focus on goals' which can help students improve their inherent interpersonal skills.

At least one session should be dedicated to an interactive session that will be delivered by an expert from the industry; giving the students an exposure to professional expectations.

Guidelines for Student's Lab Journal

Each student should have a Lab Workbook (sample workbook attached) which outlines each lab activity conducted. The student must respond by writing out their learning outcomes and elaborating the activities performed in the lab., group discussion, group exercises and interpersonal skills and similar other activities/assignments.

Guidelines for Term work Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments and performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities-SWOC analysis, presentations, team activity, event management

F. Y. B. Tech.
Pattern 2023
2300117H: Introduction to Matlab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :01hrs/week **Practical: 02hrs/week**	**01** **01**	**Continuous Comprehensive Evaluation: 25 Marks** **Term work: 25 Marks**

Prerequisite Courses, if any: -

Course Objectives:
To enable students to:
1. Understanding the MATLAB environment
2. Perform calculations to solve engineering problems using MATLAB
3. Carry out simple numerical computations and analyses using MATLAB
. 4. Write Matlab program for simple practical example

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Explain the main features of the MATLAB development environment	2- Understand
CO2	Use the MATLAB GUI effectively	3- Apply
CO3	Design simple algorithms to solve problems	3- Apply
CO4	Write simple programs in MATLAB to solve scientific and mathematical problems	3- Apply
CO5	Demonstrate Matlab applications to robotics	3- Apply

COURSE CONTENTS

Unit I	Matrix operations	(03hrs)	COs Mapped - CO1, CO2

Array generation, array indexing, basic matrix operations like Inverse of matrix, addition, multiplication, transpose, determinant, Eigen values etc. Solving linear equations, Generating special matrices

Unit II	Matlab Programming	(05hrs)	COs Mapped - CO3, CO4

Input/output commands, control flow and operators, Conditional statements - If Else, Loops - For Loop, While Loop, Nested Loops, Relational and logical operators, M-file functions, Debugging M Files,

Unit III	2D and 3D plots:	(06hrs)	COs Mapped- CO2

Using plot command, formatting a plot, plots with logarithmic axes, histogram, polar plots, mesh and

surface plots, plots with special graphics, view command			
Unit IV	**Polynomials, Curve Fitting, and Interpolation**	**(06hrs)**	**COs Mapped - CO3, CO4**
Roots of polynomial, derivatives, curve fitting, interpolation, basic fitting interface, Curve Fitting with Functions Other than Polynomials			
Unit V	**Numerical Analysis**	**(06hrs)**	**COs Mapped - CO4, CO5**
Solving algebraic equations, differentiation, integration, solving ordinary differential equation, application examples			

Text Books

1. S. J. Chapman, "MATLAB Programming for Engineers" Thomson, 2004.
2. A. Gilat, "MATLAB: An introduction with Applications", John Wiley and Sons, 2004

Reference Books

1. C. B. Moler, "Numerical Computing with MATLAB" Siam, 2004.

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	1	-	-	-	3	-	-	-	-	-	-	-
CO2	2	-	-	-	3	-	-	-	-	-	-	-
CO3	3	2	1	2	2	-	-	-	-	-	-	-
CO4	3	2	2	-	3	-	-	-	-	-	-	-
CO5	3	2	2	1	3	-	-	-	-	-	-	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Alloted**
1	Assignments (Total 3 Assignment, Unit I and II 20 marks, Unit III and IV 20 marks and Unit V 10 marks &50 marks will be converted to 10 Marks)	10
2	Tests on each unit using LearniCo (Each test for 15 M and total will be converted out of 10 M)	10

List of Tutorial Assignments		
Sr. No.	**Title**	**CO**

		Mapped
1	Performing basic matrix operations using Matlab :	CO1, CO2
2	Matlab programming using M-file	CO1, CO4
3	Creating 2D plots for given application	CO2, CO4, CO5
4	Creating 3D plots for given application	CO2, CO4, CO5
5	Determining polynomial using method of Least Square Curve Fitting	CO2, CO3, CO5
6	Numerical analysis using Matlab – numerical differentiation, integration, ordinary differential equations	CO2, CO3, CO5
7	Solving Newton's interpolation formula, Stirling's formula, Lagrange's Interpolation formula using Matlab	CO2, CO3, CO5
8	Demonstration of Matlab Simulink basics	CO5
9	Demonstration of Matlab tool box for solving Robotics problems	CO5

SEMESTER 2

F. Y. B. Tech.
Pattern 2023
2300102A: Differential Calculus

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory : 03hrs/week **Tutorial: 01hr/week**	**03** **01**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks** **Tutorial / TermWork: 25Marks**

Prerequisite Courses: -

Course Objectives:

. To introduce concepts of first order first degree differential equations.
. To model various physical systems, such as orthogonal trajectories, Newton's law of cooling, Simple electrical circuits, Rectilinear motion, Heat transfer.
. To introduce interpolating polynomials, numerical differentiation and integration.
. To introduce concept of double and triple integration and their applications.
. To introduce computational tools for solving mathematical problems.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Explain types of differential equations, finite differences and multiple integrals.	2- Understanding
CO2	Solve problems on differential equations and multiple integrals.	3- Apply
CO3	Apply concept of numerical methods, differential and multivariate calculus to engineering problems.	3- Apply
CO4	Use computational tools for solving mathematical problems.	3- Apply
CO5	Analyze the solution of differential equations, numerical differentiation & integration and multiple integrals.	4- Analyze

COURSE CONTENTS

Unit I	**Differential Equations (DE)**	**8hrs+ 2hrsTutorial**	**COs Mapped - CO1, CO2, CO3**

Formation of differential equations Exact DE, equations reducible to exact form, Linear DE and Differential equation reducible to linear form.

Unit II	**Applications of Differential Equations**	**7hrs+ 2hrsTutorial**	**COs Mapped - CO1, CO2, CO3, CO5**

Application of DE to Orthogonal trajectories, Newton's Law of Cooling, Kirchhoff's Laws of Electrical Circuits, Motion under Gravity, Rectilinear Motion, Heat flow.

Unit III	**Finite differences and Interpolation**	**7hrs+ 2hrsTutorial**	**COs Mapped – CO1, CO3 ,**

			CO5
Finite differences, differences of polynomials, relations between the operators, Newton's interpolation formula, Stirling's formula, Lagrange's Interpolation formula.			
Unit IV	**Numerical Differentiation and Integration**	**7hrs+2hrsTutorial**	**COs Mapped - CO1, CO3, CO5**
Numerical Differentiation: Euler's method, Euler's Modified Method, Runge- Kutta fourth order, Predictor- Corrector Method. **Numerical Integration:** Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rule.			
Unit V	**Multiple Integrals and their Applications**	**7hrs+2hrsTutorial**	**COs Mapped - CO1, CO2, CO3,CO5**
Double and Triple integrations, applications to area, volume, mean and root mean square values and Center of Gravity.			
TextBooks			
1.M.K. Jain, R.K.Jain, Iyengar, "Numerical Methods for scientific and engineering computation" (New age International) 2. B. S. Grewal ,"Higher Engineering Mathematics" Khanna Publication, Delhi.			
Reference Books			
1. Erwin Kreyszig ,"Advanced Engineering Mathematics" ,Wiley Eastern Ltd. 2. P. N. Wartikar and J. N. Wartikar," Applied Mathematics" (Volume I and II) , Pune Vidyarthi Griha Prakashan, Pune.			

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO 1	3	1	-	-	-	-	-	-	-	-	-	2
CO 2	3	1	1	-	-	-	-	-	-	-	-	2
CO 3	3	3	2	2	2	-	-	-	-	-	-	2
CO 4	1	-	-	-	3	-	-	-	-	-	-	2
CO5	3	3	2	2	2	-	-	-	-	-	-	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Assignments (Total 3 Assignment, Unit I and II 20 marks, Unit III and IV 20 marks and Unit V 10 marks &50 marks will be converted to 10 Marks)	10
2	Tests on each unit using LearniCo (Each test for 15 M and total will be converted out of 10 M)	10

List of Tutorial Assignments		
Sr. No.	**Title**	**CO Mapped**
1	Examples on formation of differential equations exact DE.	CO1, CO2
2	Examples on linear DE and reducible to linear differential equations.	CO1, CO2
3	Examples on application of DE to Orthogonal trajectories, Newton's Law of cooling.	CO1, CO2, CO3,CO5
4	Examples on Electrical Circuits, motion under gravity, Rectilinear Motion.	CO1, CO2, CO3,CO5
5	Solving differential equation using Matlab.	CO1, CO2, CO4
6	Examples on finite differences, differences of polynomials, relations between the operators.	CO1, CO3
7	Examples on Newton's interpolation formula, Stirling's formula, Lagrange's Interpolation formula.	CO1, CO3 , CO5
8	Solve ordinary differential equations using Numerical Methods.	CO1, CO3 , CO5
9	Solve definite integration using Numerical Methods.	CO1, CO3 , CO5
10	Solving differential equation and definite integrals using Matlab.	CO1, CO2, CO4
11	Examples on double and triple integrations.	CO1, CO2, CO3
12	Examples on applications of double and triple integration.	CO1, CO2, CO3, CO5

Guidelines for Tutorial / Termwork Assessment		
Sr. No.	**Components for Tutorial / Termwork Assessment**	**Marks Allotted**
1	Assignment on computational software	5
2	Tutorial (Each tutorial carries 15 marks)	15
3	Attendance (Above 95 % : 05 Marks, below 75% : 0 Marks)	5

F. Y. B. Tech.
Pattern 2023
2300103A: Applied Physics
(Group A – Computer, IT, E&TC, AI&DS & CSD, Electrical, R&A)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03 hrs/week Practical : 02 hrs/week	03 01	Continuous Comprehensive Evaluation: 20Marks InSem Exam: 20Marks EndSem Exam: 60Marks Termwork: 50Marks

Prerequisite Courses, if any: -

Course Objectives:

. To impart knowledge on concepts of Electromagnetism and Electromagnetic waves.
. To learn properties of semiconductors and nanomaterials for their applications in various technical fields.
. To enable students to gain the knowledge of wave optics and their applications in various technical fields.
. To study basic concepts of Quantum Mechanics for quantum computing.
. To study the fundamentals and physical processes that govern energy usage and environmental conservation.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Describe basics of electromagnetics, advanced materials, wave optics, wave mechanics and environmental energy	1-Knowledge
CO2	Classify advanced materials, refracting crystals and solar cell	2-Understand
CO3	Explain properties of superconductors, nano-materials and matter waves	2-Understand
CO4	Calculate characteristics of electromagnetic circuits and optical devices, conductivity, efficiency of solar and wind power unit.	3-Apply
CO5	Use concepts of electromagnetic effect, semiconductors, wave optics and wave equations in real life problems	3-Apply

COURSE CONTENTS

Unit I	Electromagnetism & Electromagnetic Waves	(08hrs)	COs Mapped - CO1, CO2

Electromagnetism:

Introduction: Magnetic effect of an electric current, cross and dot conventions, right hand thumb rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of mmf, flux, flux density, reluctance, permeability and field strength, their units and relationships.

Simple series magnetic circuit, Introduction to parallel magnetic circuit, comparison of electric and magnetic circuit, force on current carrying conductor placed in magnetic field.

Faradays laws of electromagnetic induction, Fleming right hand rule, statically and dynamically induced e.m.f., self and mutual inductance, coefficient of couplings. Energy stored in magnetic field; Fleming left hand rule.

Electromagnetic Waves

Introduction, Electromagnetic Waves, Electromagnetic Wave Equations, Maxwell's Wave Equations for Free Space

Unit II	Semiconductors, Superconductivity, Nano-Material	(06hrs)	COs Mapped - CO1, CO2, CO4, CO5

Semiconductors:

Types of semiconductor, Conductivity of conductors and semiconductors, temperature dependence of conductivity, Fermi Dirac distribution function, Position of Fermi level in intrinsic and extrinsic semiconductors, variation with respect to temperature and doping concentration, Hall effect: Derivation for Hall voltage, Hall coefficient, applications of Hall effect.

Superconductivity:

Definition, Properties, type of superconductor, Josephson effect and applications

Nano-Materials:

Introduction, quantum confinement effect, surface to volume ratio, properties: Optical, electrical & Mechanical.

Unit III	Wave Optics	(08hrs)	COs Mapped - CO1, CO2, CO4, CO5

Polarization – Introduction of polarization, law of Malus, double refraction, Huygens theory, LCD.

Diffraction – Introduction of diffraction, types of diffraction, diffraction grating, conditions for principal maxima and minima, maximum orders of diffraction, Rayleigh's criterion,

Interference – Introduction, thin film interference, optical flatness testing, antireflection coating, Rayleigh interferometer and Radio interferometer.

Laser: Basic terms and types of lasers, application (IT, Medical & Industry), laser interferometer and Hologram Interferometer.

Optical Fibre – Introduction and basic terms, Fibre optic communication with block diagram.

Unit IV	Quantum Mechanics & Quantum Computing	(07hrs)	COs Mapped - CO1, CO2, CO3, CO5

Basics of Quantum theory, postulates of quantum mechanics, wave nature of particles, wave function, Schrodinger's time dependent equation, Stern-Gerlach experiment, electron spin, superposition of states, Entanglement Bits and Qubits, Implementing a quantum computer : Ion trap, Linear optics, NMR and superconductors.

Unit V	Energy and Environment	(07hrs)	COs Mapped - CO1, CO2, CO4

Energy and its Usage:

Overview of World energy scenario, climate change, Engineering for energy conservation, units and scales of energy.

Solar Energy:

Introduction to solar energy, fundamentals of solar radiation and its measurement aspects, basic physics of solar cell, carrier transport, generation & recombination in solar cell, semiconductor junctions: metal-semiconductor junction & p-n junction, essential characteristics of solar photovoltaic devices, First generation solar cells, Second generations of Solar cells, Third generations of solar cells-Quantum Dot solar cell, multi junction solar cells

Fluid and Wind Power:

Fluid dynamics and power in the wind, available resources, Wind turbine dynamics, wind farms

Text Books

1. V K Mehta and Rohit Mehta ,"Basic Electrical Engineering", S Chand Publications.
2. M.N. Avadhanulu and P.G. Kshirsagar ,"Engineering Physics ", S. Chand Publications

3. Robert L. Jaffe and Washington Tayler, “The Physics of Energy”, Cambridge University Press
Reference Books
1. H.D.Young and R.A.Freedman, “University Physics”, Pearson Publication 2. Resnick and Halliday, “Principles of Physics”, John Wiley and Sons 3. Jenkins and White , “Optics” , Tata McGraw Hill 4. Noson S. Yanofsky and Mirco A. Mannucci, “Quantum computing for computer scientists”.

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	-	-	-	-	-	2	1	1	-	-	1
CO2	3	3	-	-	2	-	2	1	1	-	-	1
CO3	3	-	-	-	-	-	-	1	1	-	-	1
CO4	3	3	-	-	-	-	2	1	1	-	-	1
CO5	3	3	2	-	2	2	2	1	1	1	-	1
Average	3	3	2	-	2	2	2	1	1	1	-	1

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	Three Assignments on unit-1, Unit-2, Unit-3 & 4	05
2	Group Presentation on Unit-5	10
3	LearniCo Test on Each Unit	05
	Total	**20**

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Experiment based on Newton’s rings (determination of wavelength of monochromatic light, determine radius of curvature of plano-convex lens).	**CO1, CO5**
2	To determine position of diffraction minima by studying diffraction at a single slit.	**CO4**
3	To determine unknown wavelength by using plane diffraction grating.	**CO4**
4	To verify Law of Malus.	**CO4, CO5**
5	Experiment based on Double Refraction (Determination of refractive indices / Identification of types of crystal).	**CO1, CO5**
6	To determine band gap of given semiconductor.	**CO4**
7	To study IV characteristics of Solar Cell and determine parameters (fill factor and efficiency).	**CO4**
8	To determine Hall coefficient and charge carrier density.	**CO4, CO5**
9	Experiment based on Laser (Determination of thickness of wire / Number of lines on grating surface).	**CO4**
10	Determination of refractive index using Brewster’s law.	**CO4**
11	To determine magnetic force on a current carrying conductor.	**CO4, CO5**
12	To study magnetic induction due to current carrying conductor	**CO4, CO5**
13	To study the quantum confinement effect in synthesis of silver nano-particles.	**CO3, CO5**

Guidelines for Laboratory Conduction
1. Teacher will brief the given experiment to students its procedure, observations calculation, and outcome of this experiment. 2. Apparatus and equipments required for the allotted experiment will be provided by the lab assistants using SOP. 3. Students will perform the allotted experiment in a group (two students in each group) under the supervision of faculty and lab assistant. 4. After performing the experiment students will check their readings, calculations from the teacher. 5. After checking they have to write the conclusion of the final result.
Guidelines for Student's Lab Journal
Write-up should include title, aim, diagram, working principle, procedure, observations, graphs, calculations, conclusion and questions, if any.
Guidelines for Termwork Assessment
2. Each experiment from lab journal is assessed for thirty marks based on three rubrics. 3. Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

F. Y. B. Tech.
Pattern 2023 Semester: I / II
2300107A: Fundamentals of Electronics Engineering
(Branch: Electrical, E&TC, R&A, Comp, AIDS, CSD, IT)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :03hrs/week **Practical : 02hrs/week**	**03** **01**	**Continuous Comprehensive Evaluation: 20Marks** **InSem Exam: 20Marks** **EndSem Exam: 60Marks** **TermWork: 50Marks**

Prerequisite Courses, if any: Semiconductor Theory, Mathematics

Course Objectives:

28. To study basic electronic components like PN junction diode, Zener diode, LED, Photodiode, BJT, E-MOSFET and OpAmp along with their applications.
29. To understand different number systems, logic gates, Boolean algebra and basic digital circuits.
30. To study the basics of electronic communication system and mobile communication system.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Describe the working of semiconductor diodes, transistors and OpAmp.	2- Understand
CO2	Explain the basics of number systems, logic gates, Boolean algebra, electronic communication system, AM, FM, cellular concepts and GSM system.	2- Understand
CO3	Apply the knowledge of semiconductor diodes, transistors and OpAmp in realization of basic analog circuits.	3-Apply
CO4	Apply the knowledge of number systems, logic gates and Boolean algebra in realization of basic digital circuits.	3-Apply
CO5	Analyze the basic analog and digital application circuits.	4-Analyze

COURSE CONTENTS

Unit I	Semiconductor Diodes	(08hrs)	COs Mapped CO1, CO3, CO5

PN Junction Diode: Construction, Working and VI Characteristics
Rectifiers: Working and Parameters of Half Wave Rectifier and Full Wave Rectifiers
Working of Bridge Rectifier with Capacitor Filter
Zener Diode: Working, VI Characteristics, Breakdown Mechanisms, Zener Diode as Voltage Regulator
LED and Photodiode: Working, Characteristics and Applications

Unit II	Transistors	(08hrs)	COs Mapped - CO1, CO3, CO5

Transistors: Introduction and Types
BJT: Construction, Types and Regions of Operations, CB and CE configurations with their characteristics and current relationships, BJT as Switch, DC Load Line, Voltage Divider Bias Circuit, Single Stage CE Amplifier
Enhancement MOSFET: Types, Construction, Operation and Characteristics

Unit III	**Linear Integrated Circuits**	**(08hrs)**	**COs Mapped - CO1, CO3, CO5**

Introduction to OpAmp, Ideal Differential Amplifier, OpAmp Parameters, Introduction to Open Loop and Closed Loop OpAmp Configurations, Applications of OpAmp: Comparator, Inverting Amplifier, Non-Inverting Amplifier, Voltage Follower and Summing Amplifier.

Unit IV	**Digital Electronics**	**(08hrs)**	**COs Mapped - CO2, CO4, CO5**

Binary, Octal, Decimal, Hexadecimal, their conversion, Binary Arithmetic, Logic Gates, Boolean Laws, De Morgan's Theorem, Half Adder, Full Adder, Flip Flops: SR, JK, D and T

Unit V	**Electronic Communication Systems**	**(08hrs)**	**COs Mapped - CO2**

Block Diagram of Communication System, Communication Media: Wired and Wireless, Modes of Transmission, Electromagnetic Spectrum, Modulation and It's Need, AM and FM: Definition, Modulation Index and Bandwidth, Mobile Communication System: Cellular Concept and Block Diagram of GSM System

Text Books

1. Thomas. L. Floyd, "Electronics Devices", 9th Edition, Pearson
2. R. P. Jain, "Modern Digital Electronics" , 4th Edition, Tata McGraw Hill
3. George Kennedy, "Electronic Communication Systems", 5th Edition, Tata McGraw Hill

Reference Books

1. Paul Horowitz, "The Art of Electronics", 3rdEdition, Cambridge University Press
2. Theodore S. Rappaport , "Wireless Communications: Principles and Practice", 2ndEdition,Pearson

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	-	-	-	2	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-
CO3	3	2	-	-	2	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	-	-

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Allotted**
1	**Assignment:** Assignment No. 1 - Unit 1, 2 (10 Marks) Assignment No. 2 - Unit 3, 4, 5 (10 Marks)	**10**
2	**Quiz (Using Learnico):** Unit No. 1 (10 Questions - 10 Marks) Unit No. 2 (10 Questions - 10 Marks)	**10**

	Unit No. 3 (10 Questions - 10 Marks) Unit No. 4 (10 Questions - 10 Marks) Unit No. 5 (10 Questions - 10 Marks)	

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	Build and demonstrate appropriate AC to DC converter for Mobile charger. How to rectify the fault, if the output of your circuit reduces to half of the required value?	**CO3, CO5**
2	Build and demonstrate a circuit to superimpose analog signal with DC signal. Hint: Television system.	**CO3, CO5**
3	Build and demonstrate basic charging circuit for battery of an electric vehicle.	**CO3, CO5**
4	Build and demonstrate a simple circuit to control the flashing speed of LEDs used in decorative lighting system.	**CO3, CO5**
5	Build and demonstrate simple circuit that will convert sine waveform into square waveform.	**CO3, CO5**
6	Build and demonstrate a simple circuit that will turn off a water pump automatically when the water tank is full.	**CO3, CO5**
7	Build and demonstrate the simple PUC system which will show green light indication if all CO_2, SO_2, Carbon monoxide levels are less than threshold value otherwise it should show red light indication. Hint: MQ series sensors along with comparators cane be used	**CO4, CO5**
8	Suggest a simple electronic system for a hearing-impairedperson. (Implementation is not expected)	**CO3, CO4, CO5**
9	Suggest a simple system to transmit your voice signal from a recording room in Nashik to a broadcasting station in Mumbai. (Implementation is not expected)	**CO3, CO4, CO5**

Guidelines for Laboratory Conduction

1. Experiments should be performed in a group of two students only.
2. Avoid contacting circuits with wet hands or wet materials.
3. Double check circuits for proper connections and polarity prior to applying the power.
4. Observe polarity when connecting polarized components or test equipment.
5. Make sure test instruments are set for proper function and range prior to taking a measurement.

Guidelines for Student's Lab Journal

Student's lab journal should contain following related things -
Title, Objectives, Hardware/ Software requirement, Theory, Circuit Diagram, Observation table, Graph, Calculations, Results, Conclusion and Assignment questions

Guidelines for Termwork Assessment

3. R1: Timely completion of experiment (10 Marks)
4. R2: Understanding of experiment (10 Marks)
5. R3: Presentation / clarity of journal writing (10 Marks)
6. Total 30 marks for each experiment and average marks of all experiments will be converted into 25 marks of term work.

F. Y. B. Tech.
Pattern 2023
2300108A: Programming in C
(Branch: AIDS, COMP, IT, CSD, Electrical, E&TC, R&A)

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory : 01hrs/week Practical : 02hrs/week	01 01	InSem Exam: 20Marks EndSem Exam: 30Marks Termwork: 50 Marks

Prerequisite Courses, if any: -

Course Objectives:

- To get acquainted with the fundamental concepts of 'C'programming
- To understand data types, control structures and functions in 'C'
- To use concept of arrays, string operations in C to solve a problem
- To apply the concept of structures in 'C' to solve a problem
- To build the programming skills using 'C' to solve a problem

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Illustrate algorithm, flowchart for a given problem	2- Understand
CO2	Apply fundamentals of 'C' programming to solve a given problem	3-Apply
CO3	Build a solution for a given problem using conditional and iterative algorithmic constructs	3-Apply
CO4	Use arrays and functions in developing programs	3-Apply
CO5	Develop program using structure	3-Apply

COURSE CONTENTS

Unit I	Introduction to Programming Languages	02 hrs	COs Mapped – CO1

Program planning tools- Algorithm, flowchart and pseudo code, Introduction to top-down structured programming,
Types of Program Errors: Syntax, logical, runtime, debugging.

Unit II	Fundamentals of 'C' Programming	03 hrs	COs Mapped – CO2

Introduction to 'C' Programming, Identifiers, Data Types, Variables, Constants, Input / Output, Operators (Arithmetic, relational, logical, bitwise), Expressions, Precedence and Associatively, Type conversions.

Unit III	Conditional and Iterative Algorithmic Constructs	04 hrs	COs Mapped – CO3

Conditional algorithmic constructs- if, if-else, nested if-else, cascaded if-else and switch statement
Iterative algorithm constructs: Construction of loops, Establishing initial condition, 'for', 'while', 'do-while' statements, nested loops, Continue, break statements.

Unit IV	Arrays and Functions	04 hrs	COs Mapped – CO4

Arrays: Concept, One- dimensional, multidimensional array, character arrays (Strings).
Function types: Library functions (math, string), user defined functions: Function definition, function declaration, arguments, scope rules and lifetime of variables, function calls and return.

Unit V	Structure	02 hrs	COs Mapped – CO5

Defining a structure, accessing members, structure initialization.

Text Books

1. 1.Yashavant Kanetkar, "Let Us C" – Seventh Edition, BPB Publications, 2007
2. 2. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, 2002

Reference Books

1. 1.Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education, 1988
2. 2.Computer Science: A Structured Programming Approach Using C, B. A. Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.

Strength of CO-PO Mapping

Course Outcomes	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	3	3	3	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3

List of Laboratory Experiments / Assignments		
Sr. No.	**Laboratory Experiments / Assignments**	**CO Mapped**
1	In a departmental store, a customer is offered an x% discount on the printed price of each commodity. The customer needs to pay y% sales tax on the discounted amount. Draw a flowchart, write an algorithm / a pseudo-code and write a C program to calculate the amount to be paid by the customer for a commodity using above conditions.	**CO1,CO2**
2	A type of a triangle (equilateral, isosceles, right angle triangle etc) is decided using the length of its three sides. Draw a flowchart, write an algorithm /write a pseudo-code and write a C program to accept the length of three sides of a triangle and display the type of triangle. Also Calculate its area and perimeter.	**CO1,CO2, CO3**
3	After conducting a class test for a course, a teacher wants to record the marks obtained by all the students in the class and find the Minimum and Maximum score obtained. The teacher is also interested in knowing the number of students who passed in this test Draw a flowchart, write an algorithm/ a pseudo-code and write a C program to record the marks and perform above functions.	**CO1,CO2, CO3,CO4**
4	Draw a flowchart/write an algorithm / a pseudo-code and write a menu driven C program to perform following string operations using library and user defined function: i. Find length of a string ii. Copy a string iii. Concatenate the string iv. Compare two strings	**CO1,CO2, CO3,CO4**
5	Draw a flowchart/write an algorithm / a pseudo-code and write a C program using functions to perform the following operations: i. Addition of Two Matrices ii. Multiplication of Two Matrices iii. Transpose of a given matrix	**CO1,CO2, CO3,CO4**
6	Draw a flowchart, write an algorithm / a pseudo-code and write a C program using a function to test whether the given number is a prime number and also to find smallest divisor, GCD, LCM of the given number	**CO1,CO2, CO3,CO4**
7	A company desires to maintain a database of its customer by recording information about customers such as name, mobile, gender, city etc. The sales department personnel would like to get i. Customers with all the details, ii. Customers and their mobile numbers, iii. Customers from a given city Draw a flow-chart, write an algorithm / a pseudo-code and develop a menu driven application to provide above functionalities	**CO1,CO2, CO3,CO4, CO5**

Guidelines for Laboratory Conduction
Use coding standards such as variable naming conventions, use of constants, proper indentation, comments and documentation For each assignment, students should write number of lines of code, various errors encountered and test cases used to test the program Students should incorporate functionalities mentioned in boldface in the assignments In addition to above eight assignments, students may develop an application in consultation with the teacher
Guidelines for Student's Lab Journal
The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, problem statement, theory concepts in brief, algorithm, flowchart, test cases and conclusions). Program codes with sample outputs shall be submitted in soft form.
Guidelines for Term work Assessment
Continuous assessment of laboratory work shall be based on the overall performance of a student. Assessment of each laboratory assignment shall be based on rubrics that include R1- Timely completion (10) – Full marks if submitted in time, 5 marks otherwise, R2- Understanding of assignment (10) Full marks for accurate flowchart, algorithm / pseudo-code and working code R3- Use Coding standards, proper documentation, neatness of writeup (10) – 5 marks for coding standards and documentation and 5 marks for neatness of write up.

F. Y. B. Tech.
Pattern 2023
2300118H: Fundamentals of Robotics

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :02hrs/week	**02**	**Continuous Comprehensive Evaluation: 20Marks** **In-Sem Exam: 20Marks** **End-Sem Exam: 60Marks**

Prerequisite Courses, if any: -

Course Objectives:
To enable students to:
. 1. Understand robot configuration, structures, basic components, workspace and generations of robots.
. 2. Get acquainted with various sensors and end effectors
. 3. Learn about control technologies
. 4. Understand various robot programming platforms

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Explain the importance of robots and the field of robotics	2- Understand
CO2	Classify robots based on design, locomotion, application, control, and special features	2- Understand
CO3	Describe working principle of various end effectors and sensors	2- Understand
CO4	Explain the different ways robots are programmed and controlled to perform various tasks.	2- Understand
CO5	Demonstrate knowledge of industrial robots to perform simple tasks	3- Apply

COURSE CONTENTS

Unit I	**Robot Basics**	**(05hrs)**	**COs Mapped - CO1, CO2**

Robot-Basic concepts, Need, Law, History, Anatomy, specifications. Robot configurations-Cartesian, cylinder, polar and articulate, collaborative robots, humanoid, service robots. Robot wrist mechanism, Precision and accuracy of robot, types of actuators, drive transmission.

Unit II	**End effectors**	**(05hrs)**	**COs Mapped - CO3, CO5**

Introduction of general aspects, types of end effectors, end effectors as tools/fixtures, end effectors as gripper, gripper selection, End of arm tooling

Unit III	**Sensors**	**(06hrs)**	**COs Mapped- CO3, CO5**

Tactile sensors – position, velocity, acceleration, force sensors, proximity switches, Magnetic and inductive sensors, capacitive sensors, Resistive sensors, ultrasonic and sonar sensors. Robot vision system			
Unit IV	**Robot controllers**	**(06hrs)**	**COs Mapped - CO4, CO5**
Limited sequence controllers, playback robots with point to point control and continuous path control, intelligent control, microprocessors, microcontrollers, programmable logic controllers			
Unit V	**Robot programming**	**(06hrs)**	**COs Mapped - CO4, CO5**
Non-textual programming: Lead through programming, lead through teaching, teach pendant – modules and features, textual programming – programming platforms for various robots, robot programming languages, software tools for offline programming			

Text Books

1. David Ardayfio, "Fundamentals of Robotics", CRC Press.
2. Saha, S.K., "Introduction to Robotic", McGraw-Hill Higher Education, New Delhi.

Reference Books

2. Mikell, P Groover, Mitchell Weiss, Roger, N. Nagel, Nicholas, G Odrey "Industrial Robotics Technology, Programming and Applications", Tata McGraw-Hill Publishing Company Limited, New Delhi.

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	-	1	-	-	-	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-
CO4	2	1	1	-	2	-	-	-	-	-	-	-
CO5	2	2	2	1	2	-	-	-	-	-	-	2

Guidelines for Continuous Comprehensive Evaluation of Theory Course		
Sr. No.	**Components for Continuous Comprehensive Evaluation**	**Marks Alloted**
1	Assignments (Total 3 Assignment, Unit I and II 20 marks, Unit III and IV 20 marks and Unit V 10 marks &50 marks will be converted to 10 Marks)	10
2	Tests on each unit using LearniCo (Each test for 15 M and total will be converted out of 10 M)	10

F. Y. B. Tech. (All Branches)
Pattern 2023
2300116A: Indian Knowledge System

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Tutorial: 02 hrs/Week	**02**	**Termwork: 50Marks**

Course Objectives:
To create awareness of contributiojn of India in the field of engineering

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Understand the term 'Indian Knowledge System' it's framework andkey components.	1-Remember
CO2	Appreciate the measurement techniques and mathematics in IKS	2-Understand
CO3	Identify and elaborate the applications of IKS in engineering domain	3-Apply

COURSE CONTENTS

Unit I	**Overview of Indian Knowledge System**	**(6 hrs)**	**COs mapped-CO1**

Importance of ancient knowledge, Definition of IKS, the IKS Corpous, Caturdasa and Vidyasthana. Tarka: The Indian Art of Debate, The knowledge triangle, Premeya, Praman, Samasya, Framwork for establishing valid knowledge.

Unit II	**Mathematics and Measurement in IKS**	**(6 hrs)**	**COs mapped-CO1**

Numbering system in India, Salient features of Indian Numeral System, Unique approaches to represent numbers, measurement of time, distance and weight, Pingala and the binary system.

Unique aspects of Indian mathematics, Great mathematicians and their contribution, square a number, square root, series and progressions, Geometry, The value of π, Trigonometry, algebra, Binary mathematics and combinatorial problems in Chandah-sastra of Pingala, magic squares in India

Unit III	**Astronomy in IKS**	**(6 hrs)**	**COs mapped-CO4**

Unique aspects of Indian Astronomy, Historical development of astronomy in India, The celestial coordinate system, elements of Indian Calender, Aryabhatiya and Siddhantic tradition, Pancanga-The Indian calender system, Astronomical instruments, Jantar Mantar of Raja Jai Singh Sawai

Unit IV	**Metalworking and Other applications in IKS**	**(6 hrs)**	**COs mapped-CO2, CO3**

The Indian S&T heritage, mining and Ore extraction, metal and metalworking technology, Iron and steel in India, Lost wax casting of Idols and Artfacts, Apparatuses used.

Literature sources of science and technology, physical structures in India, Irrigation and water management, dyes and paintings technology, shipbuilding, 64 Kalas.			
Unit V	**Town Planning and Architecture in IKS**	**(6 hrs)**	**COs mapped- CO3, CO5**
Indian Architecture, Vastu-sastra, Vastupurush mandala, Eight limbs of vastu, Town planning, Unitary building, Temple architecture			

Text Books

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi.
2. Kapoor Kapil, Singh Avadhesh (2021). "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P.

Reference Books

1. Datta, B. and Singh, A.N. (1962). History of Hindu Mathematics: Parts I and II, Asia Publishing House, Mumbai.
2. Kak, S.C. (1987). "On Astronomy in Ancient India", Indian Journal of History of Science, 22(3), pp. 205–221.
3. Subbarayappa, B.V. and Sarma, K.V. (1985). Indian Astronomy: A Source Book, Nehru Centre, Mumbai.
4. Bag, A.K. (1997). History of Technology in India, Vol. I, Indian National Science Academy, New Delhi.
5. Acarya, P.K. (1996). Indian Architecture, MunshiramManoharlal Publishers, New Delhi.
6. Banerjea, P. (1916). Public Administration in Ancient India, Macmillan, London.

Online Course

1. Indian Knowledge System(IKS): Concepts and Applications in Engineering
https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

Term work Assessment:

1.	Assignment 01 (Unit 01 and 02)	15 Marks
2.	Assignment 02 (Unit 03 and 04)	15 Marks
3.	Field visit and quiz	10 Marks
4.	Group Presentation (group of 5 students)	10 Marks

Guidelines for Term Work Assessment

1. The student's termwork will be through continuous assessment.
2 Rubric R-1 for timely completion, R-2 for understanding and R-3 for presentation/journal writing where each rubric carries ten marks.

F. Y. B. Tech. Pattern 2022 2300111A: Workshop Practice		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Lecture : 01 hrs/week **Practical : 02 hrs/week**	**01** **01**	**Continuous Comprehensive Evaluation :25** **Term work: 25Marks**

Course Objectives:

To acquire the basic knowledge of fundamentals Machine Tools.

To inculcate the basics of various manufacturing processes.

To impart practical aspects of Machine Tools and Manufacturing processes used in industrial applications

To develop the skill through hands-on practices using hand tools, power tools, machine tools in manufacturing and assembly shop

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Select appropriate machine and cutting tools for a given application	1- Remember
CO2	Describe the process and programming methods for CNC machines and 3D printing	2-Understand
CO3	Apply the basic knowledge of Shop Floor Safety, Machine tools and Manufacturing processes.	3-Apply
CO4	Fabricate the simple mechanical parts	3-Apply

COURSE CONTENTS			
Unit I	**Workshop Safety and Maintenance**	**(2 hrs)**	**COs Mapped-** CO3

a. Introduction to Workshop Safety: Introduction to workshop safety norms and guidelines. Identifying potential hazards in a workshop. Proper usage of personal protective equipment (PPE). Safety guidelines forhandling various tools and equipment. Emergency procedures and first aid basics.

b. Workshop Maintenance and Housekeeping : Importance of workshop maintenance and cleanliness. Regular maintenance of tools and equipment. Workshop layout and organization for efficient workflow. Properstorage of tools and materials to ensure longevity.

Unit II	**Measurement and Introduction to Welding**	**(2 hrs)**	**COs Mapped- CO2**

a. Measurement and Metrology: Importance of accurate measurement in workshop practice. Various measuring tools and their uses –varnier calipers, micrometers, rulers, etc. Metrology and its role in qualitycontrol. Understanding measurement units and conversions.

b. Introduction to Welding Shop: Overview of Welding Shop and its applications. Understanding the arc welding process and its principles. Safety precautions for welding operations. Demonstration of simple weldingtasks.

Unit III	Machine Tools	(2 hrs)	COs Mapped- CO1,CO2

a. Demonstration of Conventional Machine Tools: Introduction to Lathe and its components. Understandingthe Milling Machine and its operations. Practical applications of Lathe and Milling Machine in different
industries. Safety guidelines while operating conventional machine tools.

b. Introduction to CNC Machine Tools: Understanding CNC (Computer Numerical Control) technology. Types of CNC machines - CNC turning, VMC (Vertical Machining Center), and plasma arc machining, CNC wood router, etc. Detailed demonstration of any one CNC process, including a programming assignment. Safety
considerations specific to CNC machine operations.

Unit IV	Introduction to 3D Printing	(2 hrs)	COs Mapped- CO2

a. 3D Printing: Overview of 3D printing technology and its applications. Step-by-step process of 3D printing,from design to printing. Software used in 3D printing - creating a design, exporting STL file, choosing parameters, and generating G code. Safety measures while handling 3D printing equipment and materials.

b. Materials and Their Properties: Overview of common workshop materials - metals, wood, and plastics.
Physical and mechanical properties of materials. Material selection criteria for specific projects. Recycling andsustainable practices in the workshop.

Unit V	Workshop Projects, Problem-Solvingand Troubleshooting	(02 hrs)	COs Mapped –CO4

a. Introduction to Workshop Projects: Planning and executing workshop projects.
Understanding projectrequirements and specifications. Breakdown of complex tasks into smaller achievable steps. Importance of teamwork and collaboration in workshop projects.

b. Problem-Solving and Troubleshooting: Approaches to problem-solving in workshop scenarios. Common issues and challenges in workshop practice. Troubleshooting techniques for tools and equipment. Encouraging aproactive approach to tackle workshop-related problems.

List of Laboratory Experiments / Assignments

Sr. No.	Laboratory Experiments / Assignments	COs Mapped
1	**Workshop safety** Introduction to workshop facilities, workshop safety norms.	**CO3**
2	**Fitting shop** Preparation of simple fitting job having sawing, filing, drilling, tappingoperations using different tools/equipments such as files, hammers, drills & taps, etc.	**CO4**
3	**Tin Smithy shop** Preparation of simple sheet metal job having shearing, bending and joining operations using different tools/equipments such as hammers, mallet, stake block, snip, etc. needed for it.	**CO4**
4	**Carpentry Shop** Preparation of simple wooden job having marking, sawing, planning, chiseling operations using different tools/equipments such as saws, Jack plane, chisel, hammer, mallet etc. needed for it.	**CO4**

5	**Welding Shop** Demonstration of simple welding job using arc welding process.	**CO1**
6	**Demonstration of conventional machine Tools** Demonstration of conventional machine Tools: Lathe and Milling machine	**CO1**
7	**Demonstration of CNC machine Tools** Introduction to CNC turning, VMC, plasma arc machining, Laser cutting, CNC wood router. Detail demonstration of any one process with one programming assignment.	**CO2**
8	**Demonstration of 3D printing** Demonstration of basic steps of 3D printing such as creating a design,	**CO2**
	exporting STL file, choosing parameters, creating G code and printing	

Guidelines for Laboratory Conduction

1. Importance of workshop practical and shop floor safety norms should be emphasized in the first practical session.
2. Students should develop one product/prototype involving operations from Practical 2 to 5.
3. Instructor should demonstrate detailed working of welding and machine tools.
4. Instructor should demonstrate one programming assignment on 3D printing and CNC machine.

Guidelines for Student's Lab Journal

1. Prepare work diary based on practical performed in workshop. Work diary consists of job drawing, operations to be performed, required raw materials, tools, equipments, date of performance with instructor signature.
2. Student has to maintain one file for write ups based on safety norms and illustrations/sketches of demonstrated parts/mechanisms/machine tools etc.

Guidelines for Termwork Assessment

Term work assessment shall be based on the timely completion of jobs, quality of job, skill acquired, completion of workshop diary and brief write-ups.

Strength of CO-PO Mapping

	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	-	-	-	-	-	-	-	1	-	1	1
CO2	2	-	-	-	1	-	-	-	1	1	-	1
CO3	2	-	-	-	-	1	-	-	1	-	-	1
CO4	2	-	-	-	-	-	-	1	1	1	-	1

Text Books

1. S. K. Hajra Choudhary, Nirjhar Roy, "Element of Workshop Technology: Vol.1 and 2", Media Promoters and Publishers Pvt. Ltd., 15th Edition, 2012
2. H. S. Bawa, "Workshop Practice", Tata McGraw Hill Education (Publisher)

Reference Books

1. John, K. C., "Mechanical Workshop Practice", Prentice Hall Publication, New Delhi
2. Mikell P. Groover, "Introduction to Manufacturing Processes", Wiley Publications

F. Y. B. Tech. **Pattern 2023 Semester: II** **2300115B: Engineering Explorations**		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Tutorial : 02hrs/week	**02**	**Tutorial/Term Work: 75Marks**
Prerequisite Courses, if any: ----		

Course Objectives:

1. To promote learning through interdisciplinary and student-centric activities.
2. To inculcate independent learning by problem solving.
3. To engage students in rich experiential learning.
4. To provide opportunity to get involved in a group so as to develop team skills and learn professionalism.

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Apply principles from several disciplines.	**3-Apply**
CO2	Demonstrate long-term retention of knowledge and skills acquired.	**3-Apply**
CO3	Function effectively as a team to accomplish a desired goal.	**3-Apply**
CO4	Explore an Engineering Product and prepare its Mind map	**4-Analysis**
CO5	Enhance their learning ability to solve practical problems.	**5-Synthesis**

Reference Books

1. Project-Based Learning, Edutopia, March 14, 2016.
2. What is PBL? Buck Institute for Education.

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	2	-	1	-	2	2	1	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	2	2	2
CO3	-	-	-	-	-	-	-	-	3	-	-	-
CO4	2	2	-	2	-	2	2	1	3	3	-	-
CO5	2	2	2	2	2	2	2	1	3	3	2	2

Preamble

Experiential learning involves a number of steps that offer student a hands-on, collaborative and reflective learning experience which helps them to "fully learn new skills and knowledge". During each step of the experience, students will engage with the content, the instructor, each other as well as self–reflect and apply what they have learned in another situation.
Students undergo the Experiential Learning through following phases of Engineering Exploration, Engineering Design and Product Realization. Students will undertake mini projects to acquaint with knowledge in the various domains of Engineering.
The course introduces students to analyzing, designing, developing, testing, report writing and project presentations that demonstrate understanding. Students will be asked to observe, document, raise questions and draw conclusions. Teachers rely on a variety of resources to enrich students' studies that may include meeting experts and hands-on experimentation.

Guidelines for Course Conduction

- There should be a group of 4-5 students.
- Groups will be monitored by the Course teacher.
- Following two assignments will be completed by all groups
  A) Exploration of an Engineering product like Electronic Voting Machine, Car, Mobile handset, Elevator / Escalator, Operation Table, Solar water heater. The exploration will be based on working principle, specifications, material used, manufacturing process, technology used, operations (observable and controllable), ergonomics, extent of automation, safety features, environmental issues, maintenance and costing.
  B) Teachers will identify 12-15 mini project ideas.
- Every group will undertake a mini project in consultation with the Course teacher.
- Project ideas will be common to all first year divisions but the implementation might be different.
- The students will plan, manage and complete the associated tasks.

Guidelines for Course Completion

Students will present/submit the Mind Map of the Engineering product chosen for exploration.
Students will exhibit/demonstrate the completed project at the end of the semester along with a brief report in a recommended format as term work submission.

Guidelines for Term work Assessment

The Course teacher is committed to assess and evaluate the students' performance. Progress of work done will be monitored on weekly basis.

During process of monitoring and continuous assessment, the individual and team performance is to be measured.

- Individual assessment for each student should be based on understanding individual capacity, role and involvement in the Engineering Product Exploration/project.
- Group assessment should be based on roles defined, distribution of work, intra-team communication and togetherness.
- Documentation and Demonstration.

It is recommended that all activities are to be recorded regularly and proper documents are to be maintained by both students as well as the course teacher.
Continuous Assessment Sheet (CAS) is to be maintained by the Course teacher.

A) Recommended parameters for assessment of Engineering Product Exploration: (25marks)

Working principle, specifications, material used, manufacturing process, technology used, operations (observable and controllable), ergonomics, extent of automation, safety features, environmental issues, maintenance and costing.

B) Recommended parameters for assessment of Project: (25marks)

- Outcomes of Mini Project / Problem Solving Skills / Solution provided / Final product **(50%)** (Individual assessment and team assessment)
- Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents) **(25%)**
- Demonstration (Presentation, User Interface, Usability, Participation in Exhibition/Contest etc) **(15%)**
- Awareness / Consideration of – Environmental / Social / Ethical / Safety / Legal aspects **(10%)**

DEPARTMENT SPECIFIC EXIT COURSES

K.K.Wagh Institute of Engineering Education and Research Center (Autonomous from Academic Year 2022-23)

F. Y. B. Tech. Pattern 2023 Semester: II 2300119A Internship		
Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
--	02	**Tutorial/Term Work: 100Marks**
Prerequisite Courses, if any: ----		
Course Outcomes: On completion of the course, students will be able to–		

	Course Outcomes	Bloom's Level
CO1	Develop professional competence through industry internship.	**3-Apply**
CO2	Apply academic knowledge in a personal and professional environment	**3-Apply**
CO3	Build the professional network and expose students to future employees.	**3-Apply**
CO4	Apply professional and societal ethics in their day to day life.	**4-Analysis**
CO5	Become a responsible professional having social, economic and administrative considerations	**5-Synthesis**

Guidelines for Course Conduction

Internships are educational and career development opportunities, providing practical experience in a field or discipline. Internships are far more important as the employers are looking for employees who are properly skilled and having awareness about industry environment, practices and culture. Internship is structured, short-term, supervised training often focused around particular tasks or projects with defined time scales. Core objective is to expose technical students to the industrial environment, which cannot be simulated/experienced in the classroom and hence creating competent professionals in the industry and to understand the social, economic and administrative considerations that influence the working environment of industrial organizations. Engineering internships are intended to provide students with an opportunity to apply theoretical knowledge from academics to the realities of the field work/training. The following guidelines are proposed to give academic credit for the internship undergone as a part of the Third Year Engineering curriculum.

Guidelines for Course Completion

Students will present/submit the Mind Map of the Engineering product chosen for exploration. Students will exhibit/demonstrate the completed project at the end of the semester along with a brief report in a recommended format as term work submission.

Internship work Identification:

Student may choose to undergo Internship at Industry/Govt./NGO/MSME/Rural Internship/ Innovation/IPR/Entrepreneurship. Student may choose either to work on innovation or entrepreneurial activities resulting in start-up or undergo internship with industry/NGO's/Government organizations/Micro/Small/ Medium enterprises to make themselves ready for the industry.

Modes of Internship:

- Participation at Events (Technical / Business)/in innovation related completions like Hackathon,
- Contribution in Incubation/ Innovation/ Entrepreneurship Cell/ Institutional Innovation Council/ startups cells of institute /
- Learning at Departmental Lab/Tinkering Lab/ Institutional workshop,
- Development of new product/ Business Plan/ registration of start-up,
- Participation in IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos,
- Industry / Government Organization Internship,
- Internship through Internshala,
- In-house product development, intercollegiate, inter department research internship under research lab/group, micro/small/medium enterprise/online internship,
- Research internship under professors, IISC, IIT's, Research organizations,
- NGOs or Social Internships, rural internship,
- Participate in open source development.

Students must maintain Internship Diary/ Internship Workbook. The main purpose of maintaining diary/workbook is to cultivate the habit of documenting. The students should record in the daily training diary the day-to-day account of the observations, impressions, information gathered and suggestions given, if any. The training diary/workbook should be signed after every day by the supervisor/ in charge of the section where the student has been working. Internship Diary/workbook and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. Internship Diary/workbook may be evaluated on the basis of the following criteria:

- Proper and timely documented entries
- Adequacy & quality of information recorded
- Data recorded
- Thought process and recording techniques used
- Organization of the information

Internship Work Evaluation:

The evaluation will be based on the following criteria:

- Depth of knowledge and skills Communication & Presentation Skills
- Team Work
- Creativity
- Planning & Organizational skills
- Adaptability
- Analytical Skills
- Attitude & Behavior at work

- Societal Understanding
- Ethics • Regularity and punctuality
- Attendance record
- Log book
- Student's Feedback from External Internship Supervisor

After completion of Internship, the student should prepare a comprehensive report to indicate what he has observed and learnt in the training period. The student may contact Industrial Supervisor/ Faculty Mentor/TPO for assigning special topics and problems and should prepare the final report on the student's presence physically, if the student is found absent without prior intimation to the department/institute/concern authority/T & P Cell, entire training can be cancelled.

K.K.Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

F. Y. B. Tech.
Pattern 2023
2300134A: Robot Operating and Programming

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory :01hrs/week **Practical: 02hrs/week**	**02** **01**	**In-sem: 20** **End-sem: 30** **Tutorial : 50**

Prerequisite Courses, if any: -

Course Objectives:
To enable students to:
1. Understand the basics of Industrial Robotics and robot cells
2. Operate the robot using teach pendant and basic online programs
3. Interface grippers with robots
4. Create, modify and execute a material handling program
5. Monitor, force and simulate input and output signal

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	Bloom's Level
CO1	Explain structure and function of robots and robotics cells.	2- Understand
CO2	Perform Motion type path programming	3- Apply
CO3	Interface grippers with robots	3- Apply
CO4	Program Control, Arithmetic, and I/O instructions	3- Apply
CO5	Perform basic job functions	3- Apply

COURSE CONTENTS

Unit I	**Introduction to Robotics**	**(05hrs)**	**COs Mapped - CO1**

Need of Robots in Industry, Type of industrial Robots, Structure and functions of robot System and additional Equipment. Applications.

Unit II	**Introduction to robot cell**	**(05hrs)**	**COs Mapped - CO1**

Introduction to Cycle time and its importance, Understanding the operator job in robot cell, Safety, Mounting Handling on robot, Understanding Coordinate system, and Different coordinate systems in Robots.

Unit III	**Modes of Jogging in Robot**	**(06hrs)**	**COs Mapped- CO2,O5**

Introduction to Teach pendent, Tool / work object definition and their calibration, Understanding Robot Program Structure, Program creation, Different Motion Types used in Programming (PTP, Linear, Circular, Spline), Via

Point and Process Points

Unit IV	Robot End effectors	(06hrs)	COs Mapped - CO3, CO5

Types of end effectors, mechanical grippers, vacuum grippers, magnetic grippers, adhesive grippers, tools. Robot end effectors interface, considerations in gripper selection, Safety instructions to be followed while loading and unloading of parts

Unit V	Programming with advance level instructions	(06hrs)	COs Mapped - CO4, CO5

Loop control instructions, Arithmetic and Logical instructions, Shift instructions, Methods to create fencing and safety equipment, Steps to work with two different types of Robots at same project, Introduction to handling grippers, Understanding Handling operation, Understanding Safety procedure for Programmer and an Operator.

Text Books

3. Mikell, P Groover, Mitchell Weiss, Roger, N. Nagel, Nicholas, G Odrey "Industrial Robotics Technology, Programming and Applications", Tata McGraw-Hill Publishing Company Limited, New Delhi.
4. S. R. Deb, Robotics technology and flexible automation, Tata McGraw Hill publishing companylimited, 1994.

Reference Books

3. Operator's manual: Flex Pendant, ABB.
4. Industrial Robot: MELFA basic operations and teach pendant, Mitsubishi Electric

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-	-
CO3	1	2	1	1	-	-	-	-	-	-	-	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-
CO5	2	2	2	1	-	-	-	-	-	-	-	2

List of Tutorial Assignments		
Sr. No.	**Title**	**CO Mapped**
1	Demonstration of Articulated, SCARA Robot	CO1
2	Run operations with Teach Pendant key functions & user interface for teach pendant	CO2
3	Perform Jogging of the industrial robot using virtual programming pendant	CO2, CO5
4	Perform Interfacing of work piece holding Grippers in Robot	CO3
5	Perform Importing, Exporting & Selection of robotic program	CO4, CO5
6	Program the Robot following the Safety procedure for Programmer	CO4, CO5
7	Perform remote monitoring and connectivity of Industrial Robot	CO5
8	Maintenance & Basic troubleshooting	CO5

Guidelines for Tutorial / Termwork Assessment		
Sr. No.	**Components for Tutorial / Termwork Assessment**	**Marks Allotted**
1	Practical Work	25
2	Tutorial	20
3	Attendance (Above 95 % : 05 Marks, below 75% : 0 Marks)	5

K.K.Wagh Institute of Engineering Education and Research, Nashik
(Autonomous from Academic Year 2022-23)

F. Y. B. Tech.
Pattern 2023
2300135A: Robotic Welding

Teaching Scheme:	**Credit Scheme:**	**Examination Scheme:**
Theory :01hrs/week **Practical: 02hrs/week**	**02** **01**	**In-sem: 20** **End-sem: 30** **Tutorial : 50**

Prerequisite Courses, if any: -

Course Objectives:
To enable students to:
1. Understand various types of welding processes
2. Identify various robotic welding components
3. Correctly position the robot using teach pendant and various motion types for welding
4. Understand robotic welding system
5. Prepare robot program for various welding patterns

Course Outcomes: On completion of the course, students will be able to–

	Course Outcomes	**Bloom's Level**
CO1	Explain types of welding processes	2- Understand
CO2	Integrate various components for robotic welding system	3- Apply
CO3	Conduct proper torch and wrist alignment check	3- Apply
CO4	Set up user, tool and jog frames into a weld program	3- Apply
CO5	Implement welding program structure and operation for different patterns	3- Apply

COURSE CONTENTS

Unit I	**Welding Technology**	**(07hrs)**	**COs Mapped - CO1**

Gas Tungston Arc Welding, Gas Metal Arc Welding, Resistance spot welding, friction stir welding, welding equipment, process parameters of welding processes

Unit II	**Robotic Welding Components**	**(07hrs)**	**COs Mapped - CO2**

Welding machine power supply, welding torch, Welding fixtures, Sensors, Safety equipment, electronic controls and human-machine interfaces (HMI), integrated welding systems, and Different coordinate systems in Robots.

Unit III	**Robotic welding system**	**(07hrs)**	**COs Mapped- CO2,CO3, CO4**

Modelling the Welding Process, Control of the Welding Process, Programmable and Flexible Control Facility,

CAD interface, Application to Robot Manipulators, Simple Welding Examples			
Unit IV	**Programming robots for welding application**	**(07hrs)**	**COs Mapped - CO4, CO5**
Programming patterns with positioning registers, Robot programming for circular pattern, Linear pattern, Weaving pattern, Program manipulation, Logic instructions, Zero Program			

Text Books

5. Pires, J. N., Loureiro A., Bölmsjo J., "Welding Robots: Technology, System Issues and Applications", Springer, 2005
6. Everhart T. C., "A Welder's Handbook to Robotic Programming", 2014, Smashwords, Inc.ISBN: 9781499396898

Reference Books

5. Piotrowski J. A., Randolph William T. "Robotic Welding: A Guide to Selection and Application" Robotics International of SME

Strength of CO-PO Mapping												
	PO											
	1	2	3	4	5	6	7	8	9	10	11	12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	2	-	-	-	-	-	-	-	-	-
CO3	1	2	1	1	-	-	-	-	-	-	-	-
CO4	2	2	2	2	2	-	-	-	-	-	-	-
CO5	2	2	2	1	2	-	-	-	-	-	-	2

List of Tutorial Assignments		
Sr. No.	**Title**	**CO Mapped**
1	Perform Arc welding and gas welding operations	CO1
2	Creating a Tool Centre, Point, Tool and Wrist Alignments	CO2
3	Correct weld deformities in patterns using Program Adjust	CO3
4	Weld commands and parameters (wait and timer instructions)	CO4
5	Programming a path, joint, linear, circular motions	CO4, CO5
6	Program manipulation	CO4, CO5

Guidelines for Tutorial / Termwork Assessment		
Sr. No.	**Components for Tutorial / Termwork Assessment**	**Marks Allotted**
1	Practical Work	25
2	Tutorial	20
3	Attendance (Above 95 % : 05 Marks, below 75% : 0 Marks)	5