DAYANANDA SAGAR UNIVERSITY

City Campus, Kudlu Gate, Bengaluru - 560068,
Karnataka.

SCHOOL OF ENGINEERING

SCHEME & SYLLABUS
FOR
BACHELOR OF VOCATION

SPECIALIZATION: MECHATRONICS

(With Effect from 2023-24)

SEMESTER – 1

GENERAL EDUCATION COMPONENTS: 12 CREDITS, 180H					
S. NO.	**Program Code**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**HOURS**
1	P002	23VM101	English -1	2	30
2	P002	23VM102	Mathematics -1	3	45
3	P002	23VM103	Applied Science	2	30
4	P002	23VM104	Electronics – 1	3	45
5	P002	23VM105	Basics of Computer	2	30
SKILL COMPONENTS: 18 CREDITS, 270H					
6	P002	23VM106	Applied Science Lab	3	45
7	P002	23VM107	Electronics -1 Lab	4	60
8	P002	23VM108	Basics of Computer Lab	3	45
9	P002	23VM109	Engineering Drawing	4	60
10	P002	23VM110	Workshop Practice- 1	4	60

SEMESTER – 2

GENERAL EDUCATION COMPONENTS: 12 CREDITS, 180H					
S. NO.	**Program Code**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**HOURS**
1	P002	23VM201	English- 2	2	30
2	P002	23VM202	Mathematics -2	2	30
3	P002	23VM203	Manufacturing Engineering	2	30
4	P002	23VM204	Electronics – 2	2	30
5	P002	23VM205	Electrical Engineering	2	30
6	P002	23VM206	Metrology	2	30
SKILL COMPONENTS: 18 CREDITS, 270H					
7	P002	23VM207	Electronics -2 Lab	3	45
8	P002	23VM208	Electrical Engineering Lab	4	60
9	P002	23VM209	CAD - Fusion 360	3	45
10	P002	23VM210	Workshop Practice-2	4	60
11	P002	23VM211	Wiring Practices and Simulation	4	60

SEMESTER – 3

GENERAL EDUCATION COMPONENTS: 12 CREDITS, 180H				
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**HOURS**
1	23VM301	DIGITAL ELECTRONICS	3	45
2	23VM302	COMPUTER PROGRAMMING – C, C++	3	45
3	23VM303	CONTROL SYSTEMS	2	30
4	23VM304	INDUSTRIAL ELECTRONICS	2	30
5	23VM305	MECHANICS OF MACHINES	2	30
6	23AU0001	ENVIRONMENTAL STUDIES	AUDIT	
SKILL COMPONENTS: 18 CREDITS, 270H				
7	23VM306	COMPUTER PROGRAMMING – C, C++ LAB	5	75
8	23VM307	PCB DESIGN AND FABRICATION LAB	4	60
9	23VM308	DIGITAL ELECTRONICS LAB	5	75
10	23VM309	INDUSTRIAL ELECTRONICS LAB	4	60

SEMESTER – 4

GENERAL EDUCATION COMPONENTS: 12 CREDITS, 180 H				
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**HOURS**
1	23VM401	MICRO CONTROLLER & APLICATIONS	2	30
2	23VM402	MEMS	3	45
3	23VM403	PYTHON PROGRAMMING	3	45
4	23VM404	PLC	2	30
5	23VM405	MEASUREMENT AND INSTRUMENTATION SYSTEMS	2	30
6	23AU0002	CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS	AUDIT	
SKILL COMPONENTS: 18 CREDITS, 270H				
7	23VM406	MICRO CONTROLLER & APLICATIONS LAB	5	75
8	23VM407	PYTHON PROGRAMMING LAB	5	75
9	23VM408	PLC LAB	4	60
10	23VM409	MEASUREMENT AND INSTRUMENTATION LAB	4	60

SEMESTER – 5

GENERAL EDUCATION COMPONENTS: 12 CREDITS, 180H				
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**HOURS**
1	23VM501	EMBEDDED SYSTEM AND IOT	3	45
2	23VM502	PRODUCT DESIGN AND DEVELOPMENT	2	30
3	23VM503	CNC TECHNOLOGY	2	30
4	23VM504	ROBOTICS	2	30
5	23VM5XX	ELECTIVE – I	3	45
6	23AU0003	KANNADA KALI – I	AUDIT	*
SKILL COMPONENTS :18 CREDITS,270H				
7	23VM505	EMBEDDED SYSTEM LAB	3	45
8	23VM506	CNC TECHNOLOGY LAB	3	45
9	23VM507	ADVANCED PLC LAB	3	45
10	23VM508	ROBOTICS LAB	3	45
11	23VM509	PROJECT PHASE – I	6	90

SEMESTER – 6

GENERAL EDUCATION COMPONENTS: 12 CREDITS, 180H				
SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**HOURS**
1	23VM601	INDUSTRIAL MANAGEMENT	3	45
2	23VM602	INDUSTRIAL EQUIPMENT MAINTENANCE	3	45
3	23VM603	ADDITIVE MANUFACTURING	3	45
4	23VM6XX	ELECTIVE II	3	45
SKILL COMPONENTS: 18 CREDITS, 270H				
5	23VM604	Seminar	2	60
6	23VM605	PROJECT PHASE II	10	210

LIST OF ELECTIVES – I

SL	COURSE CODE	COURSE TITLE
1	23VM510	ADVANCED PLC
2	23VM511	PROCESS CONTROL

LIST OF ELECTIVES – II

SL	COURSE CODE	COURSE TITLE
1	23VM606	AUTOMOTIVE ELECTRONICS
2	23VM607	ADVANCED MICROCONTROLLERS

Course code: 23VM101 Total Hours: 30 Hrs	English-I	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to enable students to: 1. Develop strong language skills, including reading, writing, speaking, and listening, in English to effectively communicate and engage in professional settings. 2. Foster an understanding and appreciation of various literary genres, periods, and authors in English literature. 3. Enhance oral and written communication abilities for effective interaction in both formal and informal contexts, including presentations, reports, and discussions. 4. Train students in writing various types of documents commonly used in professional environments, such as business correspondence, reports, proposals, and technical documentation. 5. Provide training in soft skills such as teamwork, leadership, time management, and adaptability, along with guidance on professional etiquette and workplace behavior.				
Course Outcomes	Students after the completion of this course will be able to: 1. Demonstrate language skills in reading, writing, speaking, and listening, with a focus on clarity, accuracy, and effective communication. 2. Analyze and interpret various literary genres, texts, and authors, demonstrating an understanding of their themes, historical context, and literary techniques. 3. Deliver well-structured and articulate presentations, speeches, and reports using appropriate language and communication strategies. 4. Create original pieces of fiction, poetry, and creative non-fiction, showcasing creative expression and mastery of literary techniques. 5. Analyze and critically evaluate literary texts, media content, and language-related issues, demonstrating the ability to think analytically and make informed judgments.				

MODULE-1

Understanding the alphabet, Middle and last alphabet, Final consonants, Capital & Small letters, Basic punctuation, Reading activity. Articles- 'a', 'an', & 'the, Reading activity, Writing in patterns, Reading activity, Common nouns, Proper nouns, Singular and plural nouns, writing short sentences, Reading activity. Masculine and feminine nouns.
Description of simple objects like a note book, a pen, a watch, a switch etc., Pronouns, Reading activity, Adjectives. **[05 Hrs]**

MODULE-2

Vocabulary- simple, Articles and determiners, Information in order, Common noun, Singular and plural noun, Countable and uncountable nouns, Masculine and feminine nouns, Proper nouns. Pronouns. Using word families. Adjectives, Adverbs, Verb- "Be", Prepositions, Questions, Have, Has, Do, Does, Did, Tenses, Making sentences, Connectors. **[05 Hrs]**

MODULE-3

Singular and plural, Forming plurals. Possessives, Syllables, Hidden words and silent words, Using prefixes and suffixes, Proof reading for spelling errors, Adjectives of numbers- cardinal and ordinal. Action verb, Simple present tense, Simple past tense, Formationof past tense. Questions, Negative sentence, Contractions. Types of sentences. **[05 Hrs]**

MODULE-4

Common and proper noun, Collective and abstract noun, Possessive noun, Noun numbers, Adjective of quality, Adjective of number, Parts of speech. Infinitives, Tense formation, Active and passive voice, Direct and indirect speech, Writing in time, Pick a noun, Using relative pro nouns, Reading activity, Writing activity. Reading activity.

Conjunctions, writing activity, Reading activity, Types of adverbs. Comparison of adverbs, short talk, Writing activity- writing an autobiography Degrees of comparison, Reading activity, Auxiliary verb or models. Homophones, The gerund, Transitive and intransitive verbs. Tag questions, Simple conversation, Question answer session **[07 Hrs]**

MODULE-5

Sentence transformation- simple, compound, complex Common errors in English. Synonyms & Antonyms; one word substitutions.
Communication- definition-basic purpose- types- process Skills in communication-reading skills-guidelines, definition-types, Listening skills: definition-essentials for good listening- barriers-difference, between hearing & listening, Speaking skills- guidelines for effective oral communication, Writing skills- guidelines. speaking skill- activity, listening skill – activity
Business correspondence – ii: Layout & form, Types of letters: letter of request, letter of complaint, letter of enquiry
Graphic communication: Definition, types & uses uses/Interpreting graphs and figures / Drawing, graphs using a set of information. **[08 Hrs]**

Text Books:

1. English Communication - TTTI Publication
2. A Practical English Grammar - A J Thomson
3. Intermediate English Practice - Pitt. S. Corden
4. Modern Business Letter Writing - J.S Bright
5. English without tears – Bhat

Reference Books:

1. Day.RA., Scientific English: A Guide for Scientists and Other Professional, 2nded. Hyderabad: Universities Press,2000.

Course code: 23VM102 Total Hours : 45 hrs	MATHEMATICS-I	L	T	P	C
		2	2	-	3

Course Objectives	The objective of this course is to make the students: 1. Introduce students to fundamental mathematical concepts such as numbers, algebraic expressions, equations, inequalities, and functions. 2. Introduce matrix operations and determinants highlighting their applications in fields like engineering and computer science. 3. Introduce complex numbers, trigonometric functions, their graphs, and applications in real-world scenarios. 4. Acquire the ability to calculate derivatives of various functions using differentiation rules, including algebraic, trigonometric, exponential, and logarithmic functions.
Course Outcomes	Upon successful completion of this course, the student will be able to: 1. Demonstrate the ability to manipulate algebraic expressions, solve linear equations, and inequalities, and apply the properties of exponents and logarithms. 2. Understand matrix operations, determinants, and apply these concepts to solve problems in relevant contexts. 3. Understand complex numbers and Apply trigonometric ratios to solve problems involving angles, triangles, and real-world applications such as measurements and navigation. 4. Understand the concept of a function, identify domain and range, and evaluate functions for various inputs.

MODULE-1

Fundamentals of Mathematics- Fractions-Definition, Types of fractions, Algebra of fractions (Addition, Subtraction, Multiplication and Division), Use of Logarithmic table, Simple problems, Logarithmic laws, Indices and Laws of Indices, Solution of linear equations, Solutions of Quadratic equations-Factorization, Using formula. **[09 Hrs]**

MODULE-2

Matrices and determinants-Definition of matrix and its types and matrix algebra, Problems on matrices addition, subtractions and multiplication, Transpose of a Matrix, Definition of determinant and its Evaluation, Properties of determinants. (Without Proof), Minors, Co-factors and Adjoint of a matrix, Inverse of a matrix, Solution of linear simultaneous equations using determinant method (Cramer's Rule). **[09 Hrs]**

MODULE-3

Complex numbers-Introduction of complex numbers, Representation of complex numbers, Algebra of complex numbers, Polar form of complex numbers, Exponential form of complex, Exercises on polar and exponential forms. **[09 Hrs]**

MODULE-4

Trigonometry-Defining the trigonometric functions, finding trigonometric values, Values of the trigonometric functions of 30°, 45°, 60° and 90°, Trigonometric functions of any angle and signs of trigonometric functions, Exercises on signs of trigonometric functions, Trigonometric identities, Exercises on trigonometric identities, Compound angles (sum or difference of two angles without proof), Exercises on compound angles, Multiple and Sub-Multiple angles, Exercises on multiple and sub multiple angles, Product formulae (No Problems), Heights and distances, Exercises on heights and distances(Simple Problems), Graphs of Trigonometric functions(Only Sin and Cos). **[09 Hrs]**

MODULE-5

Differential calculus- Limits definition and evaluation of limits (No derivations), Types of functions (only odd and even functions), Definition of derivative of a function and slope of tangent of the curve, Differentiation of algebraic and exponential functions (Without Proof), Differentiation of trigonometric functions (Without Proof), Differentiation of sum, difference, product quotient offunctions, Exercises on derivations of sum, difference, product, quotient of functions, Exercises onderivative of trigonometric functions, Derivatives functions of functions rule, Derivatives of inverse function, Differentiation of parametric equations, Successive differentiation, Application of differentiation-velocity and acceleration. **[09 Hrs]**

Text Books:

1. Technical mathematics - Rice and Knight, Mc-Graw Hill Book he.
2. Applied mathematics for Polytechnics-H.K. Dass

Reference Books:

1. Higher Engineering mathematics-B.S. Grewal
2. Higher Secondary Mathematics.

Course code: 23VM103 Total Hours: 30 Hrs	APPLIED SCIENCE	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to make the students understand: 1. Understand fundamental physical quantities, units, and equations of motion and Comprehend Newton's laws, momentum, work, energy, and circular motion. 2. Understand force composition and resolution, equilibrium principles, and moments, center of gravity and moment of inertia calculations. 3. Understand elasticity, plasticity, stress, strain, and fluid properties. 4. Comprehend heat transfer, calorimetry, and gas expansion. 5. Comprehend acid-base theories and their applications, industrial chemistry concepts and basic organic chemistry. 6. Gain insights into atomic structure, radioactivity, and wave motion. 7. Understand lasers, reflection, refraction, and optical principles				
Course Outcomes	After successful completion of the course, the students should be able to: 1. Apply S.I. units and equations of motion to solve problems and Analyze forces, momentum, and energy conservation in various scenarios. 2. Apply force composition techniques to analyze equilibrium situations, Calculate center of gravity and moment of inertia for different shapes. 3. Analyze stress, strain, fluid properties in real-world situations and Apply principles of heat transfer and gas expansion to practical scenarios. 4. Evaluate acid-base reactions, pH values, analyze industrial chemistry issues and identify organic hydrocarbons. 5. Explain atomic structure, radioactivity, and wave phenomena. 6. Describe laser principles and analyze optical phenomena.				

MODULE-1

Physical World: Physical quantities, Types of systems of units, Fundamentals and derived quantities, S.I. Units, Dimensions.

Force, Motion and Energy: Linear motion, Displacement, velocity, acceleration, Equations of motion, Problems, Newton's law of motion, Momentum, Law of conservation of momentum, Force, inertia, Work, power, energy, Law of conservation of energy, Circular motion, Angular displacement, angular velocity angular acceleration. **[06 Hrs]**

MODULE-2

Composition and resolution of Forces: Definition of composition, resultant, equilibrant, Law of parallelogram of forces, Triangle law of forces, Polygon law of forces.

Equilibrium of forces: Introduction, System of forces, Principal of equilibrium, Lamis theorem, Problems, Moments and its applications, Couple.

Center of gravity & Moment of Inertia: Introduction, Centroid of plane figures, Methods of finding out centre of gravity of plane, Axis of reference, Problems, Center of gravity of solid bodies, Moment of inertia of an irregular plane area. **[06 Hrs]**

MODULE-3

PROPERTIES OF SOLIDS AND FLUIDS: Plasticity, Elasticity, Stress, Strain, Hooke's Law, Young's modulus, Bulk modulus, Rigidity modulus, Surface tension, Capillarity, Viscosity.

Heat: Definition of heat, Thermometry, Platinum resistance thermometer, Thermocouple, Pyrometer, Calorimetry, Specific heat capacity, Heat transfer, Expansion of gas. **[06 Hrs]**

MODULE-4

Theory of Acids and Bases: Introduction, Hydrogen ion Concentration (pH Value)

Industrial Chemistry: Corrosion, Types of corrosion, Industrial Water, Disadvantages of using hard water in industry

ORGANIC CHEMISTRY: Introduction, Aliphatic hydrocarbons, Aromatic hydrocarbons (Benzene hydrocarbons), Nuclear Fission - Phenomenon of fission with example, Nuclear fusion - Phenomenon of fusion with example. **[06 Hrs]**

MODULE-5

MODERN PHYSICS: Structure of atom with schematic diagram, Radio activity, Nuclear Fission, Nuclear Fusion.

WAVE MOTION: Simple Harmonic Motion, Relation between wave velocity, frequency and wave length, Newton's Laplace equation for velocity of sound.

LASER: Meaning, materials used, types, Working principle, Application, Reflection, Refraction, Optical fiber, types, Working principle, Application. **[06 Hrs]**

Text Books:

1. Applied Science (Physics and Chemistry) - TTTI, Madras
2. Applied Mechanics and Strength of Material - R.S. Khurmi
3. Text book of Applied Mechanics – Ramamrutham

Reference Books:

1. Engineering Mechanics (Statics & Dynamics) - Irving H.Shames
2. Engineering Mechanics - S.Timoshinko & Young

Course Code: 23VM104 Total Hours :45 Hrs	ELECTRONICS - I	L	T	P	C
		3	-	-	3
Course Objectives	The objective of this course is to make the students: 1. Understand the historical development of electronics and the structure of an atom. 2. Comprehend the concepts of electric charge, current, and potential difference (voltage). 3. Learn about resistors, including types, resistivity, and color coding. 4. Explore Ohm's law, Kirchhoff's voltage law, and Kirchhoff's current law. 5. Develop problem-solving skills related to resistors in series and parallel combinations.				
Course Outcomes	Students after the completion of this course will be able to: 1. Explain the historical context and major milestones in the development of electronics. 2. Demonstrate an understanding of electric charge, current flow, and voltage. 3. Calculate resistance, apply color codes, and analyze resistors in various configurations. 4. Apply Ohm's law, Kirchhoff's voltage law, and Kirchhoff's current law to solve circuit problems. 5. Solve problems involving resistors in series and parallel combinations using appropriate techniques.				

MODULE-1

Fundamentals of Electronics: History & development of electronics, Structure of an atom, electric charge, Movement of Electrons [Current] And Potential Difference (voltage)

Resistance & resistivity Types of Resistors Colour coding of resistors. ohm’s law problems based on ohm's law resistors in series combination-simple problems resistors in parallel combination-simple problems resistors in series and parallel combination-simple problems Kirchhoff’s voltage law Kirchhoff’s current law. Problems based on KVL Problems based on KCL **[08 Hrs]**

MODULE-2

Capacitor and Inductor Capacitor, capacitance
Types of Capacitor, Capacitor in series, Capacitor in Parallel
Inductor, inductance Types of Inductors Alternating current, Direct current
Continuous Waveform terms and definition-Waveform, cycle, frequency, period Instantaneous value, rms value, peak value, peak to peak value, amplitude Relationship between frequency and time.

[08 Hrs]

MODULE-3

Introduction to Semiconductors

Introduction to matter and its classification

Energy level Diagram, Importance of energy band in solids classification of solids on the basis of energy bands Temperature co-efficient and its classifications Intrinsic semiconductor Doping Extrinsic semiconductor extrinsic semiconductors N—type extrinsic semiconductors P-type majority and minority carriers **[10 hrs]**

MODULE-4

Semiconductor Diode and Applications

Introduction to PN -Junction theory, Barrier potential PN junction under Forward bias PN junction under Reverse bias Diode, Forward and Reverse bias characteristics Ideal diode and practical diode Temperature effect on diode characteristics Application of diodes as Half wave Rectifier Application of diodes as Full wave rectifier Application of diodes as Bridge rectifier rectifiers with filters peak detector voltage multiplier-half wave doubler voltage multiplier-full wave doubler Clipper Circuits Clamper Circuits **[10 hrs]**

MODULE-5

Special Diodes

Zener diode and its characteristics, Zener diode as voltage regulatorZener and avalanche breakdown, Light emitting diode, Photodiode **[09 hrs]**

Text Books:

1. Electronic principles - Malvino
2. Linear Integrated Circuits - D.RoyChoudhury&Shail Jain
3. OP-AMPS and Linear Integrated Circuits - RamakantA.Gayakwad

Reference Books:

1. Electronic devices and circuit - Allan Mottershed.
2. Electronic devices and circuit theory - Boylested & Nashelsky.

Course code: 23VM105 Total hours: 30	BASICS OF COMPUTER -I	L	T	P	C
		2	--	--	2

Course Objectives	The objective of this course is to make the students: 1. Understand the definition of computers and their significance in modern society. 2. Explore the early history and evolution of computers, and identify different types of computers. 3. Comprehend the basic architecture and components of a computer system. 4. Differentiate between essential computer hardware and software components. 5. Classify computers based on different criteria and understand the concept of firmware.
Course Outcomes	Students after the completion of this course will be able to : 1. Define and explain the role of computers in various fields. 2. Analyze the historical development of computers and recognize different computer types. 3. Identify and describe the essential hardware and software components of a computer system. 4. Differentiate between different types of computers and understand their classification. 5. Understand the concept of firmware and its relevance in computer systems.

MODULE-1 **[06 Hrs]**

Introduction to Computers, Computer Definition
Early History Types of Computer, Computer Architecture
Components of Computer
Essential Computer hardware Essential Computer Software Firmware
Classification of Computers

MODULE-2 **[06 Hrs]**

Classification of Computers
Classification based on Size Classification based on Function Mobile Computers
Instruction to Computer Representing Data Processing Data Factors affecting the speed

MODULE-3 **[06 Hrs]**

Input and Output Devices
Basic Input/output devices
Inputting and outputting data in other ways
Classification of Monitors Projectors Sound Systems

MODULE-4 **[06 Hrs]**

Printer and its Types
Characteristics of Printers
Types of Printers
Other high quality printers
Plotters
Computer memory & Data Storage devices
Types of storage devices
Magnetic storage device types
Optical storage device types
Measuring Performance

MODULE-5 **[06 Hrs]**

Operating System and User Interfaces
Types of User Interfaces
Operating System and functions
Example Operating Systems

Text Books:

1. Basics of Information Technology by Priti Srivastava, North Publication
2. Fundamentals of Computer by E Balagurusamy, Tata McGraw Hill Education Pvt. Ltd, NewDelhi
3. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
4. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd. Jungpura, New Delhi

Reference Books:

1. MS Office by BPB Publications, New Delhi

<table>
<tr><td rowspan="2">Course Code:
23VM106
Total Hours: 45</td><td rowspan="2">Applied Science Lab</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td></td><td>--</td><td>3</td><td>3</td></tr>
<tr><td>Course Objectives</td><td colspan="5">The objective of this course is to make the students:
1. Understand the principles and usage of basic measuring instruments in physics experiments.
2. Develop practical skills in performing measurements and calculations using Vernier calipers and screw gauge.
3. Explore the concepts of vector addition and force equilibrium through experimental verification.
4. Apply geometric principles to verify the laws of parallelogram and triangle of forces.
5. Demonstrate an understanding of Lami's theorem and its application in force analysis.
6. Acquire the knowledge and techniques to determine the focal length of a convex lens using the u-v method.
7. Develop competence in using a simple pendulum to calculate the acceleration due to gravity.
8. Learn experimental procedures to determine the spring constant of a given helical spring.</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">Students after the completion of this course will be able to:
1. Accurately use Vernier calipers and screw gauge to measure dimensions of objects, calculate volumes and thicknesses.
2. Experimentally verify the parallelogram law of forces and understand vector addition.
3. Experimentally confirm the converse of the law of triangle of forces and analyze force equilibrium, apply Lami's theorem to analyze and solve problems involving concurrent forces.
4. Determine the focal length of a convex lens using the u-v method with precision.
5. Calculate the acceleration due to gravity using a simple pendulum and understand the principle involved.
6. Determine the spring constant of a helical spring through experimental measurements and calculations.</td></tr>
</table>

1. Vernier Calipers: Determination of volume of solid cylinder and Sphere.
2. Screw Gauge: Determination of the thickness of a thin wire and glass plate.
3. Parallelogram law: Verification of the law of parallelogram of forces.
4. Verification of the converse of the law of triangle of forces
5. Verification of Lami’s theorem
6. Determination of focal length of a convex lens by u-v method
7. Determination of acceleration due to gravity by using Simple pendulum
8. Determination of spring constant of the given helical spring

Text Books:

1. Applied Science (Physics and Chemistry) - TTTI, Madras
2. Applied Mechanics and Strength of Material - R.S. Khurmi
3. Text book of Applied Mechanics – Ramamrutham

Reference Books:

1. Engineering Mechanics (Statics & Dynamics) - Irving H.Shames
2. Engineering Mechanics - S.Timoshinko & Young

Course Code: 23VM107 Total Hours: 45	Basics of Computer Lab	L	T	P	C
		–	--	3	3
Course Objectives	The objective of this course is to: 1. Learn, experiment, and explore computer applications in education. 2. Make use of the computer for business and personal purpose through the use of applications software. 3. Adapt to use the Internet.				
Course Outcomes	Students after the completion of this course will be able to: 1. Prepare presentation and report on computer system. 2. Identify the components of a computer system and demonstrate basic proficiency in commonly used applications. 3. Create, design, and produce professional documents using word processing software (i.e., MS Word). 4. Process, manipulate, and represent numeric data using the basic functions of spreadsheet software (i.e., MS Excel). 5. Demonstrate strategies for merging and integrating source data from multiple applications.				

1. Parts of Computer
2. Data Representation
3. Software-OS, GUI, Directory
4. Typing Tutorial
5. PC tools
6. MS Office Tools

Text Books:

1. Fundamentals of Computer by E Balagurusamy,Tata McGraw Hill Education Pvt. Ltd, New Delhi
2. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
3. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd. Jungpura, New Delhi

Reference Books:

1. MS Office by BPB Publications, New Delhi

Course Code: 23VM108 Total Hours: 60	Electronics Lab – I	L	T	P	C
		–	--	4	4
Course Objectives	The objective of this course is to: 1. Introduce lab safety protocols and fundamental rules for conducting experiments. 2. Familiarize students with color coding for resistor values and their applications. 3. Provide hands-on experience with essential electrical instruments such as function generator, CRO, and MULTIMETER. 4. Develop proficiency in basic soldering techniques. 5. Teach fundamental electrical laws, including Ohm's law and Kirchhoff's laws.				
Course Outcomes	Students after the completion of this course will be able to: 1. Follow established lab safety guidelines and procedures during experiments. 2. Accurately decode resistor values using color coding and understand their significance. 3. Confidently operate and interpret measurements from the function generator, CRO, and MULTIMETER. 4. Apply soldering techniques to create basic electrical connections effectively. 5. Comprehend and apply Ohm's law and Kirchhoff's laws to analyze electrical circuits.				

1. Introduction to lab safety, procedure, rules and regulations.
2. Color coding of Resistors and Soldering Basics.
3. Familiarization of Function generator, CRO, MULTIMETER, Power supply, Tool kit and basics of bread board connections.
4. Calculation of amplitude, time-period, frequency, using CRO.
5. Active and passive components- value identification& polarity checking
6. Ohm’s law, Kirchhoff’s current law and Kirchhoff’s voltage law.
7. PN junction characteristics of diode and Temperature dependence of diode.
8. Half wave rectifier with and without filter.
9. Full wave Centre tap rectifier with and without filter.
10. Bridge full wave rectifier with and without filter.
11. Clipper and clamper circuits, Peak Detector.

Text Books:

1. Electronic principles - Malvino
2. Linear Integrated Circuits - D.RoyChoudhury&Shail Jain
3. OP-AMPS and Linear Integrated Circuits - RamakantA.Gayakwad

Reference Books/Manuals:

1. Electronic Devices and Circuits by David A Bell 4 Edition PHI
2. Hand soldering and circuit board repair by H.(Ted)Smith, Thomas Delmar.
3. Electronic instruments and systems – principles, maintenance and Troubleshooting, R.G. Gupta.

Course Code 23VM109 Total Hours : 60 hrs	Engineering Drawing	L	T	P	C
		-	-	4	4
Course Objectives	The objective of this course is to: 1. Develop foundational skills in engineering drawing techniques and CAD software operation. 2. Familiarize students with essential drawing instruments, equipment, and their applications. 3. Enable students to create and modify engineering drawings using Computer-Aided Drafting (CAD) tools. 4. Provide comprehensive knowledge of dimensioning methods and geometric construction principles. 5. Develop proficiency in generating accurate orthographic and isometric projections for engineering designs.				
Course Outcomes	Students after the completion of this course will be able to: 1. Demonstrate competence in utilizing basic drawing instruments and equipment. 2. Proficiently use CAD software for drafting and editing engineering drawings. 3. Accurately apply dimensioning techniques and annotations to engineering designs. 4. Confidently perform geometric construction for various shapes and figures. 5. Produce accurate orthographic and isometric projections, effectively communicating engineering concepts and designs.				

MODULE -1

Introduction - Engineering drawing: Importance of engineering drawing & role of drawing in engineering education, engineering drawing equipment's, Basic drawing instruments T-square, Set Square. Compass, dividers, mini drafter pro-circles, Drawing board & pencil. Introduction to computer aided drafting Importance of computer aided drafting, menu selection, begin new drawing editing existing menu selection practice on computers.

Basics of Engineering drawing: Features' of lettering (Selection of suitable size of letters & numbers as per SP 46). Introduction to CAD. By using screen menu, tool bar &cursor menu, button menu Practice on computer.

Exercises: Writing notes in engineering script. Introduction & explanation on utility commands, Help, End, Quit, Save, Limits, Units, function key & Drafting setting practice. Drawing sheet sizes, (as per SP 46).Scale, full scale, reduced scale, Enlarged scale (as per SP 46) lines (As per SP 46). Introduction to entity draw commands Line, absolute, relative, polar co-ordinates, direct distance entry, Points, Undo, redo, and Move. Practice on computers Title block & sheet layout, (As per SP 46) **[10 Hrs]**

MODULE -2

Dimensioning: Importance of dimensioning, Elements of dimensioning &general rules of dimensioning size of arrowhead , placing of dimension line ,projection line , value of dimension &leader lines, System &method of indicating dimensions, Arrangement of dimensions chain dimensioning, parallel dimensioning, superimposed dimensioning, combined dimensioning, superimposed dimensioning & co-ordinate dimensioning, Special indication for dimensions (dimensioning practice). **[10 Hrs]**

MODULE -3

Geometric construction: Arc joints, by using compasses, exercises, Line joints. [Circle, arc, polygon ellipse hatch Practice on computers. 1 h for computers], Terminology of different shape, Bisecting an angle, bisecting a line, finding a center of given circle &divide a line equal and un equal Conic section Construction of ellipse. Arc intersecting method, understand about parabola& hyperbola, cycloid construction, helix construction &understand about involute, [layers, line type properties modify command erase, copy mirror, offset Practice. **[10 Hrs]**

MODULE-4

Projection: Introduction about projections. Practice on computers. [Array, rotate, scale, trim, extend, break2 h for computer] Isometric drawings, steps involved in preparing, construction of circle in isometric view isometric drawings. Practice on computer [chamfer, fillet, stretch, explode2 h for computer] Exercise on Isometric drawings. From the reference of direct isometric view Practice on computer [edit and display command, isometric snap, object snap, iso plane. **[15 Hrs]**

MODULE-5

Ortho graphic projections, planes of projections, first angle projection and third angle projection, why second angle and fourth angle not used in engineering drawing, construction details of front view top view and side view in first angle projection Exercise on orthographic projection. Practice on computer, Exercise on Isometric drawings. From the reference of orthographic view, Identification of view & missing view. **[15 Hrs]**

Note: All the drawing exercises are performed using AutoCAD.

Text Books:

1. Machine drawing - P I Varghese and K.C John
2. SP46 - BIS
3. Engineering Drawing - N.D. Bhatt
4. IS 696 - BIS
5. IS 8000 - BIS

Reference books:

1. PSG Hand book - PSG
2. CMTI Hand book

Course Code: 23VM110 Total Hours: 60	Workshop Practice -1	L	T	P	C
			--	4	4
Course Objectives	The objective of this course is to: 1. Introduce students to basic metalworking techniques and tools used in fabrication and construction. 2. Develop proficiency in working with various metal shapes, such as U-Channels, Angle Irons, and Cylinder Pipes. 3. Enable students to accurately mark, punch, and drill metal pieces for assembly and fastening. 4. Familiarize students with metal punching techniques for creating numbers and letters on surfaces. 5. Provide hands-on experience in fabricating and assembling functional metal structures, such as Store Boxes and Cylinder Pipe structures.				
Course Outcomes	Students after the completion of this course students will be able to: 1. Demonstrate the ability to identify and differentiate different metal shapes, such as U-Channels and Angle Irons. 2. Accurately mark, punch, and drill holes in metal pieces, ensuring precise assembly. 3. Effectively use metalworking tools to create numbers and letters through metal punching. 4. Apply learned techniques to fabricate functional metal structures, such as Store Boxes and Cylinder Pipe assemblies. 5. Develop practical skills in metalworking, enabling them to contribute to construction and fabrication projects.				

1. U – Channel
2. Angle Iron
3. Rod Hammering
4. Marking & Dot Punching
5. Number & Letter Punching
6. Drill Plate
7. Store Box
8. Cylinder Pipe

Text Books:

1. DSU Workshop manual.

Course code: 23VM201 Total Hours : 30Hrs	English-II	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to make the students : 1. Learn internal communication formats like internal notes, memorandums, and incident reports (theft, clashes, facility problems), as well as accident and trip reports. 2. Understand the importance and types of formal reports, technical report layout, and the procedure for writing reports. 3. Practice descriptive writing (physical and functional/process descriptions) and learn to write clear instructions for various tasks or activities. 4. Learn effective presentation skills, including personal appearance, posture, gestures, voice modulation, language, pauses, eye contact, visual aids, articulation, and time management. 5. Understand resume and cover letter writing, tips for successful job interviews, conducting mock interviews, and techniques for group discussions (GD), along with practice sessions.				
Course Outcomes	Upon successful completion of this course, the students will be able to: 1. Demonstrate proficiency in creating various internal communication documents such as internal notes, memorandums, incident reports, accident reports, and trip reports. 2. Develop the ability to write formal technical reports by understanding their importance, different types, appropriate layouts, and the step-by-step procedure for creating them. 3. Gain the skills to document meetings effectively by understanding and creating notices, agendas, and detailed minutes of meetings. 4. Develop strong job application skills by learning how to craft resumes, cover letters, prepare for job interviews, conduct mock interviews, and participate effectively in group discussions.				

INTERNAL CORRESPONDENCE

Documents for Internal Communication, Internal note, Memorandum - Format Incident report (Theft, Internal clash, Facility problems), Accident Report, Trip Report

TECHNICAL WRITING

Report writing, Importance and types of formal report, Layout of a technical report, Procedure of writing a report.

ORGANIZATIONAL CORRESPONDANCE

Meeting and its documentation, Notice and Agenda, Minutes of meeting

WRITING SKILL (ACTIVITY BASED)

Description: Physical description, Functional/process description writing a set of instructions
Writing a set of instructions: for any of your labs/ work shop/ equipment/machines, to ride a bike/to make a cup of tea/ an omelette/to bake a cake, etc.

PUBLIC SPEAKING

Shop talk/ LAB Talk
Presentation skills: Personal appearance - Posture - Gesture – Voice - Speed – 03 language - Pauses - Eye contact - Visual aids - Articulation - Time Management.

INTERVIEW SKILLS

Resume and cover letter, Job interview - Tips to face interviews successfully, Mock interview, Group discussion (GD) Rules – Do's and Don'ts – Techniques to be followed, GD practice sessions

Text Books:

1. English Communication - TTTI Publication
2. A Practical English Grammar - A J Thomson
3. Intermediate English Practice - Pitt. S. Corden
4. Modern Business Letter Writing - J.S Bright
5. English without tears – Bhat

Reference Books:

1. Day.RA., Scientific English: A Guide for Scientists and Other Professional, 2nded. Hyderabad:Universities Press,2000.

Course code: 23VM202 Total Hours: 30Hrs	Mathematics-II	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to make the students: 1. Understand the concepts of percentage, ratios, and proportions and Develop proficiency in solving problems involving percentages, ratios, and proportions. 2. Understand the concepts of Cartesian coordinates, slopes, and equations of lines, equations of circles, parabolas, ellipses, and hyperbolas. 3. Learn to calculate surface areas and volumes of 3D shapes like cylinders, cubes, cuboids, cones, spheres, hemispheres, and pipes. 4. Understand the concept of integrals and apply standard formulae of trigonometric functions. 5. Understand statistical concepts of mean, median, mode, range, and standard deviation and solve problems involving measures of central tendency.				
Course Outcomes	Upon successful completion of this course, the students will be able to: 1. Calculate percentages and solve problems involving percentage conversions, and ratios and proportions, both forwards and backwards. 2. Apply Cartesian coordinates to find distances, midpoints, and sections, and solve problems involving equations of lines, circles, parabolas, ellipses, and hyperbolas. 3. Calculate surface areas and volumes of various 3D shapes for practical applications. 4. Apply standard formulae to solve integrals and calculate areas under plane curve, evaluate definite integrals and solve basic differential equations. 5. Calculate and interpret mean, median, mode, range, and standard deviation for data sets.				

MODULE-1

PERCENTAGE, RATIOS AND PROPORTIONS, Simple Problems (like if percentage is given find the number and vice versa) **[03 Hrs]**

MODULE-2

ANALYTICAL GEOMETRY: Area and perimeter of triangle, Areas and perimeter of Rectangle. Areaand perimeter of Square, Area and perimeter of Parallelogram, Area and perimeter of Rhombus,Area and perimeter of Trapezium, Area and perimeter of Circle, Length of an arc, Area ofsector(Direct Problems),Cartesian Co-Ordinates, Equation of axis, Distance formula, Section formula & midpoint,(Direct Problems),Definition of Centroid of Triangle(Direct Problems), **Slope**: Definition, finding slope of straight line using (given two points, equation of a line and angle) , Condition for Perpendicularity and parallelism(Simple Problems). Equation of straight line: a) Y=mx+c, b) Point slope form c) Two point form d) Intercept form

Circle-Definition, Standard form (centre(h,k)and radius r), General Equation of a circle (Simple problems) to find center and radius ,Basic concept of parabola, To find focus, vertex, directrix and axis of the parabola, Basic Concept of Ellipse, length of major and minor axis. Basic Concept of Hyperbola, length of transverse and conjugate axis. **[10 Hrs]**

MODULE-3

3D Shapes, T.S.A, L.S.A and Volume of Cylinder, T.S.A, L.S.A and Volume of Cube, Cuboid, T.S.A, L.S.A and Volume of Cone, T.S.A, L.S.A and Volume of Sphere, T.S.A, L.S.A and Volume of Hemi-Sphere, T.S.A and Volume of Pipe **[05 Hrs]**

MODULE-4

Integral calculus and differential equations, Define Integrals of function and standard formulae of trigonometric functions, Problems using standard formulae. Integration by parts. Definite Integral and evaluation of definite integrals and simple problems.

Area under plane curves – simple problems. Define differential equations with example. Define order and degree of differential equations. Solve differential equations of the type a) $ad^2y/dx^2 + b\,dy/dx + cy = 0$ b) $ad^2y/dx^2 + b\,dy/dx + cy = e^{mx}$ **[07 Hrs]**

MODULE-5

Statistics**,** Mean, Median and Mode (Raw Data), Rage and Standard Deviation. Problems on above methods. **[05 Hrs]**

Text Books:

1. Technical mathematics - Rice and Knight, Mc-Graw Hill Book he.
2. Applied mathematics for Polytechnics-H.K. Dass

Reference Books:

1. Higher Engineering mathematics-B.S. Grewal
2. Higher Secondary Mathematics.

Course Code: 23VM203 Total Hours :30	Manufacturing Engineering	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to enable students to: 1. Gain comprehensive knowledge of the origins, structures, and properties of engineering materials, including the classification of metals, ceramics, and polymers. 2. Develop proficiency in handling and utilizing a range of metalworking hand tools, such as files, hammers, hacksaws, chisels, screwdrivers, and spanners, emphasizing safety protocols. 3. Acquire a thorough understanding of conventional machines like drilling machines, milling machines, lathes, and grinding machines, focusing on their parts, operations, tool holding devices, and speed calculations. 4. Introduce various manufacturing methods, including forming processes (casting, forging, rolling), joining methods (screws, bolts, welding), and an overview of injection molding techniques. 5. Apply theoretical knowledge to practical scenarios, enhancing skills in material selection, tool handling, machine operations, and understanding manufacturing processes through hands-on exercises and demonstrations.				
Course Outcomes	Students after the completion of this course will be 1. Able to analyze and differentiate between different engineering materials based on their origins, structures, and properties, aiding in material selection for specific applications. 2. Competent in utilizing a variety of hand tools effectively and safely for metalworking tasks, demonstrating precision and skill in handling tools like files, hammers, saws, and chisels. 3. Proficient in operating and understanding conventional machines including drilling machines, milling machines, lathes, and grinding machines, with the ability to calculate speeds and effectively use tool holding devices. 4. Able to Understand the principles and methods involved in various manufacturing processes, including forming and joining techniques, enabling the selection of appropriate methods for specific fabrication needs. 5. Apply learned concepts to practical scenarios, demonstrating problem-solving skills in material selection, tool utilization, and the application of manufacturing methods, fostering a hands-on approach to engineering challenges.				

MODULE-1

ENGINEERING MATERIALS: The structure of materials; origin of engineering materials, forming engineering materials from the elements, properties. The solid state, Material classification-metals-ceramics-polymers, Properties and selection-types of polymers. **[08 Hrs]**

MODULE-2

HAND TOOLS FOR BENCH WORK: Safety; Metal working hand tools and devices: Work bench - vices, types of vices, Files: Specification of files - parts of files - different types of files. Hammers: Parts of hammer - use of hammer - specification of hammer - types of hammers: ball peen hammer - cross peen hammer - straight peen hammer. Hacksaw: Different types of frames - parts of the blade - types of blades - setting of saw teeth - material of blade - selection of blade - fixing of the blades. Chisel: Different types of chisels - designation of the chisel. Screwdrivers, Spanners: Different types of spanners- Use method. **[08 Hrs]**

MODULE-3

CONVENTIONAL MACHINES: Types of drills-materials of drills, Drilling machine-parts- machine-block diagram, types of drilling machine, work, tool holding devices, tool holding devices, drilling machine operations, and. Speed time calculation. Milling Machine, types of milling machine-parts, machine-block diagram, milling cutters- milling process, up milling, down milling, materials of cutters, work holding device
s, speed calculations. Lathe, functions of lathe-block diagram, types of lathe, lathe parts, work holding devices, lathe operations, taper turning, lathe cutting tools. Grinding Machine. Kinds of grinding, surface grinders-four types, surface grinding, machine- operations, wheels-Types of wheels, cylindrical grinding machine, work holding devices, wet anddry grinding. cutting tool materials. Cutting fluids and its importance. **[08 Hrs]**

MODULE-4

MANUFACTURING METHODS: Introduction to various methods of manufacturing like forming, joining methods (fabrication), Forming process- An over view on casting, forging, rolling, drawing, press work, etc., Joining Methods-Temporary joints like screws, bolts, nuts, keys and cotters. Permanent joints like Rivets- Types and types of riveted joints, Arc and Gas welding. (Injection Moulding) **[06 Hrs]**

Text Books:

1. Elements of workshop technology volume 01- Hajra Choudhury.
2. Elements of workshop technology volume 02- Hajra Choudhury.

Reference Books:

1. Production technology-O P Khanna.

Course code: 23VM204 Total hours: 30	Electronics-II	L	T	P	C
		2	--	--	2
Course Objectives	The objective of this course is to make the students: 1. Understand the basic structure, operational principles, and key parameters of transistors, including biasing techniques and configurations. 2. Apply transistor knowledge to design and analyze transistor-based circuits for amplification, switching, and basic digital logic functions. 3. Differentiate between JFET and MOSFET structures, operations, and basic applications. 4. Analyze amplifier characteristics such as classes of operation, coupling methods, and frequency responses. 5. Grasp the fundamentals of operational amplifiers, including configurations, parameters, and basic applications.				
Course Outcomes	Upon successful completion of this course, the students will be able to: 1. Demonstrate comprehension of transistor structure, operation, biasing, and configurations. 2. Apply transistor knowledge practically to design circuits for amplification, switching, and basic logic operations. 3. Differentiate between JFET and MOSFET, understanding their structures, operations, and basic applications. 4. Analyze amplifier characteristics, including classes of operation, coupling methods, and frequency effects. 5. Demonstrate proficiency in understanding operational amplifiers, their configurations, parameters, and basic applications.				

MODULE-1

Transistors: Basic structure of a Transistor, Transistor operation, Transistor parameters-alpha, beta & characteristics- input, output, DC LOADLINE, Q Point, importance of Q point & biasing, Transistor biasing –emitter, collector feedback, voltage feedback, Configuration characteristics –CC, CB, CE, Transistor rating and specifications – current, voltage, power, Temperature etc.

Transistor applications, Basics of JFET & MOSFET, Transistor applications- as a switch (using LED, Relay), As a constant current source, as an inverter (NOT gate). Concept of amplification – transistor amplifiers, coupling Bypass capacitors. Cascaded amplifiers –need of cascading, power calculating Equation. **[08 Hrs]**

MODULE-2

Basics of JFET & MOSFET, Basics of JFET –symbol, structure, operation, applications, MOSFET-symbol, structure, operation, applications.

Power amplifier, Amplifier Terms –DC Load Line –AC Load Line, Classes operations, Types of coupling and Frequency ranges, Power rating of a Transistor, Frequency effects –Frequency Response Of an amplifier Decibel Power. **[08 Hrs]**

MODULE-3

Differential Amplifiers: Introduction about differential amplifier, DC and AC Analysis of Differential amplifiers, Input characteristics, common mode gain and CMRR. **[05 Hrs]**

MODULE-4

LINEAR OPERATIONAL AMPLIFIER: Linear Circuits- inverting, non-inverting amplifiers, applications, voltage follower, instrumentation & summing amplifiers, current boosters & current sources.

NON LINEAR OPERATIONAL AMPLIFIER: NON LINEAR OP – AMP CIRCUITS – comparator, Zero crossing detector, inverting & differentiator, Wave form generators, a) square, triangular, saw tooth, b) Active diode circuits. **[05 Hrs]**

MODULE-5

Filters & Oscillators: Ideal Responses, Low Pass and High Pass Filters, Band pass, Band stop and All pass Filters, Sinusoidal Oscillators, RC and LC Oscillators, Timer IC 555 – Pin configuration, Monostable, Astable Operation and its application.

REGULATED POWER SUPPLIE: Power Supply characteristics, Series and Shunt Regulators, Linear and Switching Regulators, Variable Regulators - LM 317 **[04 Hrs]**

Text Books:

1. Electronic principles - Malvino
2. Linear Integrated Circuits - D.RoyChoudhury&Shail Jain
3. OP-AMPS and Linear Integrated Circuits - RamakantA.Gayakwad

Reference Book:

1. Electronic devices and circuit - Allan Mottershed.
2. Electronic devices and circuit theory - Boylested & Nashelsky.

Course code: 23VM205 Total Hours: 30	Electrical Engineering	L	T	P	C
		2	-	-	2
Course Objectives	The objective of this course is to make the students understand: 1. The importance of basic principles of electrical electronics for industrial application. 2. Electrical and Electronic measuring instruments and their usage 3. Working principles of Electrical motors				
Course Outcomes	Students after the completion of this course will be able to: 1. Learn the basic concepts and working of electrical devices. 2. Apply the electronic and electrical measuring instruments for practical applications.				

MODULE-1

POWER SOURCES: Classification of power sources, Electrochemical primary and secondary batteries and introduction to fuel cells

NETWORK THEOREMS, Kirchhoff's laws, voltage sources and current sources, Source conversion, simple problems in source conversion. Superposition theorem, simple problems in super position theorem, Thevenin's theorem, Norton's theorem, simple problems, Reciprocity theorem, Maximum power transfer theorem, simple problems, Delta/star and star/delta transformation. **[06 Hrs]**

ELECTROSTATICS AND CAPACITANCE: Static electricity, absolute and relative permittivity of a medium, laws of Electrostatics, electric field, field strength, electric flux density energy stored in a capacitor, Charging and discharging of a capacitor, current voltage relationships in a capacitor.

MODULE-2

MAGNETISM: Basic definition of flux, m.m.f, reluctance, relation between B,H,I, Comparison between electric and magnetic circuits. **[06 Hrs]**

ELECTROMAGETISM AND INDUCTION: Relation between magnetism and electricity, production of induced e.m.f and current and Faraday's laws of electromagnetic induction, Direction of induced e.m.f and current-Lenz's law–self-inductance and mutual inductance, Magnetic hysteresis, residual magnetism, energy stored in magnetic field Rise and decay of current in inductive circuits.

SINGLE PHASE A.C. CIRCUITS: Generation of alternating voltage and current, Different forms of E.M.F equations, A.C. through R, L and C and power factor, AC through R,R-C and R-L series and parallel circuits, Active and reactive components of circuit & Active, reactive and apparent Power

MODULE-3

POLY PHASE A.C. CIRCUITS: Generation of Poly phase Voltages, Phase Sequence, Star or Wave (Y) connection - Values of Phase currents Voltages in star and delta connection.

TRANSFORMERS: Definition, Construction & Principle of operation, Types of Transformers, E.M.F Equation and Voltage Transformation Ratio, Tests on Transformers – OC & SC Test, Losses & Efficiency of a Transformer, Three Phase Transformer and connections, Auto Transformers& Instrument transformer –Principle & Working.

DC GENERATORS: Generator Principle, Construction & working, Parts of a Generator, EMF equation of Generator, Losses and Efficiencies in DC Generators, Characteristics of DC generators. **[06 Hrs]**

MODULE-4

DC MOTORS: Motor Principle, Comparison of motor and generator principle, Back EMF and Voltage Equation of a Motor, Torque, Armature Torque and shaft Torque, Rated Speed and speed regulation and sped control of D.C. Motors, Selection parameters of DC Motors.

MOTOR CHARACTERISTICS, T vs la, N vs la of A DC Shunt and series motor, T vs la, N vs la of A DC Compound motor.

INDUCTION MOTORS: Classification of AC Motors, Single Phase and Three Phase Induction Motors, General Principle & Construction, Starting of Induction Motor, Relationship between Slip, Torque, Power Stages in Induction Motor, Speed control of an Induction Motor. **[06 Hrs]**

MODULE-5

SPECIAL PUPOSE MOTORS: Universal motors and its specialty, Stepper Motors and PMDC Motor, Introduction to servo Motors.

ALTERNATORS: Basics Principle & Details of Construction, Stationary Armature & Rotor, Speed and Frequency Relation **[06 Hrs]**

Text Books:

1. Electrical Technology Vol 1 &2 by B.L. Theraja
2. Electrical Technology by Hughes

Reference Books:

1. Electrical, Electronic Measurements and Instruments by Sahney

Course code: 23VM206 Total hours: 30	Metrology	L	T	P	C
		2	--	--	2
Course objectives	The objective of this course is to make the students: 1. To understand the importance of inspection, measuring instruments in industries. 2. Awareness of limits, fits and its tolerance and its importance in manufacturing. 3. To understand the errors in measurements and calibration importance.				
Course Outcomes	Students after the completion of this course will be able to: 1. Explain the basics of standards of measurement, limits, fits & tolerances industrial applications. 2. Identify the uses of gauges and comparators 3. Understand the significance of measurement system, errors, transducers, intermediate modifying and terminating devices				

MODULE-1

INTRODUCTION TO METROLOGY: Definition and concept of metrology need of inspection, principles of measurements, process of measurements, methods of measurements, measuring system and accuracy of measurements, precision and accuracy. Linear measuring instruments, steel rule, calipers-inside and outside, vernier caliper, micrometer, error surface plate, angle plate, v-block, feeler gauge, radius gauge, wire gauge. Introduction precision measuring instruments-vernier caliper, vernier height gauge, micrometer. **[08 Hrs]**

MODULE-2

LIMITS FITS AND TOLERANCE: Introduction; limits, tolerance, system of writing tolerance, unilateral, bi-lateral system; relation between tolerance and cost. Maximum and minimum metal limits; conventional diagram for limits and fits, terminology for limits. Types of fits, allowance, system obtaining different types of fits; hole basis and shaft basis system. Types of assemblies; interchangeability; selective assembly. **[08 Hrs]**

MODULE-3

GAUGES: Introduction; gauges-its types, plain gauges, limit plug gauges, snap, adjustable type, Materials for gauges. work shop gauges, inspection gauges, Slip gauges; wringing of slip gauges, selection of slip gauge. **[04 Hrs]**

MODULE-4

ERRORS IN MEASURMENTS AND CALIBRATION: Introduction; Measurement error, types, controllable and systematic error. random error Calibration; its needs, calibration procedure, calibration of vernier caliper, Screw thread measurement; terminology, errors in thread, pitch errors, measurements of various elements of thread. **[05 Hrs]**

Module-5 Measurement of Power and Flow [05 Hrs]

Text Books:

1. Elements of workshop technology volume 01- Hajra Choudhury.
2. Elements of workshop technology volume 02- Hajra Choudhury.

Reference Books:

1. Metrology- M Mahajan.

Course code 23VM207 Total Hours: 45	Electronics Lab – II	L	T	P	C
			-	3	3

Course Objectives	Students after the completion of this course will be able to: 1. Analyze and understand the relationships between collector current (Ic) and base current (IB), voltage between base and emitter (VBE), and collector-emitter voltage (VCE) for a transistor. 2. Explore and demonstrate the characteristics of transistors and FETs functioning as switches, particularly focusing on JFETs in switch applications. 3. Familiarize with IC 741, verify its parameters, and comprehend its fundamental operations and Design, analyze, and verify various op-amp circuits including voltage followers, summing amplifiers, inverting and non-inverting amplifiers, comparators, integrators, differentiators, Schmitt triggers, and filter circuits. 4. Explore and experiment with IC 555 in both monostable and astable multivibrator configurations, understanding their functions and characteristics.
Course Outcomes	Students after the completion of this course will be able to: 1. Demonstrate a clear understanding of transistor characteristics concerning collector and base currents, voltage variations, and the application of transistors as switches. 2. Differentiate and understand the specific characteristics and applications of FETs, especially JFETs, when employed as switches. 3. Demonstrate proficiency in utilizing and verifying IC 741 parameters and comprehending its operational principles. 4. Apply knowledge in designing, analyzing, and verifying various op-amp circuits for different functionalities and applications. 5. Gain practical experience and understanding of IC 555 in both monostable and astable configurations, demonstrating their operational principles and characteristics in multivibrator circuits.

LIST OF EXPERIMENTS

1. Transistor Characteristics:
   Ic vs IB
   VBEvs IB
   VBE vs lc
2. Transistor as a switch.
3. Characteristics of FET. JFET as switch
4. Familiarization of IC 741 & Verification of its Parameters.
5. Op Amp Applications – Voltage Follower, Summing Amplifier.
6. Design and Verification of Inverting Amplifier Circuit.
7. Design and Verification of Non Inverting Amplifier Circuit.
8. Op Amp as Comparator with Zero and Non Zero references.
9. Op Amp as Integrator and Differentiator.

10. Op Amp as Schmitt Trigger.
11. Op Amp as Filter Circuits and Study of Frequency Response LPF, HPF, BPF)
12. Op Amp as RC Phase Shift Oscillator.
13. Monostable Multivibrators using IC 555 Astable Multivibrators using IC 555
14. Familiarization of Fixed Regulators – 7805, 7905
15. Familiarization of Variable Regulators – LM 317.

Text Books:

1. Electronic Devices and Circuits by David A Bell 4 Edition PHI
2. Hand soldering and circuit board repair by H.(Ted)Smith, Thomas Delmar.

Reference Books:

1. Electronic instruments and systems – principles, maintenance and Troubleshooting. by R.G. Gupta.

Course code 23VM208 Total Hours: 60	Electrical Engineering Lab	L	T	P	C
			-	4	4

Course Objectives	Students after the completion of this course will be able to: 1. Demonstrate proficiency in various electrical wiring techniques, including staircase wiring, go down wiring, parallel and series wiring, and installation of extension boxes. 2. Understand transformer fundamentals including ratios, testing procedures (polarity, resistance, open circuit, short circuit), and load testing for single-phase and three-phase transformers. 3. Get acquainted with generator components and basic operations. 4. Learn about motor operations, including starting methods for 3-phase induction motors using different starters and automatic systems.
Course Outcomes	Students after the completion of this course will be able to: 1. Gain hands-on expertise in implementing different electrical wiring techniques safely and effectively. 2. Apply knowledge to conduct various transformer tests and understand their basic functionalities. 3. Gain familiarity with generator components and their basic functions. 4. Acquire practical skills in starting and operating different types of motors using various methods and automatic systems.

LIST OF EXPERIMENTS

ELECTRICAL WIRING: Staircase wiring, Go down wiring, 2 Lamps by 1 switch, Parallel and Series wiring, One lamp by one switch, Extension box

TRANSFORMERS: Transformer familiarization, Transformer ratio, polarity test and measurement of internal resistance, Open circuit test and short circuit test on transformers, Load test on single phase transformer, 3- phase transformer star and delta connection

GENERATORS: Familiarization of generators

MOTORS: Familiarization of timer/contactors, starting of 3-phase induction motor by auto-Transformer, Starting of 3-phase induction motor by DOL Starter. Automatic starting of three phase induction motor. Automatic starting of two 3-phase induction motor.

Reference Books:

1. ALTERNATING CURRENT MACHINES – A. Langsdorff
2. ELECTRICAL MACHINES – BHIMBRA
3. AC COMMUTATOR MOTORS – Taylor

Course Code: 23VM209 Total Hours: 45 Hrs	CAD- Fusion 360	L	T	P	C
		-	-	3	3
Course Objectives	The objective of this course is to make students: 1. Understand Concept of CAD, Tool bars in CAD, coordinate system, snap, grid, and ortho mode 2. Understand Drawing commands – point, line, arc, circle, ellipse.				
Course Outcomes	Students after the completion of this course will be able to: 1. Familiarize with CAD system 2. Familiarize with orthographic Projections. 3. Design objects in 1st Angle Projection. 4. Model designs using 3 Views.				

LIST OF EXPERIMENTS

INTRODUCTION TO CAD: Importance of CAD, menu selection, begin new drawing, editing existing practice simple drawing, Co-ordinate system in CAD-absolute, relative and polar, Introduction to utility commands-Help, End, Quit, Save, Limits, Units-practice, Introduction to entity draw commands-Line, Point circles, Oops Undo, Copy, Move practice, Introduction to displaycommands-Zoom, Pan, Redraw-practice, Layers and its uses, Various file formats – export and import of files

ORTHOGRAPHIC PROJECTIONS CONTINUED: Exercises on drawing the 3 views of different types of objects in 1st angle projection

Text Books:

1. Auto CAD 2000: George Omura

LIST OF EXPERIMENTS

1. Try-square
2. Left Hand Knife Tool Grinding
3. Taper Plug Gauge
4. Stud
5. T-Nut
6. Channel Milling
7. Parallel Block Grinding
8. Tray
9. T – weld (Welding Exercise)

Text Books

DSU Work shop manual.

Course code: 23VM210 Total Hours: 60Hrs	Workshop Practice – II	L	T	P	C
		-	-	4	4

Course Objectives	The objective of this course is to: 1. Introduce and familiarize students with various materials such as mild steel, dowel, socket head cap screws, and galvanized iron sheets, emphasizing their properties and applications. 2. Develop proficiency in using a range of tools essential for machining and fabrication, including files, punches, cutting tools, hacksaws, hammers, drills, and reamers 3. Introduce and explain the role and usage of accessories such as drive plates, live and revolving centers, lathe dogs, chucks, and different types of cutting tools in machining processes. 4. Teach the usage and precision application of measuring instruments such as rulers, calipers, gauges, micrometers, and thread angle tools for accurate machining and fabrication.
Course Outcomes	Upon completion of this course, students shall be able to 1. Gain practical knowledge about the application, manipulation, and properties of various materials used in machining and fabrication processes. 2. Develop hands-on skills in using a variety of tools essential for machining, shaping, and fabricating different materials. 3. Acquire skills in utilizing accessories effectively, including drive plates, centers, chucks, and specialized cutting tools, enhancing precision in machining. 4. Develop the ability to accurately measure and assess dimensions, angles, and threads using various precision measuring instruments for machining and fabrication purposes.

1. Mild Steel, Dowel, SHCS – Socket Head Cap Screw GI (Galvanized Iron) Sheet.
2. Tools: Flat bastard file, Second cut flat file, Number punch ,Roughing tool, Knife tool ,Grooving tool Center drill, Tap set & wrench, Dot Punch, Center Punch, Hacksaw blade and frame, Hammer, Hand reamer ,Drill Bits
3. Accessories: Drive plate, Live and Revolving centers, Lathe dog, Jaw self-centering chuck, Drill chuck, 'V' thread cutting tool, Trapezoidal tool, Square thread cutting tool, Lathe dog
4. Measuring Instruments: Steel rule, Straight edge, Bevel protractor, Vernier calipers, Thread Angle Gauge, Thread Pitch Gauge, Internal Straight edge, Micrometer,
5. Machines: Try square, Center Lathe/ Bench Lathe, Drilling Machine, Vertical milling Machine, Surface Grinding machine

Text Books:

1. DSU Workshop manual.

Course code: 23VM211 Total Hours: 60Hrs	Wiring Practices and Simulation	L	T	P	C
		-	-	4	4
Course Objectives	The objective of this course is to: 1. Understand and use the Eagle software for electrical circuit and domestic wiring practices 2. Understand and use LTspice software to build electronics circuits and analyse the simulated output.				
Course Outcomes	Upon completion of this course, students shall be able to • Apply Eagle software for wiring practices. • Design the electrical circuit for any domestic wiring using Eagle Software. • Apply LTspice software to design an electronic circuit. • Perform circuit Analysis under different parameters using LTspice.				

1. Introduction and familiarization of Autodesk Eagle software,Addition of components into library of eagle software.
2. One Lamp One Switch and two lamp one switch. Series & Parallel Wiring and stair case Wiring.
3. Go-down wiring and Tube light wiring. Domestic house wiring (Tube Light, Fan, Lamp and PlugPoint)
4. Design a Domestic wiring for a Computer Laboratory. Three phase transformer connection.
5. Direct online starting of a 3-phase induction motor. Direct online starting of a 3-phase inductionmotor with reversal.
6. Introduction and familiarization of LT spice Software. Diode characteristics.
7. Clippers – Positive and Negative clipper. Clampers - Positive and Negative clipper.
8. Half wave rectifier. Center tapped full rectifier. Bridge Full wave rectifier. Analysis of Transistoramplifier.
9. Inverting Amplifier using Op-amp. Non – Inverting using Op-amp. Active low pass filter. Active Highpass filter.
10. Op-amp waveform generators - Sine wave generator, Square wave generator.

Text Books:

1. Electrical Wiring Residential by Ray C. Mullin and Phil Simmons
2. The LT Spice IV Simulator: Manual , Methods and Applications by Gilles Brocard
3. PCB Design using Eagle CAD by Zak Kemble.

SEM/YEAR : THIRD/SECOND
COURSE CODE : 23VM301
TITLE OF THE COURSE : DIGITAL ELECTRONICS

Course Objectives:

1. Understand number systems and codes and their application to digital circuits and
2. understand Boolean algebra, Karnaugh maps and its application to the design and
3. characterization of digital circuits.
4. Analyze a given combinational or sequential circuit using Boolean algebra as a tool
5. to simplify and design logic circuits.
6. Understand the logic design of programmable devices, including PLDs
7. Demonstrate various synchronous & Asynchronous counters and Universal Shift
8. Registers.

Course Outcomes:

1. Infer different Number systems, Codes, Logic Gates, Boolean laws and theorems.
2. Apply the knowledge of Boolean algebra to deduce optimal digital circuits.
3. Construct & Implement different types of combinational logic circuits using Logic gates
4. Develop and test different types of Sequential logic circuits using flip flops, counters
5. Design State Machines and sequence generators & sequence detectors
6. Modify traditional design techniques to yield innovative designs

MODULE-1

Introduction to Digital System, Difference between Analog and Digital Systems Logic Levels and Pulse Waveforms, Importance of digital circuits,Decimal, Binary, Octal, Hexadecimal Numbers 9's & 10's Complements - 1's & 2's Complements Conversion of Number Systems
BCD Code - Digital Codes – Weighted and Non-weighted Codes
Perform Arithmetic operations on all basic number system **[09 Hrs]**

MODULE-2

Inverter, AND, OR, NAND, NOR, EX-OR, EX-NOR gate
Universal Property of NAND & NOR
Boolean Operations, Logic Expression
Rules and Laws of Boolean Algebra
De Morgan's Theorem
Simplifications of Boolean Expressions-- Karnaugh Map of 2Varible,3 Variable & 4 Variable

QM/ Tabular Method for Boolean Simplification [09 Hrs]

MODULE-3

Combinational logic: Half and Full Adders, Applications
Explain the Concept, comparison and Applications of Serial adders & Parallel adders
Explain the Concept of Magnitude Comparators (1 bit, 2 Bit & 4 Bit comparator)
Explain the Concept of Decoder, Encoder & code conversion circuits
Multiplexers **(1:N MUX)** and De multiplexers/**Decoder(N:1), Boolean Simplification using MUX, Encoders**
Parity Generators and Checkers –Even & odd Parity
Operating Characteristics & Applications of Flip Flops
Sequential Circuits clock & explain the types of triggering
Latches & Flip Flops – Different Types of Flip Flops
Operation of R-S, D, J-K& T Flip flop, **Flip flop conversion**
Positive & Negative edge triggered Flip flop & Importance of synchronous and asynchronous signals

MODULE- 4

Types of Registers - SISO, SIPO, PISO, PIPO and application
Bidirectional Shift Registers, Introduction to IC Shift Registers
Shift Register Counters-Ring Counter & Johnson Counter with timing diagrams & application

Introduction to Counters & Modulus of a counter
Asynchronous Counters
4- Bit binary counter using IC 7493/IC 74293 Decade counters using IC 7490/IC 74290
MOD-N counters using flip flop
4-bit Synchronous counters - using flip flop.
Synchronous counters using IC 74161
Up/Down Counters – Synchronous & asynchronous
Counter Design
Applications of counters **[09 Hrs]**

MODULE-5

Introduction to PAL, PLA, PROM, Implementation of Boolean expressions, VHDL description of combinational networks, Modeling flip-flops using VHDL, VHDL models for a multiplexer, Compilation and simulation of VHDL code, Modeling a sequential machine, Variables, Signals and constants, Arrays, VHDL operators, VHDL functions, VHDL procedures, Packages and libraries, VHDL model for a counter. **[09 Hrs]**

Text Books:

1. Digital Design – Morris Mano, PHI, 3rd Edition, 2006.
2. Fundamentals of Logic Design – Charles H. Roth, Thomson Publications, 3rd Edition.1998.
3. The Designer's Guide to VHDL, Third Edition (Systems on Silicon) 3rd Edition

Reference Books:

1. Switching & Finite Automata theory – Zvi Kohavi, TMH, 2nd Edition
2. Modern Digital Electronics by RP Jain, TMH.
3. **E-course**: https://www.udemy.com/course/vhdl-and-fpga-development-for-beginners-and-intermediates/

SEM/YEAR : THIRD/SECOND
COURSE CODE : 23VM303
TITLE OF THE COURSE : CONTROL SYSTEMS

Course Objectives:

1. Understanding types of control systems and block diagram of an open loop and closed loop control systems
2. Modeling and transfer function evaluation of control system elements and components
3. Modeling and analysis of speed control and velocity control servo system

Course Outcomes:

1. Identify open and closed loop control system
2. Formulate mathematical model for physical systems
3. Simplify representation of complex systems using reduction techniques.
4. Analyze performance characteristics of system using Frequency response method

MODULE-1 [08 Hrs]

Introduction to Control System

Control System - System Definition, Control System Definition, Difference between System & Control System, Control System Classification, Examples, Advantages & Disadvantages, Basic Elements of Closed Loop Control System and Difference between Open Loop & Closed Loop Control System. Transfer Function of Control System & Feedback Types Mathematical modeling of a System. Translational Mechanical system and Basic elements, Translational motion in mechanical System, Mathematical modeling of a Translational System. Rotational Mechanical system and Basic elements, Rotational motion in mechanical System, Mathematical modeling of a Rotational System.

MODULE-2 [08 Hrs]

Components of Control System

Introduction to Control System Components - Block diagram of Closed loop control system - Basic components of closed loop control system - Devices used for Control system Components. Controllers in Control System - Function, Uses, Types & Advantages

MODULE-3 [08 Hrs]

Time response analysis- Transient Response, Steady State Response, Test signals, Response of First Order System, Response of Second Order System, Time Domain Specifications. Steady State Errors-Definition, Steady State Errors for Unity Feedback Systems Stability - Definition of Stability, Analysis of Stable, Unstable, Critically stable and Unconditionally stable. Relative stability, Stability relationship with poles. Frequency response analysis - Introduction, Frequency domain specifications, Methods of Frequency Response Analysis in Control system, Stability Analysis using Bode Plots

MODULE -4 [06 Hrs]

Basics of Process Control and Control methods - Introduction to Process Control, Terms and definitions of Process control and Control methods - Cascade control & Feed forward Control. Adaptive Control System - Introduction, Definition of Adaptive Control Machining, and Functions of Adaptive control system. Computerized Process Control - Role of Computer in measurement and Process control, Basic Components of Computer based measurement and Control System, Case Study, Types of Computerized Process Control & Advantages of Computers in Measurement and Control.

Text Books:

1. Control systems, A Nagoor Kani, (RBC Publishers-First Edition)
2. Computer Control of Manufacturing Systems, Yoram Korner, (TATA McGRAW-Hill- 2005 Edition)

Reference Books:

1. Process Control Instrumentation Technology, Curtis D. Jhonson, (PEARSON Education - Seventh Edition)
2. Control Systems Principles and Design, M. Gopal, (TATA McGRAW-Hill)

SEM/YEAR : THIRD/SECOND
COURSE CODE : 23VM302
TITLE OF THE COURSE : COMPUTER PROGRAMMING – C,C++

Course Objectives:

1. Acquire the knowledge about computer hardware and software.
2. Learn the problem solving techniques.
3. Gain knowledge in C and C++ programming.
4. Gain knowledge in implementing Data Structure using C

Course Outcomes:

1. Demonstrate the basic knowledge of computer hardware and software.
2. Ability to write algorithms for solving problems in C and C++.
3. Ability to draw flowcharts for solving problems in C and C++
4. Ability to select the data structures that efficiently model the information in a problem.
5. Ability to assess efficiency trade-offs among different data structure implementations or combinations.

MODULE-1 [09 Hrs]

Introduction to Computing – Computer Systems-Hardware and Software, Computer Languages, Algorithm, Flowchart, Representation of Algorithm and Flowchart with examples. Introduction to C– History of C, Features of C, Structure of C Program, Character Set, C Tokens-Keywords, Identifiers, Constants, Variables, Data types, Operators.

MODULE-2 [09 Hrs]

Selection statements (Decision Making), Repetition statements (loops), Unconditional statements, Functions, Arrays, Strings, Pointers, Structures

MODULE-3 [09 Hrs]

Object oriented Programming, Functions, Class and destructor, Operator overloading and Type Conversion

MODULE- 4 [09 Hrs]

Inheritance and polymorphism, **Console IO operations, Working with files**

MODULE-5 [09 Hrs]

Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks-Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

Text Books:

1. Let Us C - Yashvant Kanetkar, BPB publications, 16th Edition, 2017
2. Object-Oriented Programming with C++ - Balaguruswamy, McGraw-Hill, 4th Edition, 2008.
3. Data structures, Algorithms, and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.

Reference Books:

1. The C Programming Language - Brian W. Kernighan / Dennis Ritchie, PHI publications, 2nd Edition, 2105
2. Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010
3. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI.

SEM/YEAR : 3rd SEM
COURSE CODE : 23VM304
TITLE OF THE COURSE : INDUSTRIAL ELECTRONICS

Course Objectives:

1. Design and troubleshoot circuits for demagnetizing inductors with switch.
2. Selections of Power switch for a given application.
3. To understand the working of Drive Circuits
4. To understand the working and specifications of UPS Analyze and evaluate performance parameters of AC and DC motors.

Course Outcomes:

1. The student will have an in-depth understanding of the theory of electrical energy conversion using power electronic systems
2. Understanding the applications within renewable energy, energy saving and industrial applications.
3. Discuss the device properties and its working principle.

MODULE-1 [10 Hrs]

Introduction to Industrial Electronics

Introduction Power Electronics Vs. Linear Electronics. Scope & Applications of industrial electronics. POWER DIODE - Construction, Operation, Characteristics. IGBT - Construction and working.

Introduction to Thyristor Family

SCR – Construction, Operation, Characteristics, Triggering and commutations methods.GTO - Construction and working, TRIAC - Construction and working. Introduction to new members of the family, SUS – Silicon Unilateral Switch and SBS – Silicon Bilateral Switch RCT – Reverse conducting Thyristor and LASCR – Light Activated Silicon Controlled Rectifier, SITh or SITS-Static Induction Thyristor and MCT – MOS Controlled Thyristor.

MODULE-2 [10 Hrs]

Control of DC Drives And AC Drives

Introduction to DC Drives: Need of Drives, DC Machine basic equations, Braking modes of DC drives, Speed control methods for DC Machines. Types of DC drives Single phase DC motor drives. Three phase DC motor driver Chopper drives, Closed loop control of DC drives, PLL control of DC drives, Microcomputer control of DC drives

Introduction to AC drives: Introduction to AC Motor drives, Advantages and dis-advantages of AC Drives, Torque - speed characteristic of induction motor, Speed control of induction motor - Stator voltage control, Variable frequency control, Rotor resistance control, Slip power recovery scheme.

MODULE-3 [10 Hrs]

Programmable Logic Controller

Evolution – advantages over relay logic, Introduction to PLC – Relays, Block diagram of PLC - PLC Programming Languages - Arithmetic Functions – (add, sub, mul, div,) – Comparison of functions- Basics of Input and output module (digital input and output module) - Logic functions- AND logic, OR logic, NAND logic, EX-OR logic -symbols used in ladder logic diagram.

Text Books:

1. James T Homphires & Lestie P Sheets, "Industrial electronics", P sheets publications.
2. M H Rashid "Power Electronics Circuits Devices & applications", Pearson publications.
3. Programmable Logic Controllers - "Frank D Petruzela" PHI publications.

Reference Books:

1. Industrial & Power Electronics By Harish C Rai, Umesh Publication, 5 th Edition 1994
2. Programmable Logic Controllers – Principles and applications - John W. Webb. Ronal A.Reis PHI publications 2017
3. Programmable Logic Controller –Pradeep Kumar & Srivashtava- BPB Publications

SEM/YEAR : THIRD/SECOND
COURSE CODE : 23VM305
TITLE OF THE COURSE : MECHANICS OF MACHINES

Course Objectives:

1. To make the student familiar with commonly used mechanism for industrial application.
2. Understand the fundamentals of the theory of kinematics of machines
3. Understand techniques for studying motion of machines and their components.

Course Outcomes:

1. Identify mechanisms in real life applications
2. Perform kinematic analysis of simple mechanisms.
3. Knowledge on different types of Drives, Gears

MODULE-1 [10 Hrs]

Introduction to Simple Machines

Definitions – Work, Energy, Load, Effort, Mechanical advantages, Work Input and Output, Efficiency, Velocity ratio. Simple Machines – Introduction to simple machines, Types of simple machines and example. Lifting machines – Introduction to lifting machines, Law of a lifting machines, Types of lifting machines. Simple Screw Jack – Definitions, Principle, Applications and calculations on velocity ration, Mechanical advantages and efficiency

MODULE-2 [10 Hrs]

Basics of Kinematics, Mechanism of Machines

Introduction to theory of machines, Difference between machine and machine Structure. Kinematic Link – Introduction to Kinematic link, Types of Kinematic links. Kinematic Pairs - Introduction to Kinematic Pairs, Types of Kinematic Pairs.
Kinematic Chain - Introduction to Kinematic chain, Types of Kinematic chains.
Intermittent Motion Mechanisms – Geneva wheel Mechanism, Ratchet and Pawl Mechanism. Mechanism used to convert rotary motion to linear motion.

MODULE-3 [10 Hrs]

Drives

Flat Belt – Materials for flat belt, Applications of flat belts, Speed ratio and RPM calculations of flat belt drives, Care and Maintenance of flat belts.
V-Belt drives – Types of V- Belt, Specification and Applications, Speed ratio and RPM calculations of V-belt drives, Care and Maintenance of V-belts.
Introduction to chain drives, Types, specification and applications of chains and sprockets.
Introduction to Gears, Types of Gears – Spur, Bevel, Helical, Rack & Pinion, Worm wheel.

Text Books:

1. Theory Of Mechanisms And Machines C. S. Sharma, Kamlesh Purohit PHI Learning Pvt. Ltd
2. Mechanics of Machines viswanatha RamamurtI CRC Press

Reference Books:

1. Theory of machines and mechanisms Joseph Edward Shigley Pearson
2. Theory of Machines R.S Khurmi and J.S Gupta S.Chand Publications

SEM/YEAR : THIRD/SECOND
COURSE CODE : 23VM308
TITLE OF THE COURSE : DIGITAL ELECTRONICS LAB

Course Objectives:

1. Know the fundamentals of Boolean algebra and theorems, Karnaugh maps including the minimization of logic functions to SOP or POS form and analyze logic to minimize gate count, signals, IC count or time delay.
2. Strengthen the principles of logic design and use of simple memory devices, flip-flops, and sequential circuits.
3. Infer the logic design of programmable devices, including PLDs.
4. Fortify the documentation standards for logic designs, standard sequential devices, including counters and registers.

Course Outcomes:

1. Minimize logic functions to SOP or POS form and Implement practically using basic gates.
2. Design simple combination logic and experiment using logic gates.
3. Conduct practical experiments to implement design of complex combinational logics.
4. Verify functioning of sequential elements like flip flops,
5. Design counters and implement practically.
6. Design and implement sequence generator
7. Training on usage of Digital trainer boards

LIST OF EXPERIMENTS

Note: Use discrete components to test and verify the logic gates.

1. Study of simple logic gates (IC 7400, 7402, 7404, 7432, 7486)
2. Simplification, realization of Boolean expressions using logic gates/Universal gates
3. Realization of Half/Full adder and Half/Full Subtractors using logic gates and **parallel**
4. adder/Subtractors using 7483 chip
5. BCD to Excess-3 code conversion and vice versa.
6. Realization of Binary to Gray code conversion and vice versa.
7. Design of decoders, encoders and priority encoders and function table verification
8. Verification of the functioning of Multiplexer and De-multiplexers and **Boolean function Implementation**
9. Realization of One/Two bit comparator and study of 7485 magnitude comparator
10. Truth table verification of **Flip-Flops along with Asynchronous inputs: (i) JK Master slave (ii) T type and (iii) D type.**
11. Realization of 4 bit counters as a sequential circuit and MOD – N counter design.
12. Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S195.
13. Wiring and testing Ring counter/Johnson counter.

SEM/YEAR : THIRD/SECOND
COURSE CODE : 23VM306
TITLE OF THE COURSE : COMPUTER PROGRAMMING C AND C++ LAB

Course Objectives:

1. Develop modular, efficient and readable C and C++ programs by hands-on experience.
2. Interpret good profound knowledge in C and C++programming language and enable them to build programs using operators, control structures, arrays, strings, functions, pointers and structures to solve the real world problems. .

Course Outcomes:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems related to Computer Science and Engineering.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems related to Computer Science and Engineering and reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems related to Computer Science and Engineering and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

List of Experiments

1. Write a C program to check whether a number is even or odd using ternary operator.
2. Write a C program to perform the addition of two numbers without using + operator.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to count and display positive, negative, odd and even numbers in an array.
6. Write a C program to print the transpose of a given matrix using function.
7. Create a Book structure containing book_id, title, author name and price. Write a C program to pass a structure as a function argument and print the book details.
8. Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.
9. Write a C++ program to read the data of N employee and compute Net salary of each employee (DA=52% of Basic and Income Tax (IT) =30% of the gross salary).

10. Write a C++ program to use scope resolution operator. Display the various values of the same variables declared at different scope levels.

11. Write a C++ program to create multilevel inheritance.

12. Write a C++ program to use pointer for both base and derived classes and call the member function. Use Virtual keyword.

13. Write a C program that uses stack operations to convert a given infix expression into its postfix equivalent. Implement the stack using an array.

14. Write C programs to implement a double ended queue ADT using

    i. array and
    ii. doubly linked list respectively

15. Write a C program that uses functions to perform the following:

    i. Create a singly linked list of integers.
    ii. Delete a given integer from the above linked list.
    iii. Display the contents of the above list after deletion.

a) Write a C program that uses functions to perform the following:

    i. Create a doubly linked list of integers.
    ii. Delete a given integer from the above doubly linked list.
    iii. Display the contents of the above list after deletion.

SEM/YEAR : III SEM
COURSE CODE : 23VM309
TITLE OF THE COURSE : Industrial Electronics Lab

Course Objectives:

1. To teach fundamental principles of thyristor family.
2. To develop an overall approach for students from construction of control rectifier, inverter, choppers, study its specification, the functionality, design and practical applications
3. To become familiar with power devices and their application in various fields
4. Learners are expected to understand various controllers, converters, inverters and choppers.

Course Outcomes:

1. Demonstrate an understanding of fundamentals of thyristor family.
2. Analyze the various applications and circuits based on thyristor.
3. Build and test circuits using power devices such as SCR, IGBT and UJT.
4. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters, how to analyze these inverters and some basic application examples.

LIST OF EXPERIMENTS

Note: Last 5 experiments will be executed by PLC Software using Ladder diagram.

1. Familiarization of digital oscilloscope.
2. General Design and winding of an inductor.
3. General Magnetization and demagnetization of L load using diode and resistor.
4. Reverse recovery characteristics of power diode.
5. VI characteristics of IGBT, SCR and TRIAC.
6. Resistance triggering of SCR and RC triggering of SCR.
7. UJT as a relaxation oscillator and Chopper fed DC motor driver.
8. Case study of Half bridge converter and Full bridge converter.
9. Case study of buck converter and boost converter.
10. Design a PLC Program for the following condition Switch– ON Light – Glows.
11. Design a program DOL Starter for motor. Design a program for forward – Reverse – stop with mutual interlock.
12. Design a program for motor start & stop by using Set & Reset Function
13. Design a program for switching on & off of light using Flip-flop.
14. Design a program for Basic Gates (AND, OR, NOT, NAND, NOR, Ex-or and Ex-Nor Gate).
15. Draw a program file for following expression (L+M+N) + (Q.R) R = S

SEM/YEAR : III SEM / II
COURSE CODE : 23VM307
TITLE OF THE COURSE : PCB DESIGN AND FABRICATION LAB

Course Objectives:

1. Understand the need for PCB Design and steps involved in PCB Design and Fabrication process
2. Familiarize Schematic and layout design flow using Electronic Design Automation (EDA) Tools

Course Outcomes:

1. Understand the steps involved in schematic, layout, fabrication and assembly process of PCB design.
2. Design (schematic and layout) PCB for analog circuits, digital circuits and mixed circuits
3. Design (schematic and layout) and fabricate PCB for simple circuits.

LIST OF EXPERIMENTS

1. Basics of eagle software.
2. Properties of copper clad laminates
3. Layout general rules & parameters
4. Pcb layout design
5. Design a pcb layout for the 5v power supply circuit
6. Design a pcb layout for the given multi-vibrator circuit.
7. Design the pcb layout for automatic street light circuit
8. Design a pcb layout for the given tone generator circuit
9. Design a pcb layout for the given ir sensor circuit
10. Design a pcb layout for the given remote control receiver circuit
11. Design a plc program for the following condition switch– on light – glows.
12. Layout planning
13. Photo printing
14. Plating
15. Etching
16. Multilayer pcb

Audit Course

SEM/YEAR	**:**	**III SEM / II**
COURSE CODE	**:**	**23AU0001**
TITLE OF THE COURSE	**:**	**ENVIRONMENTAL STUDIES**

Course Objectives:

1. Recognize concepts in environmental sciences
2. Demonstrate the understanding of the environment.
3. Demonstrate the knowledge of social responsibility

Course Outcomes:

1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. Demonstrate ecology knowledge of a complex relationship between predators, prey, and the plant community.
4. Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues.

MODULE-1

Environment, Components of Environment Ecosystem- Types & Structure of Ecosystem, Balanced ecosystem Human Activities, Food, Shelter, and Economic and Social Security. Impacts of Agriculture and Housing Impacts of Industry, Mining and Transportation Environmental Impact assessment, Sustainable Development.

MODULE-2

Natural Resources, Water resources and Energy-Availability and Quality aspects, Water borne diseases and water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles, Carbon Cycle, Nitrogen Cycle and Sulphur Cycle.

Energy: Different types of energy, Conventional sources and Non-Conventional sources of energy, Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass and Biogas Fossil Fuels, Hydrogen as an alternative energy.

MODULE-3

Environmental Pollution and Global Environmental Issues- Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. Global Environmental Issues: Population Growth, Urbanization, Land Management, Water and Waste Water Management.

MODULE-4

Air Pollution, Automobile Pollution and Waste Management - Definition, Effects, Global Warming, Acid rain and Ozone layer depletion, controlling measures. Waste Management, E - Waste Management and Biomedical Waste Management, Sources, Characteristics and Disposal methods.

MODULE-5

GIS, Environmental Acts and Regulations-Introduction to GIS & Remote sensing, Applications of GIS and Remote Sensing in Environmental Engineering Practices.
Environmental Acts and Regulations, Role of government, Legal aspects, Role of Non-governmental Organizations (NGOs), Environmental Education and Women Education.

Text Books:

1. Benny Joseph, "Environmental Studies", Tata McGraw – Hill Publishing Company Limited, 2005.
2. R.J. Ranjit Daniels and Jagadish Krishnaswamy, (2009), "Environmental Studies", Wiley India Private Ltd., New Delhi.

Reference Books:

1. Raman Sivakumar, "Principals of Environmental Science and Engineering", Second Edition, Cengage learning Singapore, 2005.
2. R Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford University Press, 2005,
3. Aloka Debi, "Environmental Science and Engineering", Universities Press (India) Pvt. Ltd. 2012.

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 23VM401
TITLE OF THE COURSE : MICROCONTROLLERS & APPLICATIONS

Course Objectives:

1. Familiarization of Micro controller
2. Describe architecture & Instruction set of 8051
3. Understand the programming and Applications of 8051

Course Outcomes:

1. Students can analyze Micro controller
2. Write assembly language coding with the help of instruction set
3. Write programming for various application.

MODULE-1

Introduction to Microprocessors & Microcomputers, Evolution of Microprocessors, Introduction to Microcontrollers, Microcontroller Survey, Comparison of Microprocessors & Micro

Basic memory storage element, 4x8 Bit Register, R/W Memory Model, ROM Memory Model Memory Map and Addresses, Memory Classification, Memory Decoding, RISC & CISC CPU Architectures, Harvard & Von-Neumann CPU architecture, Stacks.

MODULE-2

Functional Pin Description & Architecture of 8051, I/O ports, Memory organization, 8051 addressing modes Instructions set, Assembler directives,8051 assembly language programming and Time delay calculations, Software simulators of 8051, Introduction to Keil Compiler

MODULE-3

8051 Timer/counter, Serial communication Interrupts of 8051

MODULE-4

Square wave generator, Rectangular wave generator, Staircase ramp generator, Temperature controlling system using 8051 , DC Motor Control, Stepper Motor Control, Interfacing 8051 to LCD

MODULE-5

Arduino Microcontroller

Fundamentals of Embedded system, Getting Started with Arduino Exploring the Board of IDE (with its installation procedure). Interfacing with Arduino: Control LEDS from GPIO Pins, Input-Switch Buttons, DC Motor, Stepper motor, Relay, Sensor Interface: LDR, Analog POT, LM35 and Serial Communication

Text Books:

The 8051 micro controller architecture, programming & applications - Kenneth.J.Ayala

Reference Books:

The 8051 micro controller & embedded systems - M.A.Mazidi

SEM/YEAR : FOURTH
COURSE CODE : 23VM403
TITLE OF THE COURSE : PYTHON PROGRAMMING

Course Objectives:

1. Understand the need of python programming
2. Understand data collection using python
3. Understand Functions in python
4. Ability to do programming in python

Course Outcomes:

1. Understand the advantage of python in various fields.
2. Can to analysis on various data collection using python
3. Can create his own Functions in python
4. Can to do programming in python for his own application

MODULE-1

Introduction to Python Programming Language:

- Strengths
- Naming Conventions,
- String Values,
- String Operations,
- String Slices,
- String Operators,
- Numeric Data Types,
- Conversions,
- Built in Functions

MODULE-2

Data Collections and Language Component:

- Introduction,
- Control Flow and Syntax,
- Indenting,
- The if Statement,
- Relational Operators,
- Logical,
- Operators,
- True or False,
- Bit Wise Operators,
- The while Loop,
- The for Loop, Lists,
- Tuples,
- Sets,
- Dictionaries,

MODULE-3

Object and Classes:

- Classes in Python
- Principles of Object Orientation
- Creating Classes
- Instance Methods
- File Organization
- Special Methods
- Class Variables
- Inheritance
- Polymorphism
- Type Identification
- Custom Exception Classes

MODULE-4

Functions

- Introduction
- Defining Your Own Functions
- Parameters
- Function Documentation
- Keyword and Optional Parameters
- Passing Collections to a Function
- Variable Number of Arguments
- Passing Functions to a Function
- Mapping Functions in a Dictionary

MODULE-5

I/O and Error Handling in Python:

- Introduction
- Data Streams
- Creating Your Own Data Streams
- Access Modes
- Writing Data to a File
- Reading Data From a File
- Additional File Methods
- Using Pipes as Data Streams
- Handling IO Exceptions
- Working with Directories
- Metadata
- Errors
- Run Time Errors
- The Exception Model
- Exception Hierarchy
- Handling Multiple Exceptions

Text Books:

1. Kuhlman, Dave. *A python book: Beginning python, advanced python, and python exercises*. Lutz: Dave Kuhlman, 2009.

Reference Books:

1. Python Crash Course: A Hands-On, Project-Based Introduction to Programming (2nd Edition)

SEM/YEAR	**:**	**FOURTH**
COURSE CODE	**:**	**23VM402**
TITLE OF THE COURSE	**:**	**MEMS**

Course Objectives:

1. Understand the MEMS fundamentals
2. Understand the MEMS fabrication technology
3. Understand Packaging
4. Understanding Micro sensors and actuators

Course Outcomes:

1. Analyze MEMS fabrication technology.
2. Analyze the various Packaging technology
3. Application of MEMS in various fields.

MODULE-1

Overview and Introduction

New trends in Engineering and Science: Micro and Nanoscale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Microelectromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals

MODULE-2

Mems Fabrication Technologies

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology;

MODULE-3

Packaging

Microsystems packaging, Essential packaging technologies, Selection of packaging materials

MODULE-4

Micro Sensors

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor

MODULE-5

Micro Actuators

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators

References:

1. Marc Madou, “Fundamentals of Microfabrication”, CRC press 1997.
2. Stephen D. Senturia,” Micro system Design”, Kluwer Academic Publishers,2001
3. Tai Ran Hsu ,”MEMS and Microsystems Design and Manufacture” ,Tata Mcraw Hill, 2002.
4. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006,
5. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures” CRC Press, 2002

SEM/YEAR	**:**	**FOURTH**
COURSE CODE	**:**	**23VM404**
TITLE OF THE COURSE	**:**	**PLC**

Course Objectives:

1. Understand the PLC fundamental
2. Understand the PLC hardware component
3. Understand programming concept in PLC

Course Outcomes:

1. Analyze hardware component in the PLC
2. To do programming in PLC

MODULE-1

PLC BASICS
Introduction to PLC,
Overall look inside PLC
BASIC PLC PROGRAMMING
General PLC programming procedure and I/O devices
On/Off inputs and On/Off outputs
Relation between digital gates & coil/contact logic
Creating ladder diagrams for process control

MODULE-2

BASIC FUNCTIONS
Registers basics
Timer functions
Counter functions
INTERMEDIATE FUNCTIONS
Arithmetic functions
Number comparison functions
Number conversion functions

MODULE-3

DATA HANDLING FUNCTION
PLC SKIP & MASTER CONTROL RELAY functions
JMP instruction
Data Movement instruction
Other Functions
Digital bit functions & their applications
Sequencer functions
Robot control with PLC

MODULE-4

ADVANCED PLC FUNCTIONS
Analog input & output functions
Networking PLC –Profibus
Troubleshooting PLC

MODULE-5

Introduction to HMI,SCADA
Introduction to HMI
Introduction to SCADA

Reference Books:

1. Programmable Logic Controllers: Principles and Applications
2. Introduction to Programmable Logic Controllers

SEM/YEAR : FOURTH
COURSE CODE : 23VM405
TITLE OF THE COURSE : MEASURING SYSTEMS

Course Objectives:

1. To get an overview of various industrial instrumentation and its utility
2. To understand various sensors/transducers
3. To understand different electrical/electronics measuring instruments

Course Outcomes:

1. Understand various industrial instrumentation and its utility
2. Analyze various sensors/transducers
3. Analyze different electrical/electronics measuring instruments

MODULE-1

Definition of measuring system.
Measurement system and its constituent elements.
Sensors and transducers.
Performance Terminology.
Static and Dynamic characteristics
Electronic instrumentation
V-F Converter
F-V Converter

MODULE-2

Introduction to Temperature Measurement
Non electrical type temperature sensor: Bimetallic Strip.
Electrical type temperature sensors: Thermistor, RTD, Principles, Types,
Selection of RTD's and signal conditioning circuits.
Thermocouples, Principle, Types, Selection, Standard table of
Thermocouples and signal conditioning circuits
Measurement of temperature using Diodes
IC temperature Transducer using LM35 and AD590

MODULE-3

Introduction to pressure measurement.
Pressure Standards.
Conventional Pressure sensors.
Electrical and Electronic pressure transducers.
Introduction to Calibration and Calibration of Pressure Gauge

MODULE-4

Introduction to displacement measurement.
Potentiometer Sensor, Types, Construction, Operation and Errors.
LVDT, Principle, Operation and Application
Inductive Proximity Switch
Digital Encoder: Contact, Magnetic and Optical Encoder
Rotational Displacement/Angular position: Using optical Encoder and
Signal Conditioning circuits.

MODULE-5

Introduction to force, weight and flow measurement. Strain gauge and its function, Load Cell, principle and operation of load cell. Flow measurement using Orifice plate.Introduction, mechanical tachometers, electrical tachometers, types like contact less, frequency type. Basic Ultrasonic Transmission Link, piezoelectric, ultrasonic transmitter and receiver, principle and example.

Reference Books:

1. Principle of measurement systems 2000 JP Bentlley Addision Wesley
2. Instrumentation and Control system Bhasker, Anuradha Agencies

SEM/YEAR	**:**	**FOURTH**
COURSE CODE	**:**	**23AU0002**
TITLE OF THE COURSE	**:**	**CONSTITUTION OF INDOA & PROFESSIONAL AND ETHICS**

Course Objectives:

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications

Course Outcomes:

1. Have general knowledge and legal literacy and thereby to take up competitive Examinations
2. Understand state and central policies, fundamental duties
3. Understand Electoral Process, special provisions
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Engineering ethics and responsibilities of Engineers.
6. Have awareness about basic human rights in India

Module-1

Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution, Preamble to the Indian Constitution Fundamental Rights & its limitations.

Module-2

Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties, Union Executives – President, Prime Minister Parliament Supreme Court of India.

Module-3

State Executives – Governor Chief Minister, State Legislature High Court of State, Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.

Module-4

Special Provision for SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions, Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India, Powers and functions of Municipalities, Panchayats and Co - Operative Societies

Module-5

Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility, Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering

Text Books:

1. Durga Das Basu 'Introduction to the Constitution of India' (Students Edn.) Prentice Hall EEE – 2001
2. 'Engineering Ethics' by Charles E Haries, Michael. S Pritchard and Michael J Robins Thompson Asia, 2003
3. Constitution of India & Professional Ethics by Raman & Yaji

Reference Books:

1. 'An Introduction to the Constitution of India' by M V Pylee, Vikas Publishing. 2002
2. Engineering Ethics _ by M Govindarajan, S Natarajan, V S Senthail Kumar, Prentice Hall of IndiaPvt Ltd. New Delhi, 2004
3. Brij Kishore Sharma, **"Introduction to the Constitution of India"**, PHI Learning Pvt.
4. Ltd., New Delhi, 2011.
5. Latest Publications of Indian Institute of Human Rights, New Delhi.

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 23VM406
TITLE OF THE COURSE : MICROCONTROLLERS & APPLICATIONS LAB

Course Objectives:

1. Understand programming in controller and interfacing

Course Outcomes:

1. Do programming in controller and interfacing

S. No	List of experiment
	Microcontroller 8051
1	Familiarization of Keil Compiler
2	Write a program to place the number 8Dh in RAM locations from 30h to 34h
3	Write a program to copy the contents of DPTR to registers R0 (DPL) & R1 (DPH)
4	Write a program to add two 8 bit numbers and store the result in RAM location 35h
5	Write a program to subtract the contents of RAM location 13h from the Ram location 2Bh put the result in RAM location 2Ch
6	Write a program to add two 16 bit numbers without carry and store the result in 30h(LSB) and 31h(MSB)
7	Write a program to exchange the contents of B register and RAM address 30h
8	Write a program to swap the bytes in timer 0.put TL0in TH0 and TH0 inTL0
9	Write a program to Double the number in register R2, and put the result in register in R3 (high byte) and R4 (low byte)
10	Write a program to add the unsigned numbers found in internal RAM locations 25h, 26h and 27h together and put the result in RAM locations31h (MSB) and 30h(LSB)
11	Write a program to multiply unsigned numbers in register R3 by the number in register in R4and put the result in external RAM locations 10h (MSB) and 11h (LSB).
12	Write a program to divide the data in RAM location 3Eh by the number 12h,put the quotient in R4 and the reminder in R5
13	rite a program to place any number in the internal RAM location 3Ch and increment it until the number equal 2Ah
14	Write a program to move a block of data from memory X to Y.
15	Write a program to find the factorial of the number stored in the internal RAM locations 30h.
16	Interfacing programs with 8051
17	LED & Switch Interfacing and display the status in LED
18	Seven segment display interface
19	Alpha numeric LCD interface
20	DC Motor Interfacing
21	Stepper Motor Interfacing
22	Waveform generation:- a) Square Wave b) Rectangular Wave
23	4x4 Matrix Keypad Interfacing
24	Interfacing of ADC

SEM/YEAR	**:**	**FOURTH / SECOND**
COURSE CODE	**:**	**23VM407**
TITLE OF THE COURSE	**:**	**PYTHON PROGRAMMING LAB**

Course Objectives:

1. Understand using list in python
2. Understand the instructions in python
3. Creating function using python
4. Understand inbuilt function in python

Course Outcomes:

1. Write a coding using list in python
2. Write instructions in python
3. Creating his own function using python
4. Use the inbuilt function in python to his application

List of Experiments:

1. Write python program to print Hello World
2. Write python program to Hello World using string variable
3. Write python program to store data in list and then try to print them.
4. Write python program to do basic trim and slice on string.
5. Write python program to print list of numbers using range and for loop
6. Write python program to store strings in list and then print them.
7. Write python program to find maximum number in the list
8. Write python program in which a function is defined and calling that function prints Hello World
9. Write python program using a function to print the square root of a number.
10. Write python program to find the exponentiation of a number.

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 23VM408
TITLE OF THE COURSE : PLC LAB

Course Objectives:

1. Understand automation and its importance
2. Understand working of PLC
3. Understand I/O modules of PLC

Course Outcomes:

1. Known the importance of automation in the field of interest
2. Implement the various task using PLC
3. Develop programming knowledge in PLC

List of Experiments:

Sl. No	List of Experiment
1	Basic Programming
2	Design a PLC Program for the following condition Switch ON Light – Glows Switch – OFF Light - Puts Off Design a program DOL Starter for motor. Design a program for forward – Reverse – stop with mutual interlock.
3	Design a program for forward – Reverse – stop with direct reversal.
4	Design a program for start – stop – jog. Design an Alarm system.
5	Design a program for motor start & stop by using Set & Reset Function
6	Design a program for switching on & off of light using Flip-flop
7	Design a program that there are three machines, each with its own start and stop functions, only one may run at a time Design a program that the circuit consist of two start and stop button, when any one button is pressed ,the motor runs , even it is released and the stop button is used to stop the motor
8	Design a program a) AND, OR and NOT gate. b) NAND and NOR gate. c) Ex-or and Ex-Nor Gate
9	Design a conveyer control system in which conveyer 'C' is to run when Any one of the 4 inputs is ON & it should stop when any one of the 4 other inputs are ON. Write a program that a fan 'P' will run the equation is getting satisfied. (I1) (I2+I3) (I5.I6) = P
10	Draw a program file for following expression (L+M+N) + (Q.R) R = S

SEM/YEAR : FOURTH / SECOND
COURSE CODE : 23VM409
TITLE OF THE COURSE : MEASUREMENT AND INSTRUMENTATION LAB

Course Objectives:

1. Understand the Procedure of System Measurement
2. Understanding the Use of sensors
3. Understand the concept of temperature control

Course Outcomes:

1. Analyze of various measuring instruments.
2. Use the sensor and measure various parameters
3. Use the various control for various application of interest.

LIST OF EXPERIMENTS:

Sl. No	List of Experiment
1.	Converters V to F Converter using ICL 8038 F to V Converter using LM2907
2.	Thermocouples & RTD Study of types of Thermocouple and characteristics of Thermocouple. Study of RTD and characteristics of RTD.
3.	Sensors Temperature sensing using Diodes. Using LM35 and AD590 as temperature sensor
4.	Temperature Controllers Study of ON OFF control using temperature controller using Thermocouple and RTD.
5.	Pressure gauges Finding error in the given pressure gauge with respect to Digital Gauge. Finding error in the given pressure gauge with respect to Dead Weight Tester.
6.	Measurement of displacement Measurement of Displacement using LVDT.
7.	Design of Counter Designing a counter circuit using Proximity Sensor.
8.	Measurement of load by using Load cell, a. Expansion Method b. Compression method.
9. 10.	Measurement of Speed a. Contact type (Tachometer) b. Non- Contact Type (Proximity Sensor & Stroboscope) Familiarization of Proximity switch- Familiarization of Inductive Proximity, Capacitive Proximity, IR and Reed Switch. Calibration Experiments

SEMESTER	**V**					
YEAR	**3rd**					
COURSE CODE	**23VM501**					
TITLE OF THE COURSE	**Embedded System and IOT**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/ Projects Hours**	**Total Hours**	**Credits**
	3	**-**	**-**	**-**	**45**	**3**

Perquisite Courses (if any)			
S. No	**Sem./Year**	**Course Code**	**Title of the Course**
1.	3rd/2nd	23VM301	Digital Electronics
2.	3rd/2nd	22VM303	Computer Programming - C, C++
3.	4th/2nd	23VM401	Micro-controller & Applications

Course Objectives:

1. Describe the architecture instruction set of PIC16F87X.
2. Describe an Embedded System
3. Describe IoT and providing knowledge in Programming

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Able to identify architecture and advanced features of embedded processors and micro-controllers	L1
CO2	Able to Understand architecture, instruction set and programming of advanced embedded processors and controllers.	L2
CO3	Able to solve specific real world applications by working with specific microprocessor / micro-controllers	L3
CO4	Able to Understand basic components and building blocks of Internet of Things	L2
CO5	Able to explain about IoT based communication protocols	L1

Course Content:

MODULE-1 **[09 Hrs]**

Introduction: Categories, Overview of embedded system architecture, Applications, Recent trends. Hardware architecture, software architecture. Special Features: Power on reset feature, Watch dog timer, SLEEP mode, Interrupt handling capability.

MODULE-2 [09 Hrs]

Introduction to Peripheral Interface Controller and its features. Pin diagram, Architecture, Memory organization. I/O Ports, Timers, Programming of PIC.

MODULE-3 [09 Hrs]

Introduction to Node MCU and its features, Pin configuration of NODE MCU, Introduction to Arduino and its features, Variables, Data Types Constants, Programming Structure, Programming Structure, Programming Structure, Serial Data Monitoring.

MODULE-4

Definition, Basic terminologies used in IoT, Components of IoT, Architecture of IoT, Four Stages of IoT Architecture, Industrial IoT – Process, Advantages and Applications

MODULE-5

Networking Layers and Protocols, Networking Layers and Protocols, MQTT, Comparison of MQTT with other protocols and PUB/SUB approach, Control the Interface through Mobile App Using Node MCU.

Text Books:

1. Embedded / Real-Time Systems: Concepts, Design and Programming K.V.K. Prasad Dream tech Press.
2. PIC Microcontroller and Embedded System: Using assembly and C for PIC 18 - Mazidim Muhammad Ali – Pearson.

References:

1. PIC Microcontroller and Embedded System: Using assembly and C for PIC 18 - Mazidi Muhammad Ali – Pearson.
2. The Fourth Industrial Revolution" by Klaus Schwab.

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM502**					
TITLE OF THE COURSE	**Product Design and Development**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/ Projects Hours**	**Total Hours**	**Credits**
	2		-	-	30	2

Perquisite Courses (if any)			
S. No	**Sem./Year**	**Course Code**	**Title of the Course**
1	Nil		

Course Objectives:

1. Introducing a learner or students to concepts of Engineering design
2. Introducing a learner or students to concepts of Product design and development according to the market need.

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understanding the basic theories in production planning in product development	L2
CO2	Imparting the knowledge of design thinking & innovation	L3
CO3	Applying design thinking knowledge to develop a prototype of an desired product	L3
CO4	Understanding Product Life Cycle in production planning	L3
CO5	Analysis of Product Design	L4

Course Content:

MODULE-1 **[06 Hrs]**

Design Process, Key Elements for Design, Bottom up and Topdown Design, Characteristics of Structural model – Hierarchy, Modularity, Regularity and Locality

MODULE-2 [06 Hrs]

Introduction to design thinking, Design Thinking Process, Emphasize, Define the Problem, Ideate, Develop Prototype, Test the Product, Case Studies.

MODULE-3 [06 Hrs]

What is a Product? Defining Product by Nature of Demand, New Product Strategy, Production Classification, Product Life Cycle and various stages of PLC, Managing Product Life Cycle.

MODULE-4 [06 Hrs]

Introduction toProductdesignpractice, Productstrategies, Timetomarket, Analysisofthe Product, The Three S's - Standardization, Simplicity and Specialization.

MODULE-5 [06 Hrs]

Plan and Define Program, Product Design and Development Verification, Process Design and Development Verification, Product and Process Validation.

Text Books:

1. Product design and process Engineering - Benjamin W. Nebel Alnab - Draper – McGraw Hill edn.

References:

1. Mechatronics: Electronics in Product and Process - Bradley Dawson, N C Burd A Loader

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM503**					
TITLE OF THE COURSE	**CNC Technology**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/ Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	30	2

Perquisite Courses (if any)			
S. No	**Sem/Year**	**Course Code**	**Title of the Course**
1	III/ II		Control System

Course Objectives:

- To gain knowledge in NC and CNC
- Gain knowledge in different types of cutting tool materials, holders, ATC

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understanding the introduction and classification of CNC	L2
CO2	Imparting the knowledge on various tools used in CNC	L3
CO3	Imparting the knowledge on manual operation	L3
CO4	Understanding Functions for Milling and Turning	L2
CO5	Analysis of Machine Maintenance and problems associated	L4

Course Content:

MODULE-1 **[06 Hrs]**

CNC: Introduction - Application - Advantages - Disadvantages - Development - Economy, Classification of CNC based on Feed Back control system. Open loop control system - Closed loop control system, Classification of CNC based on Motion control system - Point to Point - Straight cut - Contouring, Types of Spindle drive: AC Servo Motor - Special features of servomotor, Hydraulic drives, Types of Axis Drive – stepper motor – servo motor - Features of stepper motor, Friction reducing elements, Reciprocating ball bushes - Metallic and non-metallic guide ways - Spindle Bear- ing - Ball lead screw, Feedback devices,Machine Control Unit, Automatic Tool Changer, Automatic Pallet Changer, Automatic swarf removal mechanism, Tool and Work holding devices

MODULE-2 [06 Hrs]

CNC Turning Centre - Application of Face Tool, Turn Tool, Groove Tool, Bore Tool, Thread Tool, CNC Machining Centre - Application of End Mill cutter, Ball Nose Cutter, Slab Mill Cutter, Hollow Mill Cutter, Thread Mill Cutter, Face Mill Cutter, Dovetail Cutter, Special profile milling cutters

MODULE-3 [06 Hrs]

Manual Operating Mode, Jogging an Axis, Continuous Jog, Incremental Jog,Hand Pulse Generator (HPG) Jog, Arbitrary Angle Jog, Jog Offset, Resetting over travels, Mechanical Handle Feed, Removing an Axis, Manual Machine Homing.

MODULE-4 [06 Hrs]

Axis Nomenclature, Coordinate System, Tool Length Compensation, Cutter Radius Compensation, Preparatory and Miscellaneous Functions for Milling and Turning, Program Format, exercise on Part Programming in Milling and Turning.

MODULE-5 [06 Hrs]

Coolant - Function, Types and Application, Understanding and Responding to Alarms in CNC, Types of Machine Maintenance, Maintenance Tools and Accessories required for CNC Machine Main- tenance, Problems related to Mechanical Systems in CNC, Causes for the failure of Electronic System in CNC, Deviations from Normal Performance in CNC Machine, Backlash, Checklist for CNC Main- tenance, Best Maintenance Practices, Troubleshooting - Causes and Remedie.

Text Books:

1. Student Workbook for Programming of CNC Machines - KEN EVANS - Industrial Press Inc
2. CNC Programming Techniques: An Insider's Guide to Effective Methods and Applications -Peter Smid - Industrial Press Inc.

Reference Books:

1. CNC Programming Techniques: An Insider's Guide to Effective Methods and Applications - Peter Smid - Industrial Press Inc
2. CNC Machines - M.Adithan - B S Pabla - New Age International Publishers

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM504**					
TITLE OF THE COURSE	**Robotics**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	2	-	-	-	30	2

Perquisite Courses (if any)			
#	**Sem/Year**	**Course Code**	**Title of the Course**
1	I	23VM104	Electronics-1
2	II	23VM205	Mechanical Engineering

Course Objectives:

- Familiarization to industrial robot and its application.
- Familiarization to the robot programming language.
- Familiarization to Robot Maintenance Safety

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Gaining knowledge on introduction to robotics.	L1
CO2	Understand the mechanics of robotics.	L2
CO3	Learn about Robotic Programming Language	L3
CO4	Understand the applications of Robotics	L3
CO5	Design and analyze the robotics.	L4

Course Content:

MODULE-1 **[06 Hrs]**

Introduction to Robotics and Basic Structure, Laws of Robotics, Definition of Robot, Robot Component Recognition – Robot Arm, Robot Controller, End Effector, Robot Arm components, Robot Controller Components, Accessories and Input devices, Types of Robot, Selection of Robot- Payload, Speed, Reach, Parts of Industrial Robots, Links, Joints and Joints Notation Scheme, Degrees of Freedom, Required DOF in a Manipulator, Arm Configuration and Wrist Configuration, Work Cell, Work Envelope, and Work Volume, Robot End Effectors – Definition, Classification of End Effectors, Types of Grippers, Consideration in gripper selection and designing.

MODULE-2 [06 Hrs]

Introduction, link description, Joint link connection description, Kinematic modelling of manipulator, Direct and Inverse manipulator Kinematics, Manipulator dynamics, Trajectory planning – Basics, Robot Communication methods for I/O Interfacing, Robot Communication methods for I/O Interfacing.

MODULE-3 [06 Hrs]

Types of Programming methods, Types of Programming methods, Robot Programming Languages.

MODULE-4 [06 Hrs]

Industrial applications: Material Handling, Machining, Welding, Painting, Non-industrial applications

MODULE-5 [06 Hrs]

Introduction Risks specific to robots, General Robot maintenance ,Different start modes in Robot, Mastering of Robot

Text Books:

1. Introduction to Robotics: Mechanics and Control - John. J. Craig - Pearson Education India
2. Robotics: Beginner to Expert - Peter Mckinnon - Create Space Independent Publishing Platform

References:

1. Robotics and Control - RKMittal, I.J.Nagra - McGraw Hill Education - Peter Smid - Industrial Press Inc.
2. Industrial Robotics (Special Indian Edition) - Groover - Tata McGraw-Hill Education

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM510**					
TITLE OF THE COURSE	**Advanced PLC**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Perquisite Courses (if any)			
S. No	**Sem/Year**	**Course Code**	**Title of the Course**
1	IV	18VM412	Programmable logic Controllers

Course Objectives:

1. Familiarization with PLC Hardware & Troubleshoot the PLC connections
2. Understanding the various communication protocols in PLC
3. Understanding the concept of distributed control system.

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Familiarizing with PLC Wiring and Analog & Digital I/O	L2
CO2	Interfacing PLC to external devices using different Communication Protocols	L3
CO3	Understanding Trouble shooting of PLC Connection	L3
CO4	Understanding the Role of Distributed Control System in an industrial Process	L3
CO5	Apply the knowledge of Troubleshooting, Programming to design Distributed Control System	L4

Course Content:

MODULE-1 **[09 Hrs]**

Representing Analog signals with Binary Numbers, Bits and Bytes, A/D Converter, Resolution of Analog Signals, Analog Signal Range, Analog Input, Wiring of Analog Inputs, Voltage Analog Input Wiring, Current Analog Input Wiring, 3 2- Wire, 3- Wire and 4- Wire Analog Input, Analog Input Scaling, Analog Output, Wiring of Analog Outputs, Voltage Analog Output Wiring, Current Analog Output Wiring, Analog Output Scaling and Un-scaling.

MODULE-2 [09 Hrs]

ADVANCED PLC PROGRAMMING LANGUAGES – BASICS:
Types of PLC Programming, Functional Block Diagram (FBD)

PLC COMMUNICATION PROTOCOLS: PLC Communication Protocol and Types, Modbus RTU, Ethernet/IP and Ethernet TCP/IP, Mod- bus TCP/IP, Profibus and Profinet

MODULE-3 **[09 Hrs]**

PLC TROUBLE SHOOTING: Module Failure in the input and output I/O system, Electrical Noise Interference, Corrupted Memory, Power Problems, Communication Issues
HUMAN MACHINE INTERFACE – HMI
Introduction to MMI/HMI, Types of Operator Interface, Data handling with HMI, HMI Wiring Procedure, Configuration and Interfacing to PLC and HMI, Communication Protocols, Advantages and Applications of HMI

MODULE-4 [09 Hrs]

DISTRIBUTED CONTROL SYSTEM: Introduction, Architecture of DCS, Elements of DCS, Features of DCS, Comparison of PLC and DCS, Advantages and Applications of DCS

MODULE-5 [09 Hrs]

Advantages and Applications of DCS: Introduction, Role of SCADA in Automation, Difference between SCADA and HMI, Components of SCADA System – Field Instruments, Field Controllers (RTUs/PLCs), HMI, Network Connectivity, Data Base, SCADA Architecture, Types of SCADA System, Features of SCADA, Application Example of SCADA, SCADA Communication Protocol-IEC, Distributed Network Protocol (DNP3), OPC Communication.

Text Books:

1. Programmable Logic Controllers: Principles and Applications - John. Webb, Ronald.A. Reis - Prentice Hall India Learning Private Limited
2. Programmable Logic Controllers - Frank D Petruzella - McGraw - Hill Education

References:

1. Programmable Logic Controllers: Industrial Control - Khaled kamel - Mc Graw - Hill Education.

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM511**					
TITLE OF THE COURSE	**Process Control**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Perquisite Courses (if any)			
S.No	**Sem/Year**	**Course Code**	**Title of the Course**
1	III/ II	18VM311	Control System

Course Objectives:

- To Prepare the students/learner to understand how a Process is controlled in industries.
- To enable the students to understand the concept of instrumentation, various sensors and transducers used to control the process.
- Impart the knowledge of various controller.

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Interpret PLC architecture and configure DCS to handle local and distributed automation tasks	L3
CO2	Design and Conduct experiments, as well as analyze and interpret data	L3
CO3	Analyze Various types of Controllers to configure proper process control.	L4
CO4	Recommend necessary final control element for a given application.	L3
CO5	Design or configure various subsystems for industrial automation	L3

Course Outcomes:

MODULE-1 **[09 Hrs]**

Definition – Process – Functional block diagram of an Automatic process control system – Set point – Measured variable – Comparator – Error – Controller – Final control element. Controlled variable – Manipulated variable – disturbances –Advantages of Automatic control system – Simple Liquid level control system – Flow control system – Temperature control system with transportation Lag – Self Regulation – Capacitance and Capacity. Piping and Instrumentation flow Diagram (BIS standard) for the above system

MODULE-2 [09 Hrs]

Controller – Blockdiagram, Types, General properties– Reverse andDirect action, Controller modes – Discontinuous – On – Off Control with differential gap, without differential gap – Neutral zone– Continuous – Proportional controller – Proportional band (PB) – Effect of PB on a controller output – Offset –Integral control – PI – PD – PID – Definition, salient features, applications and limitations of the above controllers – Selection of control action – Electronic controllers – Error detectorTwo position controller – P,I,D,PI,PD, PIDcontrollers –reverse action – pneumatic controllers – Flapper– Nozzle mechanism, Pneumatic relay.

MODULE-3 [09 Hrs]

Concept of tuning – Criteria for controller tuning – Quarter decay ratio, IAE, ISE, ITAE – Methods of tuning – Open loop response method – Process reaction curve –Closed loop response method – Ultimate cycle method, Damped oscillation method.

MODULE-4 [09 Hrs]

Signal converters – P to I Converter, I to P Converter – Actuators – Electrical, Pneumatic, Hydraulic and Electro pneumatic – Valve Positioners – Control valve –Characteristics Quick opening, Linear, Equal percentage – Control valve sizing – Cv rating – Selection of a control valve – Effects of Cavitation and Flashing on control valveperformance

MODULE-5 [09 Hrs]

Cascade control system, Ratio control systems, feedforward control system, Comparison of feedback control system and feed forward control system. (One specific application for each of the above systems) – Introduction DCS and SCADA Block Diagram of Fuzzy logic controller – block diagram – typical application-washing machine.

Text Books:

1. Donald P Eckman, Process control,Wiely Eastern limited,1991
2. Peter Hariot, Process control,TataMcgraw Hill.

References:

1. George Stephanopoulos, Chemical process control.
2. B. SankaraGomathi, Process control (Principles and applications), J J Publications, 1981

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23AU0003**					
TITLE OF THE COURSE	**Kannada Kali - 1**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/ Projects Hours**	**Total Hours**	**Credits**
	2	-	-	-	20	-

Perquisite Courses (if any)			
S.No	**Sem/Year**	**Course Code**	**Title of the Course**
1	Nil		

Course Objectives:

1. To acquire the ability to communicate in Kannada with others
2. To acquire the ability to read the hoardings, notices etc.
3. To acquire the ability to translate Kannada words into English and vice versa.
4. To acquire the ability to write some simple letters

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Knowledge on introducing and enquiring in kannada	L2
CO2	Knowledge on basic kannada grammar	L2
CO3	Knowledge on kannada reading	L2
CO4	Knowledge on kannada spelling	L2
CO5	Knowledge on kannada writing	L3

Course Content:

MODULE-1 **[05 Hrs]**

Lesson-1: Introducing each other-Personal Pronouns, Possessive forms, Interrogative forms.
Lesson-2: Introducing each other-Personal Pronouns, Possessive forms, Yes/No type, Interrogation
Lesson-3: Absolute Ramayana. Possessive forms of nouns, dubietive question, Relative nouns
Lesson-4: Enquiring about a room for rent, Qualitative and Quantitative adjectives
Lesson-5: Enquiring about the college, Predicative forms, locative case

MODULE-2 [05 Hrs]

Verb-iru, negation-illa, non-past, no-past continuous, past tense, verbal principle, reflexive form, past and present perfect, past continuous and their negation

MODULE-3 [05 Hrs]

Karnataka(Lessonforreading),KannadaBhaashe(Lessonforreading),Manataruva Sangatialla(Lesson for reading), Beku Bedagalu(Lesson for reading).

MODULE-4 [03 Hrs]

Direct-Indirect Speech Vocabulary Usage Homonyms, Correcting Spelling, One-word Equivalents.

MODULE-5 [03 Hrs]

PrecisWritingEssay/Report Writing,Letter WritingPersonal, Official, ApplicationsIdioms Phrases Meaning Usage in sentences

Text Books:

1. SLN Sharma K Shankaranarayana "Basic Grammar", Navakarnataka Publications
2. Jones "New International Business English", published by Cambridge University Press

Reference Books:

1. G. Sankaran, "English Rank Scorer", Addone Publishing group, Thiruvanantapuram, Kerala
2. Wren Martin "English Grammar"
3. John Seely, "Oxford Guide to Speaking and Writing", 2000

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM505**					
TITLE OF THE COURSE	**Embedded System Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	-	3	-	45	3

Course Objectives:

1. Familiarization to Embedded Systems
2. Familiarization to Programming and Interfacing

Course Outcomes:

1. Understand the Embedded Controller
2. Understand basic concepts of Programming

LIST OF EXPERIMENTS

1. Write a program to place a number FFh in memory location 20h to 25 h
2. Write a program to add two 8-bit numbers without carry
3. Write a program to subtract two 8- bit numbers and store the result in memory location 25h
4. Write a program to shift an 8 {bit number to the left by two bits
5. Write a program to move a block of 05 numbers present in memory location 20h to 30h
6. Write a program to mask the lower four bits of an 8 {bit data present in memory location 25h'
7. Write a program to check the D3 rd bit of an 8 bit data is 1 or not if it is 1 store FF in memory location 25h else store 00h
8. Write a program to SWAP an 8-bit data and store the result in 25h
9. Write a program to complement an 8-bit data and store the result in 21h
10. Interfacing Programs On Pic Micro Controller Led Blinking

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM506**					
TITLE OF THE COURSE	**CNC Technology Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	**-**	**3**	**-**	**45**	**3**

Course Objectives:

1. Familiarization to CNC Machine
2. Familiarization with Maintenance of CNC machine

Course Outcomes:

1. Understand of CNC Machine
2. Understand the Maintenance of CNC Machine

LIST OF EXPERIMENTS

1. Introduction to CNC Machine
2. Machine specification
3. Machine Control Panel
4. Settings of Offset
5. Editing of program
6. Single Block, Dry run
7. Measuring work co-ordinate offset, DNC
8. Introduction to Master CAM
9. 2D Drafting
10. 2D Contour
11. Pocket
12. Drill
13. Facing
14. 3D Counter Surface Machining

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM507**					
TITLE OF THE COURSE	**Advanced PLC Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	-	3	-	45	3

Course Objectives:

1. To understand the ladder logic programming using PLC.
2. To develop an overall approach for students, learn basics of Hardware and Software of PLC family.
3. Learners are expected to understand Timer, Counters, Conveyors and PID Controllers
4. To apply knowledge of PLC in real world applications.

Course Outcomes:

1. Understand and develop the programming language in PLC
2. Demonstrate the understanding of fundamentals of Timers and Counters.
3. Analyze the various real time applications using PLC
4. Different Advanced Case Studies using PLC

LIST OF EXPERIMENTS

Note : All the experiments will be demonstrated using Rexroth Bosh Labs(Hydraulics, Pneumatics, PLC)

1. Study Hardware and Software Used in PLC
2. Study understand perform experiments on Timers
3. Implementation of ON and OFF delay Timers
4. Study understand perform experiments on Counters.
5. Implementation of UP and Down Counters.
6. Demonstration of UP-Down Counter.
7. Implementation of PLC Arithmetic Instructions
8. Logic Implementation for Bottle Filling Application
9. Logic Implementation of Traffic Control applications
10. Design PLC Program for Direct and Indirect Double acting Cylinder
11. Case study of Conveyor System Using PLC
12. Case Study of PID controller Using PLC

SEMESTER	**V**					
YEAR	**III**					
COURSE CODE	**23VM508**					
TITLE OF THE COURSE	**Robotics Lab**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	-	-	3	-	45	3

Course Objectives:

1. Familiarization of Robotics handling
2. Familiarization with writing and running robotics programming

Course Outcomes:

1. Understand Robotics handling
2. Understand writing and running robotics programming

LIST OF EXPERIMENTS

1. Robot component recognition
2. Manipulating the robot
3. Recording the position
4. Writing and running robot programs
5. Creating a Program using
6. Control Instruction
7. Create a Pick and Place Program using control Instruction
8. Robot Simulation
9. Coordinate System
10. Macros, Mastering, Backup and restore

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**23VM601**					
TITLE OF THE COURSE	**Industrial Management**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	**-**	**-**	**-**	**45**	**3**

Perquisite Courses

No Prerequisite courses.

COURSE OBJECTIVES:

1. Familiarization of levels ofmanagement.
2. Familiarization of productivity.
3. Familiarization of with the definition of TQM/TPM

Course Outcomes:

CO No.	Outcomes	Bloom's Taxonomy Level
CO1	Understand the definitions and levels of management	L3
CO2	Understand the meaning of productivity.	L3
CO3	Understand the programming and Applications of Arduino	L4
CO4	Understand the industrial factories act.	L3
CO5	Understand the recruitment Procedure.	L2

Course Content:

MODULE-1 **[09 Hrs]**

Basics of management and Functions, Levels of management, role and responsibility, Quality control, inspection, 7 QC tools, SQC and SPC, Quality standards, ISO 9000 Clauses and Steps to Implement ISO 9000.

MODULE-2 [09 Hrs]

Types of Pollution and Environmental issues, Environment Management System - ISO 14001, Losses due to Industrial Accidents, Direct Indirect Losses, Preventive Measures, Safety Committee Safety Management System(OSHAS 18001)

MODULE-3 [09 Hrs]

Brief about TPS 14 Principles of Toyota, Definition of Lean, Lean thinking, 8 Waste of Lean Manufacturing and Common lean tools, JIT (JUST INTIME) in lean and Lean Deployment

MODULE-4 [09 Hrs]

Definitions Descriptions of TPM, Benefits of Implementing TPM, TPM Model and 8 Pillars of TPM, Introduction to Overall Equipment Effectiveness(OEE), TQM Overview and Principles of TQM, Cost of Quality and 6 Cs of Quality, 5 Core Tools, TQM Implementation

MODULE-5 [09 Hrs]

Recruitment Procedure, Training Training Needs, Leadership,Team Building Creativity, Employee's welfare facilities, Industrial relations-Industrial disputes, Trade union act-rights and Liabilities, In- dian factories act, Payment of wages act, workmen's compensation act, workmen's compensation act

Text Books:

1. Industrial Engineering and Management - O P Khanna.

Reference Books:

1. Hi-Tech Industrial Management – B C Prabhakar

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**23VM602**					
TITLE OF THE COURSE	**Industrial Equipment Maintenance**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Perquisite Courses (if any)			
S.No	**Sem/Year**	**Course Code**	**Title of the Course**
1	II/I	18VM204	Electrical Engineering Science
2	III/II	18VM312	Industrial Electronics
3	V/III	XXXXX	CNC Technology

Course Objectives:

1. To understand and become familiar with Industrial Equipment.
2. To become familiar with Condition based Maintenance of Instruments.
3. To be able understand on electrical equipment maintenance.

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the concept of reliability aspects of Electronics equipment	L2
CO2	Understand importance of calibration of Electronics equipment	L3
CO3	Understand the maintenance of Power Transmission Devices	L2
CO4	Understand the maintenance Material Handling equipment.	L4
CO5	Understand the electronics equipment test maintenance.	L2

Course Content:

MODULE-1 **[09 Hrs]**

Introduction, Objectives of Maintenance, Maintenance Policies, Types of maintenance – Scheduled, Proactive, Preventive, Breakdown. Organizational setup and Maintenance Departments, Maintenance Planning, Planning Scheduling, Repair Cycle, Repair Complexity, Equipment History card, Master Schedule Card, Work-Order, Work-Report, Controlling – Maintenance Reliability Spare Parts Planning – Codification of Spares, Preservation of Past Data, Practice to use standard spares, Effective Purchase Procedures ,Classification of spare Parts – ABC Analysis Utilization of Human Resources in Maintenance; Maintenance – Work Specification–Work Measurement; Maintenance organization, training of maintenance personnel, planning of spares inventory, assessment of spare parts requirement Example of engine lathe and milling machine overhaul, inspection and checking.

MODULE-2 [09 Hrs]

Introduction of Maintenance of Power Transmission Devices, Maintenance of bearings, clutches, brakes and couplings Installation and alignments, Maintenance of power transmission elements like belt drives, chain drives and gear Drives, Trouble in hydraulic systems and their causes, technical environment required for assembly of hydraulic transmission Pumps its Repair, Maintenance of portable electric tools, Maintenance of portable pneumatic tools, Maintenance of air compressors.

MODULE-3 [09 Hrs]

Installation, Erection, Commissioning Maintenance Of CNCMachines, Installation, Erection, Com- missioning Of CNC Machines, Maintenance Of CNC Machines.

MODULE-4 [09 Hrs]

MAINTENANCE OF MATERIAL HANDLING EQUIPMENTS:
Maintenance of rope – wire rope and fiber rope, Maintenance of hoist equipment, Wrench and EOT Crane, Maintenance of belt conveyors, Maintenance of hydraulic and pneumatic conveyors.
CONDITION BASED MAINTENANCE:
Condition Monitoring – Methods Of Load Monitoring, Temperature Monitoring, Lubrication Monitoring, Leak Detection, Corrosion Monitoring OFF – Load Monitoring – Crack Detection, Vibration Monitoring Lubrication Monitoring – Debris Deposited, Debris In Suspension, Condition Of Used Oil, Ferro Graph. Thermal Monitoring, Location Of Temperature Measurement, Temperature Monitoring Devices, Sensors, Optical Pyrometer, Radiation Pyrometer. Vibration And Noise Monitoring
Causes, Measurement, Noise Signals, Signature Analysis.

MODULE-5 [09 Hrs]

REPAIR OF A.C. AND D.C. MACHINES:
Repair of A.C. Machines – starting of induction motor, sparking at slip rings, abnormal heating of the bearings, oil leakage and oil splashing from bearings Dismantling and assembling of induction motor, adjustment, testing and repair of A.C. machines Main faults of D.C. motors, brush sparking, commutator overheating, Armature overheating of pole coils, motor fails to start, Dismantling and assembly of D.C. motors, adjustment, testing of assembled motor after repair of transformers, dismantling of transformers, repair of windings, testing of transformers
ELECTRONICS TEST EQUIPMENT MAINTENANCE:
Trouble shooting and servicing of Electronics test equipment Calibration of Electronics Test Equipment Faultdetection techniques, watchdog techniques Parityand errorcoding checks, common hard- ware faults Microprocessor systems, Emulation and simulation Reliability Aspects Of Electronic Equipment

Text Books:

1. Testing of Machine Tools Dr. George Schlesinger, Pergamon Press
2. Industrial Maintenance by HP Chand Co

Reference Books:

1. Management of Industrial Maintenance, A Kelly M J Harris
2. Maintenance Engineering, L C Morrow

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**23VM603**					
TITLE OF THE COURSE	**Additive Manufacturing**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Perquisite Courses (if any)			
S. No	**Sem/Year**	**Course Code**	**Title of the Course**
1	I/I	23VM105	Basics of Computer I
2	III/II	23VM305	Mechanics of Machines
3	V/III	XXXX	CNC Technology

Course Objectives:

1. To understand the fundamentals for additive manufacturing and how it is different and discuss about various types of liquid based, solid based and powder-based AM technologies
2. To understand the various types of Pre-processing, processing, post-processing errors in AM. Also to know the various types of data formats and software's used in AM.
3. To know the various applications of AM in design analysis, aerospace, automotive, biomedical and other fields

Course Outcomes:

CO No.	**Outcomes**	**Bloom's Taxonomy Level**
CO1	Understand the fundamentals of Additive manufacturing	L2
CO2	Understand the system and analysis of the same	L4
CO3	Understand the power based AM system	L2
CO4	Understand the AM format and analyzing the software needs	L4
CO5	Applying the AM knowledge for various application	L5

MODULE-1 **[09 Hrs]**

Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

MODULE-2 [09 Hrs]

Liquid-based AM Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing

(SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Polyjet: Process, Principle, working principle, Applications, Advantages and Disadvantages, Case studies. Microfabrication. Solid-based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modelling (MJM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

MODULE-3 [09 Hrs]

Powder Based AM Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three-dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Electron Beam Melting (EBM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP.

MODULE-4 [09 Hrs]

AM Data Formats: Reengineering for Digital Representation, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Sub division Techniques. AM Software's: Need for AM software, Features of various AM software's like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, SurgiGuide, 3-matic, Simplant, MeshLab.

MODULE-5 [09 Hrs]

AM Applications: Application – Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customised Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visulization of Biomolecules. Web Based Rapid Prototyping.

Text Books:

1. Rapid prototyping: Principles and Applications - Chua C.K., Leong K.F. and LIM C.S,
2. World Scientific publications , Third Edition, 2010.
3. Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer , 2001

Reference Books:

1. Wholers Report 2000 – Terry Wohlers, Wohlers Associates, 2000
2. Rapid Prototyping & Engineering Applications – Frank W.Liou, CRC Press, Taylor & Francis Group, 2011.

ELECTIVE SUBJECT

SEMESTER	**VI**					
YEAR	**III**					
COURSE CODE	**23VM606**					
TITLE OF THE COURSE	**Automotive Electronics**					
SCHEME OF INSTRUCTION	**Lecture Hours**	**Tutorial Hours**	**Practical Hours**	**Seminar/Projects Hours**	**Total Hours**	**Credits**
	3	-	-	-	45	3

Course Objective

1. Familiarization with different ignition systems
2. Familiarization with the safety systems implemented in an Automobile 3.Familiarization with the sensor based electronic engine management and control devices

Course Outcome

1. Understand different ignition systems
2. Understand the about the safety systems implemented in an Automobile. 3.Understand the sensor based electronic engine management and control devices

Module 1: 09 Hours

Automobile fundamentals:
The engine-components- engine block, cylinder, crankshaft, piston, cam shaft, valves, intake system, ignition, exhaust, cooling system- Lubrication system-fuel feed system ignition system- spark plug- high voltage circuit and distribution- compression ignition system.

Module 2: 09 Hours

Sensors and Actuators:
Introduction to sensors and transducers-Types-Air flow rate sensor, Engine crankshaft angular position senor, Engine speed sensor, Timing sensor, Throttle angle sensor, Pressure sensor, Temperature sensors, Pressure sensor-Flow sensor, Exhaust gas oxygen sensors, Knock Sensor, Engine torque sensors, Automotive engine control actuators, Exhaust gas recirculation actuator.

Module 3: 09 Hours

Engine Management Systems: Electronic Engine Management System, oil pressure warning system, engine overheat warning system, air pressure warning system, speed warning system, door lock indicators.

Module 4: 09 Hours

Active and Passive Safety Systems :
Cruise control system, Antilock braking system(ABS), Traction control, Stability control, Integrated engine control. Central locking, Air bags and seat belt tensioners. Voice warning system, Travel information system, GPS.

Module 5: 09 Hours

Advanced Driver Assistance System :
Introduction – - Lane Detection obstacle detection, Pedestrian Detection, Blind Spot Detection, Lane Departure Warning System, Forward Collision Warning System.

Text Books

1. Automobile engineering vol- 1, vol – 2, Kirpal singh, Standard publishers distributors New Delhi
2. Automobile Engineering, G.B.S.Narang, Khanna Publishers, New Delhi
3. Understanding Automotive Electronics, William B. Ribben, 6th edition Elsevier Science-2003

Reference Books

1. Vehicle and Engine technology. Vol. I,Heinz Heisler, , ELBS
2. Automobile Engineering,R.B.Gupta, Satya Prakashan, New Delhi
3. Understanding Automotive Electronics,Fourth Edition,William B.Ribbens
4. Sensor and Transducers, Ronald K.Jurgen, SAE-2003 Electric and Hybrid-electric vehicles, Ronald K. Jurgen, SAE 2002