Annexure-II

Syllabus

Effective for Academic Year 2025-26

B.Tech. Program

in

Electrical Engineering

(II Semester)

Department of Electrical Engineering

DC	13251201	Network Analysis	3-0-0

Course Objectives:

To make the students capable of analyzing any given electrical network, understand the graph theory and the concepts of transients and relate two port parameters.

Unit I Network Theorems: Superposition theorem, Reciprocity theorem, Thévenin's theorem, Norton's theorem, Maximum power transfer theorem, Millman's theorem, Substitution theorem, Compensation theorem, Tellegen's theorem.

Unit II Network Functions: Driving point impedance and transfer functions of RLC Networks, Natural frequencies of a network, Poles and Zeros of driving point impedances,

Unit III Two Port Network: Concept of Ports, Two port parameters e.g. z-parameter, y-parameters, ABCD and inverse ABCD parameters, h and g parameters and their determination, Ladder network, reciprocity, Symmetry and Interconnections of two port networks. Inter-relationships between parameters of two port network,

Unit IV Transients: Initial conditions, Transient response of RL, RC and RLC circuit, time constant, damped and oscillatory circuit Response of the network with impulse, Unit step and Ramp and Sinusoidal excitation.

Unit V Power System as Electric Network: Balanced **&** Unbalanced Three phase circuit, Symmetrical three-phase faults using Thevenin equivalent networks, Symmetrical Components, Simulation & Computation Tools: SPICE or MATLAB / Python for solving circuits, plotting poles/zeros, frequency responses. (Dynamic Content; Dec. 2025)

Text and Reference Books:

1. Network Analysis by ME Van Valkenburg , PHI Publication.
2. Circuit Analysis by A. Chakrawarti, Dhanpat Rai Publication.
3. Network Analysis and Synthesis by C.L. Wadhwa, New Age International Publication.
4. Network Analysis and Synthesis Pankaj Swarnkar, Tech India Publication.

Course Outcomes:

After the completion of this course students will be able to:

CO1. **Apply** different networks laws & theorems for solving AC and DC electric networks.
CO2. **Determine** network functions of single port & two port Network
CO3. **Compute** the two-port parameters for given two port networks
CO4. **Evaluate** transient response behavior of a network for given initial conditions
CO5. **Solve** three-phase circuits under balanced & unbalanced conditions

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	1	1	3	2	-
CO2	3	3	3	3	2	1	1	1	1	1	3	2	-
CO3	3	3	3	3	2	1	1	1	1	1	3	2	-
CO4	3	3	2	3	3	1	1	1	1	1	3	2	-
CO5	3	3	2	2	2	1	1	1	1	1	3	2	-

DC	13251202	Measurement & Instrumentation	3-0-0

Course Objectives

- To give an overview of current, voltage and power measuring electrical, electronics and digital instruments.
- To expose the students to the design of bridges for the measurement of resistance, capacitance and inductance.
- To provide the working knowledge of various waveform generators, analyzers and display devices.

Unit I Introduction: Measurement standards and units, definitions, classification of electromechanical and digital instruments, Static and dynamic characteristics, error analysis, Statistical evaluation of measurement data. Measurement uncertainty, calibration standards (NABL), ISO-17025

Unit II Electromechanical Meters: PMMC, MI, electrodynamometer and induction-type instruments: construction, working, types, torque equation, range extension, advantages and disadvantages, active- and reactive- power measurements in single-phase and three-phase circuits. Instrument Transformers: Construction, types, working, equivalent circuit, errors, phasor diagram.

Unit III Measurement of Circuit Parameters: Introduction to bridge circuits; Wheatstone bridge, Ammeter-voltmeter method, Kelvin's double bridge, megger, loss of charge method; Maxwell's bridges, Anderson bridge, Schering bridge, De-Sauty bridge, Wien bridge; limitations and applications.

Unit IV Transducers: Classification, types, thermistor, RTD, thermocouple, LVDT, strain gauge, piezoelectric transducers, digital shaft encoders, tachometer, Hall effect sensors; applications**.** Smart instruments: Intelligent transducer, self-diagnosis and remote calibration features, HART communication, MEMS, smart energy meter components, working principle; Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI) environments.

Unit V Modern Display & Measurement Systems, IoT-enabled sensors, edge-based measurement, Smart Grid compatibility. Industrial Measurement Standards, IEC standards for instrumentation, EMI/EMC considerations. EV & Renewable Industry Applications Measurement in EV chargers (AC/DC measurement), Battery testing instruments (C-rate, thermal profiling), Precision measurement technologies used in calibration labs. (Dynamic Content; Dec. 2025)

Text and Reference Books:

1. A.K. Sawhney, "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai & Sons, Jan 2015.
2. J.B. Gupta, "A Course in Electronics & Electrical Measurements & Instrumentation", S.K. Kataria& Sons, 2008.
3. E. W. Golding's & F. C.Widdis, Electrical Measurements and Measuring Instruments, 6th Edition, (Revised & Enlarged): With Solved Examples & MCQ's (In M.K.S. Units), Medtech, Jan 2019.
4. Albert D.Helfrick and William D.Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2003.
5. H. S. Kalsi, Electronic Instrumentation, McGraw Hill Education; 3rd Edition, 2017

Course Outcomes:

At the end of the course student will be able to:

CO 1. **Explain** the fundamental concepts, standards, and characteristics of electrical and electronic measuring instruments.

CO 2. **Compute** errors in a measurement system using analytical and statistical methods.

CO 3. **Describe** the principle and performance of PMMC, MI, dynamometer type & induction type measuring instruments and instrument transformer

CO 4. **Determine** the circuit parameters using AC and DC bridges

CO 5. **Analyze** the operation of transducers measurement of physical quantity

CO 6. **Evaluate** modern display and measurement systems integrated with IoT-enabled sensors and edge-based processing for Smart Grid–compatible EV and renewable energy applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	3	1	1	2	1	1	2	-	2
CO2	3	3	3	3	3	1	1	2	2	2	2	-	2
CO3	3	3	3	3	3	1	1	2	1	1	3	-	2
CO4	3	3	3	2	3	1	1	2	2	2	2	-	2
CO5	2	2	2	3	3	1	1	2	2	2	2	-	2
CO6	3	3	3	2	3	1	1	2	1	1	2	-	2

DC	13251203	Switching Theory and Logic Design	3-0-0

Course Objectives:

- The course intends to provide an understanding of switching algebra & switching functions. Furthermore, the course is likely to impart knowledge of various techniques of digital electronics like K-map for simplified analysis, understanding of combinational & sequential circuits.

Unit I Number System and Codes: Analog versus digital systems, merits of digital systems. Number systems, base conversions, complements of numbers. Weighted and unweighted codes. Alpha-numeric codes (e.g., ASCII). Introduction to error-detecting codes (e.g., parity) and error-correcting codes (e.g., Hamming code).

Unit II Switching algebra and switching functions: Postulates, theorems, and switching algebra. Completely and incompletely specified switching functions. Representation of Boolean expressions in sum-of-products (SOP) and product-of-sums (POS) forms. Minimization of Boolean expressions using Karnaugh maps Practice exercises on Boolean expression minimization.

Unit III Logic Gates & Combinational circuits Logic gates, Logic gates operation using discrete components, Universal Logic gates, Logic design of combinational circuits: adders, Code converters**,** Comparators, multiplexers, de-multiplexers, encoders, decoders, buffers, tri-state buffers.

Unit IV Sequential Circuits & Applications: RS flip-flop, Clocked RS flip-flop, JK flip-flop, T-flip-flop, and Master-Slave JK flip-flop. Flip-flop conversions. Buffer registers and controlled buffer registers. Shift registers: left shift, right shift, and universal shift registers (SISO, SIPO, PISO, PIPO). Counters: Ring counters, twisted ring counters, asynchronous counters, and synchronous counters.

Unit V Modern CMOS Logic Technologies and Applications Introduction to modern CMOS technology trends including FinFET and GAAFET structures. Modern process technologies. Real-world applications of logic families in processors, IoT devices and industrial controllers. (Dynamic Content; Dec. 2025)

Text and Reference Books:

1. Donald P. Leach, Malvino, and Saha, Digital Principles and Applications (SIE), McGraw Hill Education, 8th Edition, 2014.
2. Zvi Kohavi, Switching and Finite Automata Theory, McGraw-Hill, 8th Edition, 2017.
3. Herbert Taub and Donald Schilling, Digital Integrated Electronics, McGraw-Hill, 2017.
4. Robert L. Morris and John R. Miller, Designing with TTL Integrated Circuits, McGraw-Hill, 1975.
5. Anand Kumar, Fundamentals of Digital Circuits, PHI Learning, 4th Edition, 2016
6. Neil H. E. Weste and David Harris, CMOS VLSI Design: A Circuits and Systems Perspective, Pearson, 5th Edition, 2019.
7. Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolić, Digital Integrated Circuits: A Design Perspective, Pearson, 2nd Edition (2021 Reprint).
8. S. M. Sze and Kwok K. Ng, Physics of Semiconductor Devices, Wiley, 4th Edition, 2021.

Course Outcomes:

After the completion of this course students will be able to:

CO1. **Apply** number system conversions, coding schemes, and switching algebra concepts including canonical forms and functional completeness.

CO2. **Simplify** Boolean expressions using Boolean algebra, Karnaugh maps, and the Quine–McCluskey tabulation method.

CO3. **Design** combinational circuits such as adders, multiplexers, encoders, decoders, and code converters based on given functional requirements.

CO4. **Analyze** synchronous and asynchronous sequential circuits using flip-flops, registers, and counters for real-time digital applications.

CO5. **Explain** the operation, characteristics, and applications of different logic families including TTL, CMOS, and ECL, along with modern CMOS technology trends.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	2	1	2	1	1	1	1	1	2	2	-
CO2	2	1	2	2	2	1	1	1	1	1	2	2	-
CO3	2	2	2	2	2	2	1	1	1	1	2	1	-
CO4	2	2	2	2	2	1	2	1	1	1	2	1	-
CO5	2	2	2	3	2	2	1	1	1	1	2	1	-

1 - Slightly; 2 - Moderately; 3 – Substantially

ESC	13251204	Engineering Drawing	1-2-0

Course Objective:

- To inculcate the imagination and mental visualization capabilities for interpreting the geometrical details of common engineering objects.
- To impart knowledge about principles/methods related to projections of one, two and three dimensional objects.

Unit I: Scale and Spirals: Basics of instruments, Lettering and dimensioning, Plane geometrical constructions. Plain and diagonal scale - Representative fraction, Unit conversion and Exercises based on linear, area, volume, Archimedean and logarithmic spiral curves.

Unit II: Projection of points: Introduction, types of projections, quadrant system, positions of points and Exercise. **Projection of straight line**: Introduction, Orientation of a straight line, Traces of a line and Exercise.

Unit III: Projection of planes: Introduction, Types of planes, Traces of planes, Position of planes and Exercise. **Projection of solids**: Introduction, Types of solids, Positions of solids and Exercise.

Unit IV: Section of solids: introduction, Types of section planes and Anti-section and Exercise. **Development of surfaces**: Introduction, Methods of development of Prism, Pyramid, Cone, Cylinder.

Unit V: Isometric projections: Introduction, isometric scale, isometric axis, isometric view and isometric projections from orthographic views, orthographic views from pictorial view and exercise. **Computer Aided Drafting using Auto CAD:** Introduction, software's basic commands, transformation and editing commands.

Recommended books:

1. Engineering Drawing by N. D. Bhatt, Charotar Publication Pvt. Ltd.
2. Engineering Drawing by P.S. Gill, S. K. kataria& sons, Delhi
3. Engineering Drawing by Basant Agrawal & C. M. Agrawal, Tata McGraw Hill Education Pvt. Ltd.
4. Engineering Graphics by K. Venugopal, New Age International Publication, India

Course Outcomes:

After successful completion of this course students will be able to:

CO1. **Draw** plain, diagonal scale and spirals for given conditions.

CO2. **Analyse** and represent the positions of points and orientations of straight lines in different quadrants.

CO3. **Interpret** and represent the projections of planes and solids in various orientations.

CO4. **Create** sectional views of solids using appropriate section planes, including anti-sections, and apply various methods to develop the surfaces.

CO5. **Develop** the ability to create isometric projections and views of 3D objects using isometric scales and auto CAD.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	1	1	1	1	1	1	1	-
CO2	3	3	2	2	1	1	1	1	1	1	1	1	-
CO3	3	3	2	2	1	2	1	1	1	1	1	1	-
CO4	3	3	2	2	1	1	1	1	1	1	1	1	-
CO5	3	3	2	3	3	2	1	1	1	1	1	1	-

1 - Slightly; 2 - Moderately; 3 – Substantially

ESC	13251205	Calculus and Laplace Transform	3-0-0

Objective of course

- To understand the basic concepts of differential & interatrial calculus, explore their applications.
- To be familiar with vector calculus
- To understand the use and application of Laplace transform

Unit I: Differential Calculus Partial derivatives, Euler's theorem for homogeneous functions, Taylor's and Maclaurin's Theorems, Jacobian, properties of Jacobian, Extrema of functions of several variables (Maxima and Minima of function of one and two variables).

Unit II: Integral Calculus Beta and Gamma function and its properties, transformation of Beta function, transformation of Gama function, relation between Beta and Gama function, Double and triple integrals, Change of order of integration, Application of Integration to Volumes and Surface areas.

Unit III: Vector Calculus Vector Calculus: Scalar and vector fields; Laplacian operator; Vector differentiation; Directional derivative; Gradient of a scalar field; Divergence and curl of a vector field; Line, surface and volume integrals; Green's theorem in a plane (without proof); Stoke's theorem (without proof); Gauss divergence theorem (without proof).

Unit IV: Laplace Transform Definition, Basic properties, Linearity properties, first shifting theorem, second shifting theorem, change of scale property, Laplace transform of derivative and integration, function multiply by power of t, function divided by t, Laplace transform of periodic function, Laplace transform of special functions (error function of , Bessel function of zero order, unit step function and Unit Impulse function).

Unit V: Inverse Laplace Transform Inverse Laplace transform, various properties, inverse Laplace transform of derivative and integration, function multiply by s, function divided by s, convolution theorem, Application to solving certain initial value problem, solving system of linear differential equations.

Recommended Books:

1. E. Kreyszig: Advance Engineering Mathematics, John Wiley & Sons, 10th Edition 2011
2. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics, Narosa Publishing House Pvt.Ltd, 5th Edition 2016
3. F. B .Hildebrand: Advanced Calculus for application, Englewood Cliffs, N. J. Prentice- Hall, 2nd Edition
4. B. S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Edition 2015
5. B.V. Ramanna: Higher Engineering Mathematics, McGraw Hill Education, 1st Edition 2017

Course Outcomes

After completing this course, student will be able to:

CO 1. **Analyze** differential calculus in basic engineering problems
CO 2. **Apply** integration techniques to various complex engineering problems
CO 3. **Apply** the concepts of gradient, divergence and curl of scalar and vector point functions to formulate engineering problems.
CO 4. **Apply** Laplace transform to various complex engineering problems
CO 5. **Deduce** the applications of Laplace transform in engineering problems

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	1	1	3	3	1
CO2	3	3	3	3	2	1	1	1	1	1	3	3	1
CO3	3	3	3	3	2	1	1	1	1	1	3	3	1
CO4	3	3	2	3	3	1	1	1	1	1	3	2	1
CO5	3	3	2	2	2	1	1	1	1	1	3	2	1

1 - Slightly; 2 - Moderately; 3 – Substantially

MAC	13251212	Sustainability & Environmental Science	0-2-0

Course Objective:

To equip students with a comprehensive understanding of environmental science, pollution control, sustainability, and global frameworks, enabling them to analyze environmental challenges and contribute to sustainable solutions through informed decision-making and responsible practices.

Syllabus:

Unit I Introduction to Environmental Science: definition, importance and its components. Ecosystem and its components. Water cycle, carbon cycle, food chain, energy flow in ecosystem. Current state of environment in India and world; Underlying reasons (root causes) of modern environmental degradation (social, psychological, cultural). Introduction to Environmental pollution: air, water, noise, soil, thermal and radioactive.

Unit II Environmental Pollution and Management: air, water, noise, soil, thermal and radioactive. Causes, impacts, pollution control techniques and mitigation strategies. Solid waste management: Principles of waste management, different components of waste management system and introduction to management of hazardous waste like e-waste, plastic waste. Global environmental Issues: Climate change, global warming, ozone layer depletion, urban heat island

Unit III Environmental policies and laws in India: Environmental Protection Act, Water Act, Air Act. **Overview of global environmental policies and frameworks:** Kyoto protocol, Montreal protocol, COP summits. Introduction to clean development mechanism, carbon credit, carbon trading. Environmental audit.

Unit IV Sustainability concepts: definition, importance, pillars of sustainability (economic, environmental, and social). Sustainable development. Overview of UN Sustainable Development Goals (SDGs) and their global relevance. Concept of circular economy, resource efficiency, energy conservation, green buildings and sustainable manufacturing.

Unit V Sustainable Energy solutions: New energy sources: need of new sources, different types of new energy sources, application of hydrogen energy, ocean energy sources, and tidal energy conversion. Concept, origin and power plant of geothermal energy. Renewable energy sources like water, wind etc. Overview of sustainable materials and construction practices. Introduction to sustainable transportation systems and sustainable water infrastructure.

Recommended Books:

1. D. K. Asthana, Meera Asthana, A Text Book of Environmental Studies, S Chand & Co., New Delhi.
2. S. K. Dhameja, Environmental Engineering & Management, S K Kataria & Sons, New Delhi
3. C. S. Rao, Environmental Pollution Control Engineering, C.S. Rao, New Age International Publishers
4. A. K. Gupta, Environmental Sustainability and Green Technologies, PHI Learning.

Course Outcomes:

Upon completion of the course, a student will be able to

CO 1. **Explain** the fundamental concepts of environmental science, including ecosystems and the causes of environmental degradation.

CO 2. **Analyze** the sources, causes, and impacts of air, water, and solid waste pollution and propose appropriate mitigation strategies.

CO 3. **Evaluate** the effectiveness of environmental policies and global frameworks in addressing environmental challenges.

CO 4. **Explain** the concepts of sustainability and sustainable development goals.

CO 5. **Apply** various solutions for achieving sustainable development.

Annexure-III

List of Experiments

Effective for Academic Year 2025-26

B.Tech. Program

in

Electrical Engineering

(II Semester)

Department of Electrical Engineering

DLC	13251206	Measurement & Instrumentation Lab	0-0-2

List of Experiments

1. Study and observe the oscilloscope as a test and measuring instrument. (Test the resistors, capacitors, diodes, transistors, measure AC/DC voltages, frequency, phase and study the Lissajous patterns).
2. Plot the B-H curve of a magnetic specimen to obtain its hysteresis loss and calculate its Steinmetz's constant & co-efficient.
3. Calibration of Single-phase induction-type energy meter by phantom loading.
4. Measurement of inductance using Maxwell's bridges and Anderson bridge.
5. Measurement of capacitance using Schering bridge and De-Sauty bridge.
6. Frequency measurement using Wein bridge.
7. Determination of ratio & phase error in a potential transformer.
8. Determination of ratio & phase error in a current transformer.
9. Temperature measurement using RTD, thermistor and thermocouple.
10. Measurement of pressure and weight using piezoelectric transducer.
11. Active power measurement in a balanced Three-phase system using two wattmeter methods.
12. Reactive power measurement in a balanced Three-phase system using single wattmeter method.
13. To simulate and analyse the performance of a biosensor for pulse (heart rate) measurement and evaluate its key performance metrics (sensitivity, SNR, accuracy, response time).

Course Outcomes

At the end of the course, the student will be able to:

CO1. **Measure** resistance, inductance, and capacitance using electrical bridges.
CO2. **Collect** experimental data accurately and effectively for temperature, displacement, pressure using suitable transducer
CO3. **Integrate** theoretical knowledge from coursework into practical applications and experiments
CO4. **Communicate** experimental results effectively through oral presentations and written documentation
CO5. **Demonstrate** responsibility and professionalism in the completion of lab tasks and assignments
CO6. **Show** willingness to learn new techniques, tools, or methods to enhance practical engineering skills

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	2	2	3	3	-
CO2	3	3	3	3	2	2	2	3	2	2	3	3	-
CO3	3	3	3	3	3	2	1	2	3	2	3	3	2
CO4	2	2	2	2	2	1	2	2	2	3	3	3	-

DLC	13251207	Problem Solving through Python Programming	0-0-2

List of Experiments

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool and developing a game activity using Pygame like bouncing ball, car race etc.

Course Outcomes

Upon completion, the student will be able to:

CO 1. **Develop** Python programs effectively.
CO 2. **Implement** programs using conditional statements and looping structures to control program flow.
CO 3. **Solve** real time problems using Python.
CO 4. **Acquire** teamwork skill for working effectively in groups.
CO 5. **Prepare** an organized report of the programs with necessary flowcharts.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1	1	1	1	3	1	1	1	1	2	3	2	2
CO2	1	1	1	1	3	1	1	1	2	1	3	2	2
CO3	1	1	1	1	3	1	1	1	2	1	3	2	2
CO4	1	1	1	1	3	1	1	1	1	2	3	2	2
CO5	1	1	1	1	3	1	1	1	2	1	3	2	2

1-Slightly; 2-Moderately; 3-Substantially

List of Micro Project-II (13251109)

S. No.	Project Title	Type	Short Description
1.	A Hardware Implementation of Mobile phone cell charger	Hardware	AC power to a lower-level DC voltage, which is then stabilized using voltage regulators such as the LM7805
2.	Design of Low-Cost Solar Lamp for Rural Applications	Hardware	Utilizes a small solar panel, rechargeable battery, and high-efficiency LED light
3.	Implementation of Series and Parallel bulb connection	Hardware	Help to understand current distribution, voltage drop, and electrical power management in practical circuits.
4.	Development of simple burglar alarm using LDR	Hardware	Circuit uses an LDR whose resistance varies with light levels low resistance in bright light and high resistance in darkness
5.	Development of a Basic Led Traffic light system	Hardware	Using simple electronic components such as LEDs, resistors, a microcontroller or a timer IC like 555, the system controls the sequence and duration of each light.
6.	Smart energy saving desk lamp	Hardware	Automatically adjusts light intensity based on ambient lighting and user activity, helping reduce power consumption
7.	Water Pump controller	Hardware	It monitors the water level through sensors and automatically switches the pump ON when the water level is low and OFF when the tank becomes full, preventing overflow
8.	Basic electrical components and their applications	Hardware	Role in household appliances, industrial machinery, power distribution systems, communication devices, and electronic gadgets.
9.	Automatic Street Light Using "LDR"	Hardware	A smart lighting system that automatically turns street lights ON in the evening when darkness increases and switches them OFF in the morning when natural light is sufficien
10.	Implementation of clap switch circuit	Hardware	Using a transistor or operational amplifier and fed to a timer IC such as the 555 timer, which processes the signal and triggers a relay.
11.	Simple Low power inverter	Hardware	Basic switching components like transistors or MOSFETs, an oscillator circuit, and a step-up transformer to generate AC output (commonly 230V AC from 12V DC).

12.	Smart Energy Meter Model	Hardware	Electrical measurement device designed to monitor and record real-time power consumption in homes
13.	Designing Staircase Wiring using Two-Way Switch	Hardware	Uses two two-way (SPDT) switches connected in such a way that toggling either switch can turn the light ON or OFF
14.	Measurement of Soil moisture Using DHT-11 sensor	Hardware	Interfacing the sensor with a microcontroller such as Arduino, real-time data can be collected and displayed.
15.	Hardware implementation of DC servomotor control using IoT	Hardware	Integrates sensors, a microcontroller (such as Arduino/ESP32), and wireless communication modules to enable remote monitoring and control of motor speed and position through an online platform
16.	Hardware implementation of a Mini Emergency Light	Hardware	uses components such as rechargeable batteries, LED light sources, a charging circuit, and an automatic changeover system
17.	Voltage and current calibration in A series parallel DC Circuit	Hardware	Voltage and current calibration in a series-parallel DC circuit involves adjusting and verifying the measurement devices
18.	Design and Development of a Current Flow Detector	Hardware	Involves designing and developing a device capable of detecting and indicating the flow of electric current in a circuit
19.	Design and Implementation of a Fan Speed Controller	Hardware	Using electronic components such as microcontrollers, PWM (Pulse Width Modulation) circuits, or triacs, the system regulates the fan's speed efficiently according to user input
20.	Parallel Connection of electrical load and power measurement	Hardware	Power in each load can be measured individually using ammeters and voltmeters or a single wattmeter per load, and the total power is the sum of the powers consumed by all loads