MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(Deemed University)

(Declared Under Distinct Category by Ministry of Education, Government of India)

NAAC Accredited with A++ Grade

Department of Electronics Engineering

Syllabus (EL)

Subject Code	Category Code	Subject Name	Theory Slot				Practical Slot		Total Marks	Contact Hr./week			Total Credits
			Minor Evaluation I	Minor Evaluation II	Quiz/ Assignment Marks	Major Evaluation	Continuous Evaluation/ Lab work & Sessional	Major Evaluation		L	T	P	
14241101	DC	Instrumentation & Sensors	20	20	30	30	-	-	100	3	-	-	3

Instrumentation & Sensors (14241101)

Course Objective:

- To understand the significance of measurement techniques, errors in measurement, and statistical analysis process, sensors, classification, operating principles, and their practical use to design smart electronic systems.

Unit 1: Measurement Systems: Introduction, Significance of measurement, block diagram of measurement system, methods of measurements, elements and their functions of measurement systems, applications, characteristics of measurement systems-static and dynamic, Static characteristics- accuracy, precision, sensitivity, reproducibility, drift, static error, dead zone, linearity, resolution, hysteresis, loading effects, Dynamic characteristics- Speed of response, measuring lag, fidelity, dynamic error, calibration.

Unit 2: Errors in Measurement and their Statistical Analysis: Types of Error- Gross, Systematic (Instrumental, Environmental, Observational error), and random error, Statistical treatment of data-measurement tests, histogram, arithmetic mean, dispersion measurement, range, deviation, average deviation, standard deviation, variance, Noise, signal to noise ratio.

Unit 3: Thermal Sensors: Introduction, Sensor Classifications, Sensors Parameters, Selection criterion of Sensors, General requirements for interfacing, Temperature sensors, Thermo resistive sensors- Resistance Temperature Detectors, Thermistor, Thermoelectric sensors- Thermocouple, Electric Sensors- Capacitive position, proximity, and displacement sensors, LVDT.

Unit 4: Force and Pressure Sensors: Introduction**,** Force sensor- Strain gauge**,** Semiconductor strain gauge**,** Strain gauge accelerometers, Pressure sensors- Mechanical pressure sensors, Piezoresistive pressure sensor, Capacitive pressure sensor.

Unit 5: Humidity and Moisture Sensors: Humidity and moisture sensors- Resistive humidity sensor, capacitive moisture sensors, Thermal conduction moisture sensors, Light dependent resistor (LDR).

Text Book:

1. A.K. Sawhney: "A Course in Electrical and Electronic Measurements and Instrumentation", 18th Edition, Dhanpat Rai Publications, 2001.
2. Nathan Ida, "Sensors, Actuators and Their Interfaces, A multidisciplinary introduction", 2nd Edition, IET Publication.

Reference Books:

1. Subhash Chanda Mukhopadhyay, "Intelligent Sensing, Instrumentation and Measurements," Springer Publication.
2. Sanjay N. Talbar, Akhilesh R. Upadhyay, Instrumentation and Measurement, Dhanpat Rai Publishing Company. Third Edition 2004.
3. Process Control Instrumentation Technology, Curtis D. Johnson, PHI
4. A Hands-On Course in Sensors Using the Arduino and Raspberry Pi, Volker Zeimann, CRC Press.

Course Outcomes (COs):

After completion of this course students will be able to:

CO1. Examine the measurement systems, significance, and their characteristics.
CO2. Evaluate the errors in measurement systems.
CO3: Analyse the selection criteria and parameters for various sensors.
CO4: Describe the working of force, pressure, humidity and moisture sensors.
CO5: Differentiate sensors based on their applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	2	2	2	2	1	1	1	3	3	3
CO2	3	3	1	3	2	2	2	2	1	1	1	3	3	3
CO3	3	3	1	1	3	2	2	2	1	1	1	3	3	3
CO4	3	2	1	1	3	2	2	2	1	1	1	3	3	3
CO5	3	2	1	1	3	2	2	2	1	1	1	3	3	3

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14241103	DC	Electronics Devices	20	20	30	30	-	-	100	2	1	-	3

Electronics Devices (14241103)

Course Objective: To understand of the fundamental principles and operational characteristics of electronic devices, and apply this knowledge in practical electronic applications and further advanced studies in electronics.

Unit I: Semiconductor Physics: Elemental & Compound Semiconductor Materials, Bonding Forces and Energy Bands in Intrinsic and Extrinsic Silicon, Charge Carrier in Semiconductors, Carrier Concentration, Extrinsic Semiconductor, Hall Effect, Mechanism of Current Flow, Drift Current, Diffusion Current, Einstein Relation, Continuity Equation.

Unit II: Semiconductors Diodes: P-N Junction properties, Diode Characteristics, Equilibrium condition, biased junction, Steady state condition, P-N Junction breakdown mechanism, Capacitance of junction barrier, Diode circuit parameters, Basic circuits of Rectifier, Clippers and Clampers.

Unit III: Types of Diodes: Basic operation and characteristics of; Zener diode, Zener diode as a voltage regulator, Tunnel diode, Varactor diode, Schottky diode, Light emitting diode, Photo-diode.

Unit IV: Transistors (BJT & FET): **Bipolar Junction Transistors;** Construction, basic operation, current components and equations, CB, CE and CC configuration, input and output characteristics, Early effect, Region of operations: active, cut-off and saturation region. **Field effect transistors;** Construction and characteristics of JFET, working principle of JFET.MOSFET construction and characteristics, MOSFET enhancement and depletion mode.

Unit V: Power Electronics Devices: Basic principle and working of SCR, IGBT, Uni-junction Transistor (UJT) and Thyristors. UJT: Principle of operation, characteristics.

Text Books:

1. Electronics Devices and Circuits: Boylested & Nashelsky, 11th Edition, Pearson Education India
2. Electronic devices and circuits: S. Salivahanan, 2nd Edition, Tata McGraw-Hill Education, 2011.

3. Microelectronic Circuits: Theory and Application: Sedra & Smith, 7th Edition, Oxford University Press.

Reference Books:
1. Micro Electronics: Millman, & Grabel, 2nd Edition, McGraw Hill Education
2. Integrated Electronics: Millman &Halkias, McGraw Hill Education.

Course Outcomes

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

- **CO1.** **Explain** the semiconductor materials with their importance.
- **CO2.** **Design** the circuits using diodes.
- **CO3.** **Analyze** the construction, operation, and characteristics of various diodes.
- **CO4.** **Compare** the characteristics of Bipolar Junction Transistors (BJT) and Field Effect Transistors (FET).
- **CO5.** **Explain** the working and characteristics of power electronics devices.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	1	2	2	1	2	_	3	2	2
CO2	3	3	3	3	2	2	2	2	2	2	2	3	3	3
CO3	3	3	2	3	3	3	2	1	2	2	3	3	3	3
CO4	3	3	3	3	3	3	2	1	2	2	3	3	3	3
CO5	3	3	2	1	2	3	2	1	2	2	1	3	2	2

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14241104	DC	Network Theory	20	20	30	30	-	-	100	2	1	-	3

Network Theory (14241104)

Course objective: To understand basic electric circuits, study of network theorems, transient analysis, analysis of two port networks.

Unit-I Introduction – Basics of Circuit Elements**,** Characteristics of Independent & Dependent Sources, KCL & KVL for circuits with dependent & independent sources, Dot convention for coupled inductor and their characteristics, co-efficient of coupling.

Unit-II Network theorems: Superposition theorem, Thevenin theorem, Norton theorem, Millman theorem, Reciprocity theorem and Maximum Power Transfer theorem for various types of dependent and independent power source networks.

Unit-III Laplace Transform & Passive Filters: The Laplace transform, Properties of Laplace transform, Initial and final value theorem. Waveform synthesis & Laplace Transform of various waveform function, Low pass, high pass, band pass and band elimination filters,

Unit-IV Transient analysis: Transients in RL, RC and RLC circuits, initial conditions, time constants, Steady state analysis, Node and mesh analysis of RL, RC and RLC networks with sinusoidal sources.

Unit-V Two Port Network: Concept of Ports, Calculation of network functions for one port and two port, Two port parameters – Z, Y, hybrid and chain Parameters, Relationship between two port network parameters, T and π networks, Characteristics impedance & propagation constant.

Text Books:

1. Network Analysis: M.E. Van Valkenberg, 3rd Edition, Prentice Hall of India.
2. Network and Systems: D. Roy Chaudhary,2nd Edition**,** New Academic Science Ltd.

Reference Books:

1. Introduction to Modern Network Synthesis: M.E. Van Valkenberg, Prentice Hall of India.
2. Network Analysis & Synthesis: F. Kuo, 2nd Edition, Wiley & Sons.
3. Network Analysis & Synthesis: Ravish R Singh, 1st Edition, McGraw Hill Education.

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Course Outcomes

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

CO1. **Analyze** the circuits using Kirchoff"s laws.
CO2. **Apply** Network theorems for the simplification of circuits.
CO3. **Apply** the Laplace transform to linear circuits and systems.
CO4. **Evaluate** transient response and steady state response.
CO5. **Determine** ABCD, Z,Y and h parameters of an electrical circuit.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	1	2	1	2	1	2	2	3	3	3
CO2	3	3	3	3	2	3	1	2	2	1	3	3	2	2
CO3	3	3	3	3	2	2	1	-	1	2	1	2	3	3
CO4	3	3	2	2	2	2	2	-	2	1	1	2	3	3
CO5	3	3	3	2	3	3	1	1	1	1	2	3	2	3

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14241102	ESC	Computer Programming	20	20	30	30	-	-	100	2	-	-	2

Computer Programming (14241102)

Course Objectives: Equip students with the skills to design and implement programming solutions in C++ using fundamental algorithms, approaches, and documentation techniques.

Unit I: Introduction to Programming: Types of computer programming languages, Program Execution and Translation Process, Problem solving using Algorithms and Flowcharts. Introduction to C++ Programming: Data Types, Constants, Keywords, variables, input/output, Operators & Expressions, Precedence of operators.

Unit II: Control Statements and Decision Making: Conditional statements: if, if-else, nested if, Switch statement with break and default, Loops: while, do-while, for, nested for, Loop control: break, continue, return, Decision making using logical operators, Real-world examples and applications of control structures.

Unit III: C++ Functions: Function Declaration and Definition, Function syntax, Parameter types and names, Return types and values, Function Types, Function Scope and Lifetime, Function Templates, Recursion, Recursive function definition.

Unit III: Strings and Arrays: C-style strings (character arrays), C++ string class, Declaring and initializing strings, String operations: concatenation, comparison, String manipulation functions: strlen(), strcpy(), strcat(). One-dimensional and multi-dimensional arrays, Array declaration and indexing, Array-based operations: sorting, searching**.**

Unit IV: C++ Pointers: Basics of Pointers & Addresses, reference variable, Pointer to Pointer, Pointer to Array, Array of Pointers, Pointer to Strings. Dynamic memory allocation using new and delete operators.

Unit V: Object Oriented Programming: Features of OOPS, Comparison of Procedural Oriented Programming with Object Oriented Programming, Abstract Data Types, Specification of Class, Visibility Modes, Defining Member Functions, Scope Resolution Operator, Creating of Objects, Static Data Member, Static Member Function, Array of Objects, Object as Arguments, Inline Function, Friend Function.

Text Books:

1.C++ How to Program, H M Deitel and P J Deitel, Prentice Hall.
2.Programming with C++, D Ravichandran, T.M.H.
3.Computing Concepts with C++ Essentials, Horstmann, John Wiley.

Reference Books:

1. The Complete Reference in C++, Herbert Schildt, TMH.
2. Object-Oriented Programming in C++, E Balagurusamy.
3. Fundamentals of Programming C++, Richard L. Halterman.

COURSE OUTCOMES:

After the completion of the course, the student will be able to:

CO1: Design algorithms and flowchart for a given problem.
CO2: Implement the concepts of procedural programming with control statement.
CO3: Develop optimized recursive functions and function templates to solve challenging computational tasks.
CO4: Implement the pointer concept for effective C++ programming.
CO5: Design object-oriented programs that effectively model real-world scenarios with encapsulation and abstraction.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	3	1	1	1	1	1	3	2	2
CO2	3	2	2	2	1	2	1	2	2	1	1	3	2	2
CO3	3	2	2	2	2	2	1	2	2	1	1	3	2	2
CO4	3	2	1	1	2	3	1	2	2	1	1	3	2	2
CO5	3	2	1	1	1	2	1	1	1	1	1	3	2	2

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14241105	ESC	Basic Electrical and Electronics Engineering	20	20	30	30	-	-	100	3	-	-	3

Basic Electrical & Electronics Engineering (14241105)

Course Objectives: Equip students with foundational knowledge of DC/AC circuits, magnetic circuits, transformers, electrical machines, and electronic circuits in electrical engineering.

Unit I :D.C. Circuits Analysis: Voltage and Current Sources: Dependent and independent source, Source conversion, Kirchhoff‟s Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin‟s theorem & Norton‟s theorem and their applications.

Unit II :Single-phase AC Circuits: Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and importance of Power factor.

Unit III- Magnetic Circuits:Basic definitions, AC excitation in magnetic circuits, self-inductance and mutual inductance, Induced voltage, laws of electromagnetic Induction, direction of induced E.M.F. Flux, MMF and their relation, analysis of magnetic circuits.

Unit IV:Single-phase Transformer &Rotating Electrical Machines: Single phase transformer, Basic concepts, construction and working principal, Ideal Transformer and its phasor diagram at No Load, Voltage, current and impedance transformation, Equivalent circuits and its Phasor diagram, voltage regulation, losses and efficiency, testing of transformers, Construction & working principle of DC and AC machine.

Unit V - Digital Electronics, Devices & Circuits: Number systems used in digital electronics, decimal, binary, octal, hexadecimal, their complements, operation and conversion, Demorgan’s theorem, Logic gates- symbolic representation and their truth table, Introduction to semiconductors, Diodes, V-I characteristic, Bipolar junction transistors and their working, Introduction to CB, CE & CC transistor configurations.

Text Books:

1. Basic Electrical and Electronics Engineering, D.P. Kothari & I.J. Nagrath-Tata McGraw Hill
2. Basic Electrical and Electronics Engineering, S. K Bhattacharya -Pearson
3. Electrical Machinery- A.E. Fitzgerald, C. Kingsley and Umans - TMH
4. Principles of Electrical Engineering- Vincdent Del Toro- Prentice Hall.
5. Basic Electrical Engineering -A,E. Fitzgerald, Higginbotham and Grabel -TMH
6. Integrated Electronics- Millmann & Halkias

Reference Books

1. Principles of Electrical Engineering- Vincdent Del Toro- Prentice Hall.
2. Basic Electrical Engineering -A,E. Fitzgerald, Higginbotham and Grabel -TMH
3. Integrated Electronics- Millmann & Halkias

Course Outcomes

After the completion of the course, the student will be able to –

CO 1. **Solve** dc &ac circuits by applying fundamental laws & theorems
CO 2. **Compare** the behavior of electrical and magnetic circuits for given input
CO 3. **Explain** the working principle, construction, applications of rotating electrical machines
CO 4. **Explain** the working principle, constructional details, losses & applications of single phase transformer.
CO 5. **Select** the logic gates for various applications in digital electronic circuits.
CO 6. **Explain** characteristics of Diode and Transistor.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	3	-	-	-	1	-	3	2	2
CO2	3	2	2	2	1	2	1	2	2	1	1	3	2	2
CO3	3	2	2	2	2	2	1	2	2	1	1	3	2	2
CO4	3	2	1	1	2	3	1	2	2	1	-	3	2	2
CO5	3	2	1	1	-	2	1	1	1	1	-	3	2	2

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14241109	DLC	Micro Project-I#					70	30	100	-	-	2	1

Micro Project-I# (14241109)

Course Objectives: To Fabricate Electronic Circuits on PCB.

List of Microprojects

1. Design a half and full wave rectifier circuits.
2. Design hardware model for Simple Rain Water Alarm System.
3. Design hardware model for Flashing Lamps Using 555 Timer.
4. Design hardware model for DC Power Supply.
5. Design hardware model for Simple Light Sensitivity Metronome Using Transistors.
6. Design hardware model for Simple Temperature Monitor.
7. Design hardware model for Invisible Burglar Alarm.
8. Design hardware model for Automatic Door Bell Ringer.
9. Design hardware model for Electronic Fuse.
10. Design hardware model for Geyser timer circuit
11. Design hardware model for Water Sensor Alarm.
12. Design a circuit for BJT as a Touch Switch.
13. Design a circuit for Water Level Indicator.
14. Design a circuit for LED Blinker Circuit.
15. Design a circuit for Automatic Night Light.
16. Design a circuit for Fire Alarm Detector.
17. Design a circuit for Automatic Smoke Detector.
18. Design a circuit for Laser-based Security System.
19. Design a circuit for Auto Water Pump Switcher.
20. Design a circuit for wireless Power Transfer System.
21. Design a Clap Circuit for Controlling Home Automation (light & fan).

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Course Outcomes

CO1: **Analyze** the electronic components, measuring instruments, and tools.
CO2. **Design** and simulate the schematic, layout using CAD software.
CO3. **Design** and fabricate PCBs for various electronic circuits individually and in a team.
CO4. **Troubleshoot** the fabricated circuit individually and in a team.
CO5. **Implementation** of electronic mini project that benefits society.

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14241107	DLC	Electrical and Electronics Lab					70	30	100	-	-	2	1

Electrical and Electronics Lab (14241107)

Course Objective: Develop skills in designing and testing electrical and electronic circuits.

List of Experiment

1. To determine the volt –ampere characteristics of diode in forward bias & reverse bias condition.
2. Verification of Kirchhoff's Current Law & Kirchhoff's Voltage Law.
3. Verification of Superposition Theorem.
4. To determine resistance & inductance of a choke coil.
5. To determine active & reactive power in a single phase A.C circuit.
6. To determine voltage ratio & current ratio of a single phase transformer.
7. To determine the polarity of a single phase transformer.
8. To perform open circuit & short circuit test on a single phase transformer.
9. Measurement of various Electrical Quantities using multimeter.
10. Study of construction details of D.C machine.

Course Outcomes:

After the completion of the lab, the student will be able to -

1. Verify circuit theorems.
2. Perform tests on transformer for determination of losses, efficiency & polarity.
3. Demonstrate the constructional features of electrical machines
4. Acquire teamwork skills for working effectively in groups
5. Prepare an organized technical report on experiments conducted in the laboratory.

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14241106	DLC	Computer Programming Lab					70	30	100	-	-	2	1

Computer Programming Lab (14241106)

Course Objectives: Develop skills in modular programming by writing reusable functions and dividing the code into logical modules.

List of Experiments

1. WAP to perform addition, subtraction, multiplication and division of integer and floating values.
2. WAP to perform swapping between two user entered values without using third variable.
3. WAP to take temperature from the user in Fahrenheit, then convert and display the temperature in Celsius and Kelvin.
4. WAP to calculate and display Simple Interest where the principle, rate and time are given by the user.
5. WAP to calculate and print the values of sinθ, cosθ and tanθ using math.h library.
6. WAP to implement Pythagoras Theorem. 7. WAP to display whether a user entered number is even or odd.
7. WAP to check and display whether a user entered number is divisible by 30 or not (using nested if).
8. WAP to find and display the greatest number among the three numbers entered by the user.
9. WAP to check and print whether a user entered number is negative, positive or zero.
10. WAP to print whether a user entered character is vowel or consonant using switch-case.
11. WAP to print mathematical table of a user entered number (example, 5*1=5) (for loop).
12. WAP to find factorial of a user entered number using while loop.
13. WAP to print all the numbers between 1 to 100 whose sum of the is even (do-while loop).
14. WAP to find factorial of a user entered number using recursion.
15. WAP to print the maximum and minimum element of a user entered 1D array and sort the array elements in ascending and descending order.
16. WAP to search an element and print its position in a user entered 2D array.
17. WAP to take enrollment number, name, 5 subject marks form students and calculate and print percentage along with their respective enrollment numbers using structure.

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Course Outcomes

After completing the lab, students will be able to:

CO1 Demonstrate the computer programming concepts data types, sizes, variable name, declaration and statements using C++.

CO2 Implement the programming of string and arrays using C++.

CO3 Implement the use of functions in C++.