MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

(A Govt. Aided UGC Autonomous & NAAC Accredited Institute affiliated to RGPV, Bhopal)

Department of Electrical Engineering

Scheme of Evaluation

B.Tech I Semester (Internet of Things)

(for batch admitted in academic session 2022-23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam.	Duration of Exam.
				Theory Slot				Practical Slot										
				End Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation			L	T	P				
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/Assignment		Lab Work & Sessional	Skill Based Mini Project								
1.	160122	ESC	Computer Programming	50	10	20	20	60	20	20	200	2	1	2	4	Blended	AO	2 Hrs
2.	100022	ESC	Basic Electrical & Electronics Engineering	50	10	20	20	60	20	20	200	2	1	2	4	Blended	MCQ	1.5 Hrs
3.	250100	BSC	Linear Algebra	50	10	20	20	-	-	-	100	3	1	-	4	Blended	PP	2 Hrs
4.	220121	DC	Basics of Internet of Things	50	10	20	20	-	-	-	100	3	1	-	4	Blended	MCQ	1.5 Hrs
5.	220122	DC	Digital Electronics and Logic Design	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
Total				**250**	**50**	**100**	**100**	**120**	**40**	**40**	**700**	**12**	**5**	**4**	**19**	**-**	-	-
7.	3000004	**Natural Sciences & Skills**	**Language**	50	10	20	20	30	10	10	150	1	-	2	GRADE	Blended	MCQ	1.5 Hrs
Induction programme of three weeks (MC): Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations.																		

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

Natural Sciences& Skills: Engineering Physics / Engineering Chemistry / Environmental Science/ Language

Credits of Natural Sciences & Skills will be added in the VI Semester

MCQ: Multiple Choice Question **AO:** Assignment + Oral **OB:** Open Book **PP:** Pen Paper **SO:** Submission + Oral

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Department of Electrical Engineering

Scheme of Evaluation

B. Tech. II Semester (Electrical Engineering)

(for batch admitted in academic session 2022-23)

S. No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted							Total Marks	Contact Hours per week			Total Credits	Mode of Teaching	Mode of Exam	Duration of Exam
				Theory Slot				Practical Slot										
				End Term Evaluation		Continuous Evaluation		End Sem. Exam	Continuous Evaluation			L	T	P				
				End Sem. Exam	$Proficiency in subject /course	Mid Sem. Exam.	Quiz/Assignment		Lab Work & Sessional	Skill Based Mini Project								
1.	220221	DC	Operating System	50	10	20	20	-	-	-	100	2	1	-	3	Blended	PP	2 Hrs
2.	220222	DC	Sensor Technology	50	10	20	20	60	20	20	200	2	1	2	4	Blended	PP	2 Hrs
3.	220223	DC	Data Structures	50	10	20	20	60	20	20	200	2	1	2	4	Blended	PP	2 Hrs
4.	220224	DC	Python Programming	50	10	20	20	60	20	20	200	2	1	2	4	Blended	AO	2 Hrs
5.	2501062	BSC	Probability & Random Process	50	10	20	20	-	-	-	100	3	1	-	4	Blended	PP	2 Hrs
Total				**250**	**50**	**100**	**100**	**180**	**60**	**60**	**800**	**11**	**5**	**6**	**19**	**-**	**-**	**-**
6.	3000003	**Natural Sciences & Skills**	Environmental Engineering	50	10	20	20	30	10	10	150	1	-	2	GRADE	Blended	MCQ	1.5 Hrs
Summer Internship Project – I (Institute Level) (Qualifier): Minimum two-week duration: Evaluation in III Semester.																		

$Proficiency in course/subject – includes the weightage towards ability/ skill/ competency /knowledge level /expertise attained etc. in that particular course/subject

Natural Sciences& Skills: Engineering Physics / Engineering Chemistry / Environmental Science/ Language

Credits of Natural Sciences & Skills will be added in the VI Semester.

MCQ: Multiple Choice Question **AO:** Assignment + Oral **OB:** Open Book **PP:** Pen Paper **SO:** Submission + Oral

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Department of Electrical Engineering

Syllabus

2020-2021

2021-2022

B.Tech.

in

Electrical Engineering (IoT)

Electrical Engineering Department

Madhav Institute of Technology & Science

Gwalior-474005

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Electrical Engineering

Basics of Internet of Things:220101

Course Objectives:

- To familiarize the students to the basics of Internet of things and protocols.
- It expose the students to some of the electrical engineering application areas where Internet of Things can be applied.

Unit I. Introduction to Internet of Things: IoT: Definition and importance**,** Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Three-layer and Five-layer model of IoT.

Unit II. IoT Communication network: Architecture of IoT, Communication network: Home Area Network (HAN), Neighborhood Area Network (NAN), Field Area Network (FAN), Wide Area Network (WAN), Wireless Sensor Networks (WSNs)

Unit III. IoT Protocols: IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRa WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT

Unit IV. IoT Sensors/Actuators and IoT Challenges: IoT: Sensor Technology, Mobile Phone Based Sensors, Medical Sensors, Neural Sensors, Environmental and Chemical Sensors, Radio Frequency Identification, Actuators, IoT Challenges: Design challenges, Development challenges, Privacy and Security challenges, Data Management and Other challenges

Unit V. Application of IoT: Smart Homes: Smart Appliances, Security and Safety. Smart Energy: Smart Meters, Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Real Time Pricing, Smart grid, Smart Cities: Smart Vehicles, Smart Lighting, Smart Parking etc.

Recommended Books:

1. Internet of Things By Rajkamal, Tata McGraw Hill publication
2. Internet of things(A-Hand-on-Approach) By Vijay Madisetti and ArshdeepBahga1st Edition, Universal Press
3. The Internet of Things: Connecting Objects By Hakima Chaouchi Wiley publication
4. The Internet of Things – Key applications and Protocols By Olivier Hersent, David Boswarthick, Omar Elloumi,, Wiley, 2012

Course Outcomes:

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

CO 1. **Explain** the function blocks, three-layer model and five-layer model of IoT

CO 2. **Develop** an understanding of various communication network: HAN, NAN, FAN, WAN and WSNs

CO 3. **Describe** privacy, security and design related challenges of IoT

CO 4. **Select** proper sensor technology for IoT application

CO 5. **Describe** IoT applications in the field of Electrical Engineering

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Department of Electrical Engineering

Basic Electrical & Electronics Engineering: 100022

Course Objectives:

- To impart the basic knowledge of the DC and AC circuits and their applications.
- To familiarize the students with the basic knowledge of magnetic circuits and its terminology, the importance of transformers in transmission and distribution of electric power.
- To expose the students to the working of DC Machine, various electronic circuits and its importance.

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

Recommended Books:

1. Basic Electrical and Electronics Engineering, Tata McGraw Hill - D.P. Kothari & I.J. Nagrath
2. Basic Electrical and Electronics Engineering, Tata McGraw Hill – V N Mittle& Arvind Mittal
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
7. Electronics Devices & circuits- Sanjeev Gupta, Dhanpat Rai Publication
8. Basic Electrical and Electronics Engineering, Tata McGraw Hill - D.C Kulshreshtha

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Department of Electrical Engineering

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. **Analyze** the response of linear 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.

Basic Electrical & Electronics Engineering Lab (100022)

LIST OF EXPERIMENT

1. To verify Kirchhoff's Current Law & Kirchhoff's Voltage Law.
2. To verify Superposition Theorem
3. To determine resistance & inductance of a choke coil.
4. To determine active & reactive power in a single phase A.C circuit.
5. To determine voltage ratio & current ratio of a single phase transformer.
6. To determine the polarity of a single phase transformer.
7. To perform open circuit & short circuit test on a single phase transformer.
8. To study multimeter& measure various electrical quantities
9. To study of constructional details of DC machine.
10. To determine the V-I characteristics of diode in forward bias & reverse bias condition.

Course Outcomes:

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

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

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Department of Electrical Engineering

250100 Linear Algebra

Objective of Course

o To understand the concept Matrices and its applications
o To understand the various aspect of algebraic structures'
o To explore vector space
o To perceive knowledge of linear transformation and their application

Unit 1:

Matrix, Rank of Matrix, Echelon form, Normal form of matrix, Solution of simultaneous equation by elementary transformation, Consistency of equation, Eigen values and Eigenvectors, Normalized eigenvector, Cayley Hamilton theorem and its application to finding inverse of matrix.

Unit 2:

Introduction of Groups and its properties, Sub-groups, Coset, Lagrange's theorem for finite group, Normal sub-group, Cyclic group, Ring and its properties, Field, Finite field, Integral domain and its properties.

Unit 3:

Vector spaces over the field and its properties, sub-spaces, linear dependent vectors and linear independent vectors, linear span of a set of vectors, basis and dimension of a vector space, sum and direct sum.

Unit 4:

Linear transformation, Kernel and range space of linear transformation, Nullity and Rank, Singular and Non- Singular transformation, Matrix representation of a linear transformation, change of basis and similarity.

Unit 5:

Inner product spaces, Properties of inner product space, Norm space, Schwarz's inequality, Triangular inequality, Parallelogram Law, Orthogonality, Generalized theorem of Pythagoras.

Recommended Books:

1. S. Lipschutz and M. Lipson, Linear Algebra (4th Edition), Schaum's Outline series, Mc- Graw Hill. (2009).
2. S. Boyd and L. Vandenberghe, Introduction to Applied Linear Algebra Vectors, Matrices, and Least Squares, University Printing House, Cambridge CB2 8BS, United Kingdom One Liberty Plaza, 20th Floor, New York, NY 10006, USA, (2018).
3. E. Kreyszig: Advance Engineering Mathematics, John Wiley & Sons, 10th Edition (2011).
4. R. K. Jain, S. R. K. Iyengar: Advance Engineering Mathematics, Narosa Publishing House Pvt. Ltd, 5th Edition (2016).

Course Outcomes:

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

CO 1.	**Develop** an understanding of the algebra of matrices i.e. inverses of matrices, determinants and other algebraic operations
CO 2.	**Compute** eigenvalues and eigenvectors,
CO 3.	**Explain** the basic concepts of a vector space, properties and dimension of vector space
CO 4.	**Explain** matrix representation of a linear transformation
CO 5.	**Describe** the concept of Inner product spaces

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Energy, Ecology, Environment & Society (EEES):100015

Course Objectives:

To create awareness about global energy status, climate issues and sustainable development for development of society using new rand renewable energy resources for power needs, to generate an understanding of human relationships, perceptions and policies towards environment and focus on design and technology for improving environmental quality and to develop moral values and morals to conduct efficiently and ethically in society.

Unit –I: Sources of energy: Renewable and non-renewable energy, current Indian and global scenario of energy, state wise energy consumption, role of energy in economic and social development and social transformation. **Energy Polices:** National level and State level policy and International policy of G-8, G-20, OPEC and European countries, solar energy policy of India, National Solar mission energy policy issues. Energy securities and challenges in Indian context.

Unit 2: Energy conversion: Solar Energy, sun-earth angle, solar water heating, concentrated solar power, PV power: roof top; off Grid and on grid, Hydro, wind, biomass, geothermal, tidal and nuclear energy, Fossil fuels, thermal power station basic concepts. Per kilowatt hr cost of energy produced from various energy sources and its future prospects, business opportunities in various non-conventional sources.

Unit–3: Ecology: Ecosystems, concept, components, types, Atmosphere, hydrosphere, lithosphere, biosphere, cycles in Ecosystem, Water, Carbon, Nitrogen. Biodiversity, threats and conservation, Producers, composers and decomposers, Energy and matter flow, Ecological succession, Food chains webs and ecological pyramids, Characteristics, structures and functions of ecosystems such as Forest, Grassland, Desert, Aquatic ecosystems. Community ecology- Characteristics, frequency, life forms, and biological spectrum, Ecosystem structure, Biotic and a-biotic factors, food chain, food web, ecological pyramids; Population ecology

Unit- 4: Environment: Air pollution, causes, classifications, adverse effects, Greenhouse gases and effect, their major concerns, present status, emission from automobile, power, infrastructure, agriculture and transportation, environmental security. Global warming causes and effects, acid rain, ozone layer depletion, climate change, its model, impact on human health, national and international impact of climate change, Kyoto protocol, national and additional measures; flexible mechanism for reduction of carbon, clean development mission, joint implementation programme, carbon credit, carbon trading, emission trading, Voluntary Emission Rights (VER), Certified Emission Reductions (CER), and emission reduction unit (ERU), Indian initiatives of reduction in greenhouse gases. Environmental ethics.

Unit -5: Values and ethics: Definition, Sources, and approaches to ethics, Social values and individual attitudes, Work ethics and work values, philosophical and Social ethics, human values and morals, business ethics, self-concept and Johari Window, emotional intelligence, social intelligence, self-development, character strengths and virtues, Impact of waste on society, management of e-waste.

Recommended Books:

1. Cunninghan WP and MA; Principles of Environment Sciences; Tata McGraw Hill (TMH)
2. Pandey, S.N. & Mishra, S.P. Environment & Ecology, 2011,AneBooks,Pvt.Ltd,New Delhi
3. Svakumar; Energy Environment & Ethics in Society;TMH
4. Bukhootsow, B., Energy Policy and Planning, Prentice Hall of India, New Delhi, 2003.
5. Jose Goldenberg, Thomas Johanson, and Reddy, A.K.N., Energy for Sustainable World, WileyEastern, 2005.
6. Charles E. Brown, World Energy Resources, Springer Publication, New York, 2002.
7. Culp, A.W., Principles of Energy Conversion, McGraw Hill New York, 2004.
8. BalaKrishnamoorthy; "Environmental management", PHI
9. Gerard Kiely, "Environmental Engineering" ;TMH
10. BharuchaErach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmadabad, 2002.
11. Chakraborty, S.K., Values and Ethics for Organizations, Theory and Practice, Oxford University Press, New Delhi, 2001.
12. Leary M.R., "The Curse of Self: Self-awareness, Egotism and the Quality of Human Life", Oxford University Press. 2004
13. Louis P. P., "The Moral Life: An Introductory Reader in Ethics and Literature", Oxford Univ.Press. 2007

Course Outcomes:

After successfully completing this course the students will be able to

CO 1. **Describe** various energy resources, their conversion to electrical power and role in technological & economic development.

CO 2. **Update** with national/international power status and renewable power development targets & missions.

CO 3. **Recognize** the impact of pollution on the ecosystem and control policies adopted at national/international levels.

CO 4. **Illustrate** the concepts of ecosystems and their conservation.

CO 5. **Solve** practical problems of society in a sustainable and ethical manner.

CO 6. **Fulfill** professional duties keeping in mind the environmental safety, health, and welfare of public.

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Digital Electronics and Logic Design: 220201

Course Objectives:

- To familiarize the students with the number representation and conversion between various representations in digital electronic circuits.
- To expose the students to the logical operations using combinational logic circuits, sequential logic circuits and the characteristics of memory and their classification.

Unit 1. Number System: Representation of Binary numbers, octal and hexadecimal numbers, complements, signed binary numbers, Binary codes, code conversion, floating-point numbers and arithmetic, and the conversion process. Subtraction using 1's and 2's complement, Excess 3, Gray code, Hamming Code.

Unit 2. Boolean Algebra and Logic Gates: Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms- SOP & POS. Logical operations, truth tables, logic gates, logic levels, and pulse waveforms. Simplification of Boolean functions**:** The map method- the Karnaugh map, minimal SOP & POS, Don't care conditions, multiple output minimization, tabular method, determination, and selection of prime implicants.

Unit 3. Combinational Logic Circuits: Introduction: Design Procedure, adder, subtractor, Magnitude Comparator, Universal Gate, Encoders, Decoders, Multiplexers, Demultiplexer, Parity Checker Generator.

Unit 4. Sequential Logic Circuits: State tables and diagrams, Flip Flop and its various types -S-R, J-K, D and T Flip Flops, Excitation table, Triggering of FFs & Latches. Registers: - Shift – Registers, Ripple Counters, Synchronous Counters. Ring Counters**.** Timing Sequences, design procedure.

UNIT 5: Memory and Programmable Logic Device: Introduction to Digital Logic families (RTL, DTL, TTL, ECL, CMOS &Schottky logic) and their special characteristics: Fan-Out, Fan in, power dissipation, the figure of merit, Noise Margin; Circuits of Logic Families, RAM, ROM, A/D And D/A converters and their types.

Recommended Books:

1. Digital Design by Morris Mano, Pearson Education, 6th edition 2018
2. Logic Design Theory by NNBiswas,Prentice Hall India Learning Private Limited,1993
3. Digital Fundamental by TLFloyd, Pearson Education, 11th edition, 2017
4. Digital Electronics by R. P.Jain, McGraw Hill Education; 4 edition ,2009
5. Digital Logic Design by MansafAlam,PHI Learning Pvt. Ltd., 2015

Course Outcomes:

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

- **CO 1.** **Perform** conversion among Different number systems and codes.
- **CO 2.** **Simplify** the logic expressions using Boolean laws, map method and design them by using logic gates.
- **CO 3.** **Design** a given digital combinational circuits using basic gates for different applications.
- **CO 4.** **Analyze** different types of flip-flops and design a sequential logic circuit.
- **CO 5.** **Understand** basics of Logic family and converter like A/D and D/A.

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Department of Electrical Engineering

Sensor Technology: 220202

Course Objective. Introduction to various types of sensors and the design of basic circuit building blocks.

Unit I. Sensors Fundamentals and Characteristics: Sensor, actuator and transducer, Signals and Systems; Sensor Classification: passive and active Sensor, absolute and relative Sensor; Units of Measurements; Sensor Characteristics: Transfer Function, Calibration, Nonlinearity, Saturation Repeatability, Dead Band, Resolution.

Unit II. Principle of Sensing & Transduction: Mechanical and Electromechanical sensor, Resistive (potentiometric type), Strain gauge, Inductive sensor: common types- Reluctance change type, LVDT, Capacitive Sensors, Thermal Sensors, Magnetic Sensors, Proximity Sensor, Piezoelectric Effect.

Unit III. Interface Electronic Circuits: Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors.

Unit IV. Smart Sensor Technologies: Architecture of Smart Sensor: Features, Fabrication of Sensor And Smart Sensor, Integration of Micromachining and Microelectronics, Wafer bonding, LIGA process, Standard of Smart Sensor Network, Communication for smart sensors.

Unit V. Sensors in Different Application Area: Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors Neuro sensors, Biosensors, MEMS Sensors**,** Sensors for Mechanical Shock, Machinery Vibration Monitoring Sensors, Humidity Sensors, Electromagnetism in Sensing.

Recommended Books:

1. John S.Wilson “Sensor Technology” 4TH edition,Elsevier.2005
2. Jacob Fraden “Sensor Technology Design & Application”4thedition ,Springer .2010
3. Frank “Understanding Smart Sensors”2nd Ed.2002.
4. Ramon P. A. and Webster J. G., “Sensors and Signal Conditioning” 2nd 2001 Ed., John Wiley and Sons.
5. Feng Z. and Leonidas G., “Wireless Sensor Networks”, Elsevier Eastern Limited. 2007
6. Barney G., “Intelligent Instrumentation”, Prentice-Hall International Editions
7. Yamasaki H., “Intelligent Sensors”, Elsevier Eastern Limited. 1996

Course Outcomes:

After completing this course, the student will be able to:

- **CO 1.** **Explain** fundamentals of Sensors & Transducers
- **CO 2.** **Describe** physical principles of sensing
- **CO 3.** **Compare** various sensor materials and technology used in designing sensors
- **CO 4.** **Select** appropriate sensor for given application
- **CO 5.** **Recognize** the latest trends in the field of sensor

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Department of Electrical Engineering

Sensor Technology Lab: 220202

1. Glow the combinations of different colors of LEDs
2. Sense and measure temperature and humidity using DHT11
3. Identify the object and measure the distance using ultrasonic sensor
4. Display the single number using 7-segment display
5. Display the numbers from 0000 to 9999 using 4 digit 7-segment display
6. Verify the characteristic of NTC type thermistor
7. Speed control of servo motor
8. Display the different types of the shapes and alphabets using matrix display 8 × 8 pixels
9. Identify the card details using RFID technology
10. Sense and measure the light using photosensor

Additional experiments using virtual lab platform

11. Verify the characteristic of RTD using virtual lab platform
12. Verify the characteristic of LVDT using virtual lab platform
13. Measure the weight through strain gauge using virtual lab platform

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

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Department of Electrical Engineering

DATA STRUCTURE: 230202

COURSE OBJECTIVES

- To be familiar with the use of data structures as the foundational base for computer solutions to problems.
- To understand various techniques of searching and sorting.
- To understand basic concepts about stacks, queues, lists, trees and graphs.

Unit-I Introduction to Data Structures:

Algorithms & their characteristics, asymptotic notations. arrays and its representations, index to address translation. Link list: Introduction, implementation of linked list, operations, circular link list, doubly linked list, polynomial manipulation using linked list

Unit-II Stacks:

Concepts and implementation of stacks, operations on stack, conversion of infix to postfix notation, evaluation of postfix expression, recursion.
Queues: Concepts and implementation, operations on queues, dequeue, priority queues, circular queues and application.

Unit-III Trees:

Types, terminology, binary tree -representations, traversal, conversion of general tree to binary tree, binary search tree, threaded binary tree and height balanced tree.

Unit-IV Graphs:

Background, graph theory terminologies, representation of graphs- sequential & linked representation, path matrix, graph traversals- BFS, DFS, spanning trees, applications of graph.

Unit-V

Searching & Sorting: Linear search, binary search, bubble sort, selection sort, insertion sort, quick sort, merge sort, radix sort and heap sort, comparison between sorting techniques, hashing and collision resolution techniques.

RECOMMENDED BOOKS

- Data Structures, Algorithms and Applications in C++, Sartaj Sahni, 2 nd Edition.
- An Introduction to Data Structures with Applications, Jean-Paul Tremblay, Mcgraw hill.
- Data Structures & Algorithms, Aho, Hopcroft & Ullman, original edition, Pearson Publication.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO 1. **Explain** the basics of Algorithms and their performance criteria.
CO 2. **Describe** the working of linear/Non-Linear data structures.
CO 3. **Select** the appropriate data structure to solve specific problems.
CO 4. **Analyse** the performance of various Data Structures & their applications.
CO 5. **Evaluate** the time/space complexities of various data structures & their applications.
CO 6. **Design** the optimal algorithmic solutions for various problems**.**

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OBJECT-ORIENTED PROGRAMMING AND METHODOLOGY: 230203

COURSE OBJECTIVES

- To study the concept of object-oriented programming.
- To create C++ programs that leverage the object-oriented features of the C++ Language.
- To apply object-oriented or non-object-oriented techniques to solve bigger computing problems.

Unit-I Introduction to C++ and Object-Oriented Concepts:

Basics of C++, Tokens, I/O Statements, Structure of Program, Operators and Expressions, Flow of Control, Arrays, Structures, Functions and its type, Function Prototyping, Pointers, Pointer Variables, Pointers and Arrays, Array of Pointers, Pointers and Structures, Dynamic Memory Allocation.

Programming Techniques: Unstructured & Structured Programming, Object Oriented Paradigm, Features of Oops, Comparison with Procedural Oriented Programming & Object Oriented Programming, Abstract Data Types, Reference Variable, Scope Resolution Operator.

Unit-II Classes & Objects:

Specification of Class, Visibility Modes: Private, Public, Protected, Defining Member Functions, Creating of Objects, Characteristics of Object, Static Data Member, Static Member Function, Array of Objects, Object as Arguments, Inline Function, Default Arguments, Friend Function, Recursion.

Constructors and Destructors: Introduction, Types of Constructors- Default Constructor, User Defined Constructor, Parameterized Constructor, Copy Constructor, Constructor with Default Arguments, Rules of Constructor Definition and Usage, Destructors.

Unit-III Polymorphism:

Introduction, Type of Polymorphism: Compile Time Polymorphism & Run Time Polymorphism, Function Overloading, Operator Overloading: Binary Operators, Arithmetic Assignment Operators, Unary Operators, Rules for Operator Overloading, Pitfalls of Operator Overloading, Data Conversion, Type Casting.

Unit-IV Inheritance:

Introduction to Code Reuse, Visibility Modes, Types of Inheritance: Single Level, Multilevel, Multiple, Hybrid, Multipath. Virtual Base Classes, Abstract Classes, Constructors in Derived Classes, Nesting of Classes, Overriding Member Function. Containership: Classes with in Classes, Function Overriding.

Unit-V Pointer & File Concept:

Pointers Overview, Pointers to Objects, This Pointer, Pointers to Derived Classes, Virtual Functions & Pure Virtual Function, Association, Type of Association, Aggregation, File Concepts, Study of Various Files and Streams, Opening and Closing of Files- Functions Get(), Getline(), Put(), Opening The Files Using Function Open(), File Manipulator Function.

RECOMMENDED BOOKS

- C++ How to Program, H M Deitel and P J Deitel, Prentice Hall.
- Programming with C++, D Ravichandran, T.M.H.
- Computing Concepts with C++ Essentials, Horstmann, John Wiley.
- The Complete Reference in C++, Herbert Schildt, TMH.

- Object-Oriented Programming in C++, E Balagurusam.
- Fundamentals of Programming C++, Richard L. Halterman.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. Explain the concepts of classes & objects and their significance in the real world.
CO2. Describe the benefits of object-oriented design.
CO3. Build C++ classes using appropriate encapsulation and design principles.
CO4. Analyze the utilization of inheritance and polymorphism in the solution of problems.
CO5. choose appropriate object orient programming concepts for solving real world problems.
CO6. Develop solutions to problems demonstrating usage of control structures, modularity, I/O and other standard language constructs.

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Electrical Engineering

220301: Fundamentals of Signals & Control Systems

Course Objectives:

- To develop an understanding of fundamental characteristics of signals and systems.
- To develop mathematical skills to solve problems involving convolution, and sampling.
- To understand the concepts of various transforms for signal analysis.
- To learn the basics of system representations, control systems and dynamic system response.

Unit I: Elementary Signals & Systems:
Basic definitions and classification of signals, impulse, step, complex exponential and sinusoidal signals, system models and basic properties, representation of signals and systems, Linear Time Invariant (LTI) systems: convolution sum, convolution integral, properties, difference equations, differential equations, and eigen functions.

Unit II: Fourier Transforms
Fourier series representation of periodic signals, properties of Fourier series, LTI system response to periodic signals, spectral properties of signals, continuous-time Fourier transform: properties, convolution property.

Unit III: Sampling and Discrete Transforms
Sampling Theorem, sampling of continuous time signals and signal reconstruction, sampling of discrete time signals. Discrete-time Fourier transform: properties, convolution property. Z-Transform: definition, region of convergence and properties, inverse z-transform, LTI systems analysis using the z-transform.

Unit IV: System Representations and basics of Control System
Laplace Transform: definition, region of convergence, and properties, representation of LTI systems using the Laplace transform. Fundamentals of control: plant, input, output, open loop system, closed loop system and need for modeling, Transfer functions, significance of poles & zeros, stability: definition, equilibrium state, and bounded input bounded output stability. state representation: concepts of state, sate variables and state space model.

Unit V: Dynamic Response of Systems
Response of LTI systems to excitation, solutions of state equations. Transition matrix of an LTI system, Transformation from transfer function model to State-Space representation, Eigenvalues and their role to the state evolution matrix, Concepts of Controllability and Observability, transformation between time and frequency domain, basic concepts of bode plot.

Recommended Books:

1. Signal and systems by Oppenheim AV, Willisky AS and Nawab SH, Pearson
2. Signals and systems by Hwel. P. Hsu, Schaum's outlines, TME
3. Digital Signal Processing Principles by Proakis JP, Manolaxis, Pearson
4. Fundamentals of Signals & Systems by Michael J Roberts, McGraw Hil
5. Control System Engineering by I.J. Nagrath and M. Gopal, New Age International Publication.

6. Control System Engineering by Norman Wiley Publication.
7. Linear Control Systems by B. S. Manke, Khanna Publishers
8. Modern Control Systems by R. C. Dorf and R. H. Bishop, Addison-Wesley publishing company.

Course Outcomes

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

CO 1. **Describe** the elementary characteristics of the signals and systems.
CO 2. **Analyze** the spectral characteristics of periodic signals using Fourier Transforms.
CO 3. **Explain** the sampling process and discrete transforms for the analysis of discrete time-signals and systems.
CO 4. **Apply** the Laplace transform for the analysis of continuous-time signals and systems.
CO 5. **Explain** the concepts of control system and system representation using transfer function and state variables.
CO 6. **Evaluate** the time domain and frequency domain behavior of the dynamic response of systems.

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Department of Electrical Engineering

DESIGN & ANALYSIS OF ALGORITHMS: 220302

COURSE OBJECTIVE:

- To introduce the topic of algorithms as a precise mathematical concept.
- To demonstrate the familiarity with major algorithm design paradigms and methods of analysis.
- To design efficient algorithms for common computer engineering problems.
- To enhance the skills using well-known algorithms and data structures for solving real-life problems.

Unit-I

Introduction to Computational Model: RAM model, Algorithms and its importance, Recurrences and Asymptotic Notations, Growth of function, Mathematical Analysis of Non-Recursive and Recursive Algorithm, Review of Sorting & Searching Algorithms, Basic Tree and Graph Concept: Binary Search Trees, Height Balanced Tree, B-Trees and Traversal Techniques.

Unit-II

Divide and Conquer Method: Introduction and its Examples such as Finding the maximum and minimum, Binary Search, Merge Sort, Quick Sort and Strassen's Matrix Multiplication.

Unit-III

Greedy Method: Introduction, Characteristics, greedy activity selection. **Minimum Cost Spanning Trees**: Prim's and Kruskal's Algorithm, knapsack Problem, Single Source Shortest Path: Dijkstra's single source shortest path algorithm, Huffman Coding.

Unit-IV

Dynamic Programming: Introduction, The principle of Optimality, Examples of Dynamic Programming Methods such 0/1 Knapsack, Travelling salesman problem, Floyds All Pairs Shortest Path, Longest Common Subsequence and Reliability Design.

Unit-V

Backtracking: Concept and its Examples like 4-Queen's Problem, Knapsack problem Hamiltonian Circuit Problem, Graph Coloring Problem etc. **Branch and Bound**: Introduction and its Examples like – Travelling
Salesperson Problem etc. **NP Completeness**: Introduction, Class P and NP, Polynomial Reduction, NP-Hard and NP-Complete problem.

RECOMMENDED BOOKS:

- Fundamentals of Computer Algorithms, Horowitz & Sahani, Universities press
- Introduction to Algorithms, Coreman Thomas, Leiserson CE, Rivest RL, PHI.
- Design & Analysis of Computer Algorithms, Ullman, Pearson.
- Algorithm Design, Michael T Goodrich, Robarto Tamassia, Wiley India.

COURSE OUTCOMES:
After Completion of this course, the students would be able to:

CO1: Define the basic features of an Algorithms.
CO2: Outline major Algorithms and Data Structures.
CO3: Apply various algorithmic design paradigms.
CO4: Analyze the asymptotic performance of Algorithms.
CO5: Compare different design techniques to develop algorithms for computational problems.
CO6: Design algorithms using greedy strategy, divide and conquer approach, dynamic programming, backtracking, branch and bound approach.

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Department of Electrical Engineering

Design and Analysis of Algorithm Lab

List of Programs

1. WAP to implement the following using array as data structure and analyze its time Complexity.
   a. Insertion sort b. Selection sort c. Bubble sort d. Quick sort
   e. Bucket sort f. Radix sort g. Heap sort h. Merge sort
2. WAP to implement Linear and Binary Search and analyze its time complexity.
3. WAP to implement Matrix Chain Multiplication and analyze its time complexity.
4. WAP to implement Longest Common Subsequence Problem and analyze its time Complexity.
5. WAP to implement Optimal Binary Search Tree Problem and analyze its time complexity.
6. WAP to implement Huffman Coding and analyze its time complexity.
7. WAP to implement Dijkstra's Algorithm and analyze its time complexity.
8. WAP to implement Bellman Ford Algorithm and analyze its time complexity.
9. WAP to implement DFS and BFS and analyze their time complexities.
10. WAP to Implement 0/1 knapsack using dynamic programming**.**

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. Relate the principles of algorithm design in solving problems.
CO2. Demonstrate basic algorithms and different problem solving strategies.
CO3. Design and implement optimization algorithms in specific applications

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Electrical Engineering

OPERATING SYSTEMS: 220303

Course Objectives

- Provide basic knowledge of computer operating system structures and functioning.
- Compare several different approaches to memory management, file management and process management
- Understand various problems related to concurrent operations and their solutions.

Unit- I

Basics of operating systems: Generations, Types, Structure, Services, System Calls, System Boot, System Programs, Protection and Security.

Process management: Process Concepts, Process States, Process Control Block, Scheduling-Criteria, Scheduling Algorithms and their Evaluation, Threads, Threading Issues.

Unit-II

Process synchronization: Background, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlock: System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery form Deadlock.

Unit-III

Memory management: Main Memory, Swapping, Contiguous Memory Allocation, Paging, Structure of Page Table, Segmentation, Virtual Memory, Demand Paging, Page Replacement Algorithms, Allocation of Frames, Thrashing.

Unit-IV

Storage management: Mass-Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, RAID Structure.

Unit-V

File system interface: File Concept, Access Methods, Directory Structure, File System Structure, Allocation Methods, and Free-Space Management.

System Protection: Goals, Principles, Domain of Protection, Access Matrix, Access Control.

Recommended Books

1. Operating System Concepts, Silberschatz, Ninth Edition, Willey Publication.
2. Operating Systems, Internals and Design Principles, Stallings, Seventh Edition, Pearson Publication.
3. Modern Operating Systems, Tanenbaum, Fourth Edition. Pearson Publication.

COURSE OUTCOMES

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

CO1. Outline the basic concept of operating systems
CO2. Analyze the working of operating system
CO3. Examine the working of various scheduling/allocation approaches
CO4. Measure the performance of various scheduling/allocation approaches
CO5. Analyze the various operating system problems/issues

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Electrical Engineering

Analog Electronics: 220304

Course Objectives:

The course intends to provide an understanding of the principles, operation and application of the analog building blocks like diodes, BJT, FET etc. for performing various functions, use of simple models and equations to illustrate the concepts involved, an overview of different amplifiers and oscillators and the knowledge about practical analog circuits.

Unit I: Special Diodes

LED, Varactor diode, Photo diode, Schottky diode, Tunnel diode; their characteristics and applications. Rectifiers, Characteristics of diodes, BJT, MOSFET.

Unit II: Transistor Biasing

CE, CB and CC configuration, Input output characteristics, Operating point Transistor load line, Transistors as a switch. Frequency Response: Amplifier transfer function, low and high frequency response of common emitter and common base configuration.

Unit III: Transistors Amplifier

Small Signal BJT amplifiers: AC equivalent circuit, hybrid model and their use in amplifier design. Multistage amplifiers, frequency response of basic & compound configuration, Power amplifiers; Class A, B, AB, & C Amplifier.

Unit IV: Feedback & Oscillator Circuits

Effect of positive and negative feedbacks, basic feedback & their properties, Analysis of practical feedback amplifiers, Sinusoidal Oscillators, Crystal Oscillators, tuned oscillators- collpits and Hartley, Multivibrators, 555 timer.

Unit V: Operational Amplifiers

Op-Amp Basics, Op-amp parameters characteristics ideal and practical Op-Amp circuits, differential and Common mode operation, Inverting &Non-Inverting operational Amplifier, Log and Antilog Op-Amp, Op-Amp applications.

Recommended Books:

1. Microelectronics Circuits by A.S. Sedra& K.C. Smith, Oxford University Press (1997)
2. Electronic Principles by A.P. Malvino, Tata Mcgraw Hill Publications
3. Electronic Devices & Circuit Theory by Robert L. Boylestad& Louis Nashelsky,
4. Digital Electronics by William Kleitz, Prentice Hall International Inc.
5. Introduction to Semiconductor Materials and Devices by M. S. Tyagi, , John Wiley & Sons Inc
6. Introduction to Electronic Devices Michael Shur by John Wiley & Sons Inc., 2000.

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Department of Electrical Engineering

Course Outcomes:

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

CO 1. **Explain** working principles of electronic devices e.g. Diode, Zener Diode, LED, Rectifiers, Transistor, Power Amplifier, Oscillator and Op-Amp.

CO 2. **Categorize** the different types of diode, Power Amplifier, Oscillators and Op-Amp and transistor Biasing.

CO 3. **Explain** the different types of characteristics of Diode, Transistor, Power Amplifier and Op-amp.

CO 4. **Describe** the various mathematical model of transistor e.g. Hybrid model, re model.

CO 5. **Develop** an ability and skill to design different types of diode rectifier, transistor biasing, oscillators and timer circuit.

CO 6. **Apply** the various principles of electronics to design different types of Analog Electronics circuits for various applications.

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Department of Electrical Engineering

Analog Electronics Lab: 220304

List of Experiments

1. To measure and plot the forward and reverse V-I characteristics of diode
2. To measure and plot the forward and reverse V-I characteristics of the SCR
3. To determine ripple factor and rectification efficiency of half wave rectifier with and without filter
4. To determine ripple factor and rectification efficiency of full wave rectifier with and without filter
5. To test and plot input and output common emitter transistor characteristics
6. To verify the operation of Darlington pair and also determine the gain, input and output impedances
7. To construct Wien bridge oscillator using 741 op-amp and to measure the frequency of oscillation
8. To design and test differential Amplifier using Transistor
9. To determine and verify the amplification and voltage gain of a two stage RC coupled Amplifier
10. To construct push pull Amplifier and calculate the efficiency

Course Outcomes:

On the successful completion of the lab experiments students will be able to:

CO1. Develop the understanding of diode biasing conditions.
CO2.Investigate the operation of half-wave and full wave rectifier and find their performance curves.
CO3.Examine transistor configurations and investigate common emitter configuration input-output characteristics.
CO4. Develop teamwork skills for working effectively in groups
CO5. Prepare technical report on experiments conducted in the lab

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Electrical Engineering

Programming & Simulation lab :220305

List of Experiments

1. Introduction to Arduino Programming and its Hardware interface
2. Working with control of Light Emitting Diodes (LEDs)
   a. Pushbutton Control
   b. Light Dimmer
3. Write a program to create LED BAR graph with Arduino
4. Write a program to measure the moisture in soil using Arduino
5. Write a program to control SERVO motor with Joystick
6. Write a program to monitor the weather using temperature and humidity sensor
7. Write a program to make musical keyboard using Arduino
8. Write a program to get the Arduino to spin a colorful pinwheel using a motor
9. Write a program to control DC motor in forward and backward direction using H-Bridge
10. Write a program to build your own Arduino

Course Outcomes:

On the successful completion of the lab experiments students will be able to:

CO1 Familiar with Arduino environment and its applications and to understand Arduino programming with C++.

CO2 Learn about any new IDE, compiler, and MCU chip in Arduino compatible boards or similar types

CO3 Develop teamwork skills for working effectively in groups

CO4 Prepare technical report on experiments conducted in the lab

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Electrical Engineering

DATABASE MANAGEMENT SYSTEM : 220401

Course Objectives

- To understand the fundamental concepts of a database management system.
- To analyses database requirements and determine the entities involved in the system and their relationship to one another.
- To develop the logical design of the database using data modelling concepts & normalization.
- To manipulate a database using SQL commands.

Unit-I Introduction:

DBMS Concepts & Architecture, File processing system, limitation of file processing system, Advantages of Database System, Schemas, Instances, Data Independence, Data dictionary, Functions of DBA, Database languages, Data Models: Hierarchical Data Model, Network Data Model & Relational Data Model, E-R Model, Comparison between Models, Introduction of File organization Techniques.

Unit-II Relational Data Models:

Entities & Attributes, Entity types, Key Attributes, Relationships, Domains, Tuples, types of Attributes, Relations, Characteristics of Relations, Keys, Attributes of Relation, Relational Database, Integrity Constraints. Relational Algebra: Concept and Relational Algebra operations like Select, Project, Join, Division, Union etc.

Unit-III SQL:

Introduction of SQL, features of SQL, Data Definition & Data Manipulation commands in SQL, SQL operators, Update Statements & Views in SQL, Query & Sub query, Data Retrieval Queries & Data Manipulation Statements examples etc. Overview of Tuple Oriented Calculus & Domain Oriented Relational Calculus.

Unit-IV Normalization:

Introduction to Normalization, concepts of anomalies and its types, closure set of dependencies and of attributes, Various Normal Forms: 1NF, 2NF, 3NF, BCNF, Functional Dependency, Decomposition, Dependency Preservation, Loss Less & Lossy Join, Definition of Dangling Tuple, and Multi-values Dependencies.

Unit-V Transaction Processing & Concurrency Control:

Transaction Processing Concepts, ACID properties, State Diagram, Types of Transaction, Basic idea of serializability, Concurrency Control, Concurrent operation of Databases, Recovery, Types of Recovery, Basic overview of Distributed Databases System and Relational Database Management System, Concepts of Object-Oriented Database System and its tools.

RECOMMENDED BOOKS

- Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill, 6th Edition.
- Raghu Ramakrishnan, Johannes Gehrke,"Database Management System", McGraw Hill., 3rd Edition.
- Elmasri & Navathe, "Fundamentals of Database System", Addison-Wesley Publishing, 5th Edition.
- Date C.J, "An Introduction to Database", Addison-Wesley Pub Co, 8th Edition.
- B.C. Desai, "An introduction to Database systems"

Course Outcomes

After completion of the course students would be able to:

CO 1. Develop the understanding about different type of database system i.e terminology, features, classifications, and characteristics embodied in database systems.
CO 2. Identify different issues involved in the design and implementation of database system.
CO 3. Analyze database schema for a given problem domain.
CO 4. Justify principles for logical design of databases, including the E-R modelling and Normalization approach.
CO 5. Apply transaction processing concepts and recovery methods over real time data.
CO 6. Formulate, using relational algebra and SQL, solutions to a broad range of query problems.

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Department of Electrical Engineering

DATABASE MANAGEMENT SYSTEM :220401

List of Experiments

1. Implementation of DDL commands of SQL with suitable examples
    1. Create table
    2. Alter table
    3. Drop table
2. Implementation of DML commands of SQL with suitable examples
    1. Insert
    2. Update
    3. Delete
3. Implementation of different types of function with suitable examples
    1. Number function
    2. Aggregate function
    3. Character function
    4. Conversion function
    5. Date function
4. Implementation of different types of operators in SQL
    1. Arithmetic operators
    2. Logical operators
    3. Comparison operators
    4. Set operation
5. Implementation of different types of joins
    1. Inner join
    2. Outer join
    3. Natural join
6. Study and implementation of
    1. Group by and having clause
    2. Order by clause
    3. Indexing
7. Study and implementation of
    1. Sub queries
    2. Views
7. Study and implementation of different types of constraints.
8. Study and implementation of Database Backup and Recovery commands.
9. Study and implementation of Rollback, Commit, Savepoint.

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Department of Electrical Engineering

Power Electronics :220403

Course Objective:

- To introduce the students, the basic theory of power semiconductor devices and passive components.
- their practical application in power electronics and to familiarize the operation principle of AC-DC, DC-DC, DC-AC conversion circuits and their applications.
- To provide the basis for further study of power electronics circuits and systems.

Unit I. Power Semiconductor Devices: Application of power electronics, Power diodes, Power Transistors, Power MOSFET, IGBT, Thyristors, TRIAC and GTO. MCT, Firing circuits and protection, Design of snubber circuit, Static Switches. Diodes circuits.

Unit II. Controlled Rectifiers: Principle of phase controlled converter operation, Single phase half wave, full wave and semi converters, Power factor improvement, Symmetrical angle control. Dual converters.

Unit III. Chopper: Principles of single quadrant, Two quadrant, four quadrant chopper. Control strategies. Pulse width modulation. Frequency modulation. Thyristor commutation schemes, switched mode power supplies, buck-boost regulators.

Unit IV. AC voltage controller: Principle of Ac phase control, ON-OFF control, Single Phase bidirectional control with resistive and inductive loads, Power Supplies,

Unit V. Inverter circuits: Principle of operation of voltage source inverter. Single phase and three phase inverters. Voltage control using PWM technique, Current source inverters, Inverter applications

Recommended Books:

1. Power Electronics by P.S. Bimbhra, Khanna Publishers, 9th ed., 2017
2. Power Electronics: Circuits, Devices & Applications by MH Rashid, Pearson, 12th ed. 2018
3. Power Electronics by Cyril W.Lander , McGraw-Hill; 8thedition,1987
4. Power Electronics Principles and Applications by JosephVidyathil, TMH,2020
5. Bose, B.K., Handbook of Power Electronics, IEEE Publications.

Course Outcomes:

After completing this course the student will be able to:

CO1: Develop an understanding of power electronics devices (i.e. Diode SCR, BJT, MOSFET and IGBT. etc) and explain their static/ dynamic characteristics.

CO2: Analyze the configuration of AC to DC converter, Dual converter, chopper, cyclo-converter

CO3: Classify converters and identify their applications.

CO4: Develop different model of different converters to calculate their performance parameter

CO5: Identify the problems/limitations of power electronics devices, converters and suggest solution

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Electrical Engineering

Microprocessors & Embedded Systems: 220404

Course Objective:

- To provide fundamental operating concepts of microprocessors and microcontrollers.
- This course aims to provide students with a solid theoretical basis as well as comprehensive professional understanding of Arduino and Raspberry Pi.

Unit I. Microprocessors:8085-architecture, operation, pin configuration and functions, bus organization, control signal generation for external operations- fetch, IO/M, read/write, machine cycles and bus timings. Addressing mode, instruction set, Overview/concept of peripheral interfacing devices- 8251, 8253, 8255 and 8279.

Unit II. Microcontrollers: 8051-architecture, operation, pin configuration and functions, memory organization, register, I/O ports, addressing modes, instruction sets, instruction classification. Assembly language programming, Interrupts in 8051. Timer/Counter programming for time delay generation and waveform generation. Interfacing with ADC, DAC, LEDs and seven segment display.

Unit III. Arduino: Introduction to the Arduino, creating an Arduino programming Environment, Arduino IDE, creating an Arduino program, Arduino Libraries, Analog and Digital Interfacing, Adding Interrupts, communicating with devices and sensors.

Unit IV. Raspberry Pi: Introduction to the Raspberry Pi, basic functionality of the Raspberry Pi board and its processor, setting and configuring the board, programming on Raspberry Pi, python programming environment, python expressions, general purpose IO pins, Protocol pins, RPi,GPIO library, communicating with devices and sensors.

Unit V. IoT application using Arduino and Raspberry Pi: Arduino- Playing tones and a melody, alphanumeric LCD display, speed and direction control, temperature and humidity sensor interfacing. Raspberry Pi -controlling LED, interfacing an LED and Switch, Interfacing a Light Sensor (LDR), camera interfacing etc.

Recommended Books:

1. "8085 Microprocessors Architecture Application and Programming", Ramesh S. Goankar, Penram International, 5th Edition.
2. "The 8051 Microcontroller", Kenneth J. Ayala, Cangage learning, 3rd Edition.
3. "Arduino Cookbook", Michael Margolis, O'Reilly Media, Inc., 1st Edition.
4. "Arduino for beginners: Essential Skills Every Maker Needs", John Baichtal, Person Education, Inc., 1st Edition.
5. "Raspberry Pi User Guide", Eben Upton and Gareth Halfacree, August 2016, 4th Edition, John Wiley & Sons.
6. "Programming with Raspberry Pi: Getting Started with Python", Simon Monk, January 2012, McGraw Hill Professional.

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Department of Electrical Engineering

Microprocessors & Embedded Systems: 220404

Course Outcomes:

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

CO1	**Distinguish** various types of processor architectures.
CO2	**Describe** architecture, memory organization of 8085 and 8051.
CO3	**Create** sketches, libraries and Arduino development environment.
CO4	**Design** Raspberry Pi hardware and implement program.
CO5	**Develop** interfacing between different sensors and Arduino / Raspberry Pi.

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Department of Electrical Engineering

Programming with Python :220406

Course Objectives

- To understand components of Python Program
- To learn the basic construct of python programming for solving real world research-based problems.
- To visualize and analyze data using python libraries

List of Experiments

1. Introduction to Python programming
2. Write a program to create, concatenate and print a string and accessing substring from a given string
3. Write a program in Python for demonstration of list creation and its appending & removal
4. Write a program to demonstrate working with Tuples in python
5. Write a program to demonstrate working with Tuples in python
6. Write a code to create Functions in Python
7. Write a code to demonstrate the use of loops & conditions in Python
8. Write a code to take input from user & then to sort the numbers using Python
9. Write a python program to convert temperature units to and from degree Celsius to degree Fahrenheit
10. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order

Course Outcomes:

CO1: **Write** basic Python programs a program to solve real world problem

CO2: **Demonstrate** the use of loops & conditional statements in Python

CO3: **Demonstrate** the use of “list” & “dictionary” type of built-in data structure

CO4: **Prepare** technical report on experiments conducted in the lab

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Department of Electrical Engineering

IoT in Microgrid: 220501

Course Objective:

- To provide the basic concepts of Microgrid, its configuration, operation and control.
- To familiarize the students with energy storage devices, smart metering and IoT application in Microgrid.

Unit I. An Overview of Microgrid:
Concept of Microgrid, Typical structure and configuration of a Microgrid, Significance of Microgrid, Sources of microgrid, Types of Microgrids, AC, DC and hybrid Microgrids.

Unit II. Microgrid Operation and Control:
Modes of Operation: Grid Connected Mode, Islanding Mode, Issues in Island Mode of operations, Control laws, Power relations and power control, Bi-directionality and its need in a Microgrid, Control of DC-DC converters and inverter and challenges in a Microgrid, Microgrid Control Strategies: Centralized, Decentralized and Hierarchical control.

Unit III. Energy Storage for Microgrid: Role of energy storage systems AND their applications in Microgrid, Overview of energy storage technologies: Thermal, Mechanical, Chemical, Electrochemical, Electrical, Battery Energy Storage Systems (BESS), Superconducting Magnetic Energy Storage (SMES), Compressed Air Energy Storage (CAES)

Unit IV. Introduction to IoT: Architecture of IoT, Communication network: Home Area Network (HAN), Neighborhood Area Network (NAN), Field Area Network (FAN), Wide Area Network (WAN), Wireless Sensor Networks (WSNs)

Unit V. IoT in Microgrid: Smart Meters, Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI), Real Time Pricing, Smart Appliances. Smart sensors: home & building automation, plug in hybrid electric-vehicles (PHEV), algorithms for vehicle to grid and grid to vehicle management, smart charging stations.

Recommended Books:

- Microgrids: Architectures and Control by Nikos Hatziargyriou, Wiley-IEEEPress,2013.
- Microgrid: Advanced Control Methods and Renewable Energy System Integration by Magdi S. Mahmoud, Butterworth-Heinemann,2016
- Microgrids and Active Distribution Networks by S. Chowdhury, P. Crossley, IET Press, 2010
- Design of Smart Power Grid Renewable Energy Systems, AliKeyhani, JohnWiley&Sons,2011.
- Smart Grid: Infrastructure, Technology and Solutions by Stuart Borlase, CRC Press 2012.
- Smart Grid: Technology and Applications by Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama,Wiley

MADHAV INSTITUTE OF TECHNOLOGY & SCIENCE, GWALIOR

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Department of Electrical Engineering

Course Outcomes:

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

CO 1. Identify the role and significance of microgrid in future power systems
CO 2. Describe different types and modes of operation of Microgrids
CO 3. Explain the different control strategies available for Microgrid.
CO 4. Select proper energy storage devices for smooth operation of microgrid
CO 5. Describe applications of IoT in Microgrid

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Department of Electrical Engineering

Cloud Computing: 220502

Course Objectives

- To understand Cloud Computing concepts, technologies, architecture and applications.
- To understand the underlying principle of cloud virtualization, cloud storage, data management and data visualization.
- To understand different cloud programming platforms and tools to develop and deploy applications on cloud.

Unit- I Cloud Architecture and Model:

Technologies for Network-Based System, System Models for Distributed and Cloud Computing, NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics, Cloud Services, Cloud models (IaaS, PaaS, SaaS), Public vs Private Cloud, Cloud Solutions Cloud ecosystem, Service management, Computing on demand.

Unit- II Virtualization:

Basics of Virtualization, Types of Virtualization, Implementation Levels of Virtualization, Virtualization Structures, Tools and Mechanisms, Virtualization of CPU, Memory, I/O Devices. Virtual Clusters and Resource management, Virtualization for Data-center Automation.

Unit- III Cloud Infrastructure:

Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources.

Unit -IV Programming Model:

Parallel and Distributed Programming Paradigms- MapReduce, Twister and Iterative MapReduce, Hadoop Library from Apache, Google App Engine (GAE), Amazon Web Service (AWS), Smart Cloud, Public Clouds and Service Offerings, Microsoft Windows Azure.

Unit -V Security in the Cloud:

Security Overview, Cloud Security Challenges and Risks, Software-as-a-Service Security, Security Governance, Risk Management, Security Monitoring, Security Architecture Design, Data Security, Application Security, Virtual Machine Security, Identity Management and Access Control.

Recommended Books

- Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
- John W. Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
- Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
- Kumar Saurabh, " Cloud Computing — insights into New-Era Infrastructure", Wiley India,2011
- George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly
- James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. define various basic concepts related to cloud computing.

CO2. identify the architecture, infrastructure and delivery models of cloud computing.

CO3. apply suitable virtualization concepts.

CO4. choose the appropriate programming models and public cloud platforms.

CO5. analyse various security issues in cloud computing.

CO6. compose virtualization, security and programming modules in cloud computing solutions.

Embedded Control of Electrical Machines: 220503

Course Objective: To expose the students to the construction, principle of operation and performance of Special Electrical Machines. In addition, students will able to control the different types of motor by using microcontrollers.

Unit 1:

Transformer: Construction, working principle and types of Single phase & Three phase transformer, basics of star and delta connections of three phase transformer, Power and distribution transformers, losses & efficiency, All day efficiency. Instrument Transformer: Introduction & their applications.

Unit 2 :

DC Machines: Construction, working principle and types of DC motor, DC Generator, speed control of DC motor control with microcontrollers.

Brush-Less DC(BLDC) Motors: Construction, Principle of operation, EMF and torque equations, Motor characteristics, applications and control of BLDC with microcontrollers. Introduction of PMSM (permanent magnet synchronous motor) motors.

Unit 3 :

Single Phase Induction Motor: Construction, Double revolving field theory, Types of single phase induction motors, Operating characteristics, applications and speed control using with microcontrollers.

Universal Motor: Construction, working, applications and control.

Unit 4 :

Three Phase Induction Motor: Construction, Working, Equivalent circuit, Torque equation and torque-slip characteristics, industrial applications and speed control using Arduino/Rasberry-pi.

Unit 5 :

AC Servo Motor: Construction, Working principle, Torque-speed characteristics, and applications in position controlling, tracking system, robotic machinery etc.and microcontroller based schematic.

Stepper Motors: Constructional features, Principle of operation, Its types and microprocessor based control.

Text Books:

1. Husain Ashfaq, “Electrical Machines”, Dhanpat Rai & Sons 3 P.S.Bimbhra, “Electrical Machinery”, Khanna Publisher

2. Brushless Permanent Magnet DC and Reluctance Motor Drives by T.J.E Miller, Clarendon Press, Oxford.
3. Stepping Motors and its Microprocessor Controls by T. Kenjo, Clarendon Press London, Oxford.
4. Stepping Motors-A Guide to Motor Theory and Practice by P.P. Aearnley, Peter Perengrinus London.
5. I.J. Nagrath & D.P.Kothari, " Electrical Machines", Tata McGraw Hill

Course Outcomes:
After completing this course the student will be able to:
CO1: Describe the need of transformer in various electric applications
CO2: Explain the constructional features of Motors
CO3: Select a suitable drive for specific application
CO4: Describe microcontroller based control of a dc motor, universal motor and stepper motor

IoT Architecture and Protocols: 220504

Course Objective: The main objective of the course is to teach students the fundamental concepts and architecture of the Internet of Things, as well as the various protocols that are utilized in IoT applications.

Unit I – Introduction:
IoT architecture outline, standards - IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics

Unit II – IoT reference architecture:
Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints

Unit III – IoT data link layer & network layer protocols:
PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), WirelessHART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP

Unit IV – IoT transport & session layer protocols:
Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT

Unit V – IoT service layer protocols & security protocols:
Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC802.15.4, 6LoWPAN, RPL, Application Layer.

Recommended Books:
1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications,2016

2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2015
3. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642- 19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016
4. N. Ida, Sensors, Actuators, and Their Interfaces, Scitech Publishers, 2014

Course Outcomes:

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

CO 1. **Explain** various concepts, terminologies, and architecture of IoT systems
CO 2. **Describe** the architectural views of IoT and various design challenges
CO 3. **Discuss** about data link and network layer protocols.
CO 4. **Analyze** various transport and session layer Protocols
CO 5. **Explain** the need of IoT service layer protocols

Data Sciences In IoT: 220505

Course objectives

- To understand the key technologies in analytics for IoT.
- To understand the IoT data and requirement of analysis.
- To gain practical, hands-on experience with statistics programming languages, tools.

Unit-I Introduction to Data Analytics: Defining IoT Analytics and Challenges: The situation, Defining IoT analytics, IoT analytics challenges, Business value concerns, IoT Analytics for the Cloud. Types of Analytics: Streaming Analytics, Spatial, Time Series and Prescriptive Analytics.

Unit-II Data Collection: Getting to know your data, Types of Data, Data collection strategies, Data Pre-processing, Feature engineering with IoT data**,** Exploratory Data Analytics, Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis.

Unit-III Data Visualization and Representation: Model Development Simple and Multiple Regression, Model Evaluation using Visualization, Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making, Box Plots, Pivot Table, Heat Map.

Unit-IVStrategies to Organize Data for Analytics: Linked Analytical Datasets, Linking together datasets, Managing data lakes, Data retention strategy, Economics of IoT Analytics, Cost considerations for IoT analytics, Thinking about revenue opportunities, The economics of predictive maintenance example, Data Analytics Life Cycle.

Unit-V Application of Analytics in IoT: IoT based applications, Healthcare, Marketing, Finance, Smart cities, Cyber security, video surveillance, Agriculture and Weather Forecasting and other domains; Real Time IoT based data analysis.

RECOMMENDED BOOKS:

- Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
- Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
- David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013

- Andrew Minteer, Analytics for the Internet of Things "IoT" (1 ed.), Packt Publishing, 2017. ISBN 978-1787120730.
- Hwaiyu Geng, Internet of Things and Data Analytics Handbook (1st st ed.), Wiley, 2017. ISBN 978-1119173649.

COURSE OUTCOMES

After completion of this course, the students would be able to:

CO1. Define the fundamentals of data science and its importance.

CO2. Classify the evolution, roles, stages in data science projects.

CO3. Analyze the pre-processing and data reduction strategies.

CO4. Explain the different data visualization and representation techniques.

CO5. Evaluate the performance of algorithms in data science.

CO6. Design the different real time applications of data science in IoT.