BRANCH- AUTOMATION AND ROBOTICS

1st Semester

Specialization: AUTOMATION AND ROBOTICS

First Semester							
Theory					**Practical**		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
Internet of Things	4-0	4	100	50	-	-	-
Robotics-Analysis And Its Application In Industrial Automation	4-0	4	100	50	-	-	-
Industrial Automation And Instrumentation	4-0	4	100	50	-	-	-
Advanced Microprocessor And Microcontroller	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 24							

INTERNET OF THINGS (IoT)

MODULE I

Introduction to Internet of Things

Introduction-Definition & Characteristics of IoT , **Physical Design of IoT-** Things in IoT , IoT Protocols, **Logical Design of IoT-** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Enabling Technologies-** Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, **IoT Levels & Deployment Templates.**

MODULE II

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-**Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-**Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle -**Health & Fitness Monitoring, Wearable Electronics

IoT and M2M

Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

MODULE III

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Inf
ormation Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, **Case Study on IoT System for Weather Monitoring, Motivation for Using Python**

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, **Exemplary Device: Raspberry Pi**, **About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –** Serial, SPI , I2C , **Programming Raspberry Pi with Python-**Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , **Other IoT Devices-** pcDuino, Beagle Bone Black , Cubieboard

MODULE IV

IoT & Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Text Books:

1. Internet of Things, A Hand Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

Reference Books:

1. The Internet of Things, by Michael Millen, Pearson

COMPUTATIONAL METHODS AND TECHNIQUES

MODULE-I:

Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.
Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen's Featrure Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.

MODULE-II:

Fuzzy Logic: Basic Concepts of Fuzzy Logic, Fuzzy vs Crisp Set, Linguistic variables,Membership Functions, Operations of Fuzzy Sets, Fuzzy If-Then Rules, Variable Inference Techniques, Defuzzification, Basic Fuzzy Inference Algorithm, Fuzzy System Design, FKBC and PID Control, Antilock Breaking System(ABS), Industrial Applications.

MODULE-III:

Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.
LINEAR Programming: Simplex Method, Duality, Sensitivity Methods
NON-LINEAR Programming: Newton's Method, GRG Method, Penalty Function Method, Augmented Langrange Multiplier Method, Dynamic Programming and Integer Programming, Interior Point Methods, Karmakar's Algorithm, Dual Affine, Primal Affine.

MODULE-IV:

Genetic Algorithm: GA and Genetic Engineering, Finite Element based Optimization, PSO,BFO, Hybridization of Optimization Technique, Application of Optimization Technique for Solving Projects(Project solutions).

Implementation of Branch Relevant Industrial Applications by Matlab Code.

Books Recommended:

1. Neural Networks- by Simon Haykin
2. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
3. Neural Networks and Fuzzy Logic – by Bart Kosko
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7. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
8. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering",Prentice Hall,1999
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10. Gill,Murray and Wright ,"Practical Optimization"
11. James A.Memoh. "Electric Power System Application Of Optimization".
12. Song Y.,"Modern Optimization Techniques In Power System"
13. Optimization Research; Prabhakar Pai,Oxford University Press.

ROBOTICS-ANALYSIS AND ITS APPLICATION IN INDUSTRIAL AUTOMATION

Module-1

Introduction. Construction of manipulators, advantages and disadvantages of various kinematic structures. Applications, Non servo robots, motion planning. Feedback systems, encoders Kinematics, homogeneous coordinates solution of the inverse kinematic problem, multiple solutions, jacobian, work envelopes.

Module-2

Trajectory planning. Joint Interpolated Trajectory, Link joints and their Manipulator dynamics and force control. Sensors: Vision, ranging, laser, acoustic, tactile. Developments in sensor technology, sensory control. Introduction to Robotic Technology, Robot physical configuration, Basic robot motions. Types of Manipulators: Constructional features, Advantages and disadvantages of various kinematics structures, servo & non-servo manipulator.

UNIT-3

Actuators and transmission systems: pneumatic, hydraulic and electric actuators and their characteristics, Control systems. Feedback systems and sensors: Encoders and other feedback systems, vision, ranging systems, and tactile sensor.
Concept of automation in industry, mechanization and automation, classification of automatic systems. Basis of automated work piece handling, working principles and techniques, job orienting job-feeding devices, transfer mechanisms.

UNIT-4

Air cylinders design and mountings, pneumatic and hydraulic valves, flow control valves, direction control valves, and hydraulic servo systems

Text Books / References:

1. K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.
2. Y. Koren, Robotics for Engineers, McGraw Hill, 1985
3. J.J. Craig, Robotics, Addison-Wesley, 1986.
4. Saeed B. Niku, " Introduction to Robotics – Analysis, Systems and Application" : PHI 2006
5. Richard D, Klafter, Thomason A ChmielOwski, Michel Nagin "Robotics Engg-an Integrated Approach" PHI 2005
6. R.K. Mittal & I.J. Nagrath, "Robotics & Control" TMH-2007
7. CAD/CAM by MikellGroover
8. Automation, production system & computer aided manufacturing by Groover

Reference Books:

1. Robotics Engineering an Integrated Approach by Richard D. Clafter, A. Chmielewski, Michael Negin
2. Pneumatics by Majumdar
3. Industrial Robotics & Flexible Manufacturing by S. Dev
4. Industrial Automation and Robotics by S.K. Arora and A.K. Gupta

INDUSTRIAL AUTOMATION AND INSTRUMENTATION

Module-1

Nature of Industrial Process: continuous & discrete state sequential process, process variables and their classification.
Introduction to Process Control Philosophies: type of relays, ladder logic methodology, ladder symbols.
Introduction to Programmable Logic Controllers: advantages & disadvantages of PLC with respect to relay logic, PLC architecture, Input Output modules, PLC interfacing with plant, memory structure of PLC.

Module-2

PLC programming methodologies: ladder diagram, STL, functional block diagram, creating ladder diagram from process control descriptions, introduction to IEC61131 international standard for PLC.
PLC functions: bit logic instructions, ladder diagram examples, interlocking, latching, inter dependency and logical functions, PLC Timer & Counter functions on-delay timer, off-delay timers, retentive on-delay timers, pulse timers, timer examples, up-counter, down-counter and up-down counter, counter examples, register basics.
PLC Data Handling: data move instructions, table and register moves, PLC FIFO & LIFO functions**.**

Module-3

PLC arithmetic and logical functions: addition, subtraction, multiplication, division instructions, increment decrement, trigonometric and log functions, AND, OR, XOR, NOT functions, PLC compare and convert functions.
PLC program control and interrupts: jumps, subroutine, sequence control relay, watchdog.
Analog value processing: types of analog modules, analog input and output examples, PID control of continuous process.

Module-4

Measurement error and uncertainty. Accuracy, confidence limits, confidence level. Measuring methods. Characteristics of measuring instruments. Voltage and current measurement. Frequency measurement. Signals and noise. Signal conditioning: instrumentation amplifiers, sample and hold circuits, filters, current to voltage conversion analog multiplexers, isolation amplifiers. A/D and/a conversion: parallel, successive approximation and dual slope A/D converters.

Text/References:

1. JOHN WEBB: Programmable Logic Controllers Principles & applications, PHI
2. T. A. HUGHES: Programmable Controllers
3. C. D. JOHNSON: Process Control Instrumentation
4. D.V. Murty, *Transducers and Instrumentation*, PHI, 2008.
5. C. S. Rangan, G. R. Sarma, V. S. V. Mani, *Instrumentation: Devices and Systems*, TMH, 2008.
6. A.S. Morris, *Principles of Measurement and Instrumentation*, Prentice Hall, 2007.
7. J. Bouwens, *Digital Instrumentation*, TMH, 2002.

ADVANCED MICROPROCESSOR AND MICROCONTROLLER

Module I

(Prerequisite: A basic course on 8 bit ups such as 8085)

16-bit microprocessor(one well known processor, say 8086 to 68000 to be taken as case study)-quick overview of the instruction set, Assembly language programming. Interrupt structure, Interfacing memory and I\O devices. Memory organizations.

Standard peripherals and their interfacing-(s\w and h\w aspects) color graphic terminals and ASCII keyboards, mouse, floppy and hard disc drive, other storage media (optical disks, Digital Audio Tapes etc.)

Module II

Data transfer techniques-Asynchronous and synchronous. Serial and parallel interface standards. Communication media and adapters. Modems and their interfacing.

Bus structures and standards-basic concepts. Example of a bus standard (PC\-VME bus).

Salient features of other processors (80286\386\486 or 68020\68030\68040). Microcontrollers and digital signal processors. I\O processors and arithmetic coprocessors.

Logic design for microprocessor-based systems-design of state.

Module III

Introduction to Microcontrollers - Motorola 68HC11 - Intel 8051 - Intel 8096 - Registers - Memories - I/O Ports - Serial Communications - Timers - Interrupts.

Text/References

Module IV

Data acquisition systems. Virtual instrumentation. Sensors and transducers: temperature, geometric displacement, force, torque, vibration. Microprocessor and PC based Instrumentation system Design. Introduction to computer control of processes.

Reference Books:

1. John.F.Wakerly: Microcomputer Architecture and Programming, John Wiley and Sons.
2. Ramesh S.Gaonker: Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing (India).
3. Yu-Cheng Liu and Glenn A.Gibson: Microcomputer systems: The 8086/8088 Family Architecture, Programming and Design, Prentice Hall of India.
4. Raj Kamal: The Concepts and Features of Microcontrollers, Wheeler Publishing

BRANCH-CIVIL ENGINEERING

Specialization: STRUCTURAL & FOUNDATION ENGINEERING,
STRUCTURAL ENGINEERING,
CIVIL ENGINEERING,
GEOTECHNICAL ENGINEERING,
SOIL MECHANICS & FOUNDATION ENGINEERING,
SOIL MECHANICS,
WATER RESOURCE ENGINEERING AND MANAGEMENT,
WATER RESOURCE ENGINEERING,
TRANSPORTATION ENGINEERING

First Semester							
Theory					Practical		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
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Internet of Things	4-0	4	100	50	-	-	-
Theory of Elasticity and Plasticity	4-0	4	100	50	-	-	-
Finite Element Analysis and its Application to the Civil Engineering	4-0	4	100	50	-	-	-
Environment Impact Assessment and Auditing	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
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Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-**Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-**Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle -**Health & Fitness Monitoring, Wearable Electronics

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8. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering", Prentice Hall,1999
9. Rao S.S "Engineering Optimization"
10. Gill, Murray and Wright ,"Practical Optimization"
11. James A. Memoh. "Electric Power System Application Of Optimization".
12. Song Y., "Modern Optimization Techniques In Power System"
13. Optimization Research; Prabhakar Pai, Oxford University Press.

FINITE ELEMENT METHOD IN CIVIL ENGINEERING

Module I:

Introduction:

Finite Element Method-Basic Concepts and Solution of Discrete Problems-Steady State and Time Dependent Continuous Problems. Application of Finite Method through illustrative Examples. Finite Difference Method-Finite Difference. Representation of Differential Equations- Stability Consistency and Convergence of Partial Differential Equations-Time integration-Finite Difference Methods in Solution of Steady and Unsteady Problem-Jacobi's Method, Gauss Seidel Method.

Module II:

FEM for Two and Three Dimensional Solids:

The Continuum, Equations of Equilibrium, Boundary Conditions, Strain displacement relations, Stress strain Relations, Plane stress and plane Strain problems, Different methods of structural analysis including numerical methods. Basics of finite element method (FEM), different steps involved in FEM, Different approaches of FEM, Direct method, Energy approach,.

Module III:

Element properties:

Interpolation Functions for General Element Formulations: Compatibility and Completeness, Polynomial Forms: One Dimensional Elements, Geometric Isotropy, Triangular Elements, Rectangular Elements, Lagrange and Serendipity Elements, Solid Elements, Isoparametric Formulation, Stiffness Matrix of Isoparametric Elements. Three Dimensional Elements, Isoparametric Formulations, Axisymmetric Elements; Numerical Integration: One, Two and Three Dimensional.

Module IV:

Analysis of Frame Structures:

Stiffness of Truss Members**,** Analysis of Truss**,** Stiffness of Beam Members**,** Finite Element Analysis of Continuous Beam**,** Plane Frame Analysis**,** Analysis of Grid and Space Frame, Introduction to Plate Bending Problems**,** Finite Element Analysis of Shell.

Additional Applications of FEM:

Finite Elements for Elastic Stability**,** Finite Elements in Fluid Mechanics and ground water modelling.

Reference Book:

1. Reddy, J. N., An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math, 2005.
2. Logan D. L., A First Course in the Finite Element Method, Thomson- Engineering, 3rd edition, 2001.
3. Cook R.D., Malkus, D.S. and Plesha, M.E., Concepts and Applications of Finite Element Analysis, Third Edition, John Wiley, 1989.
4. O. C. Zienkiewicz and Y. K. Cheung, The Finite Element Method in Structural and Soild Mechanics, McGraw Hill, London
5. Logan D. L., A First Course in the Finite Element Method, Thomson- Engineering, 3rd edition, 2001.
6. S. S. Rao, Finite Element Analysis, Elsevier Butterworth-Heinemann
7. W. Weaver Jr. and J. M. Gere, Matrix Analysis of Framed Structure, CBS Publishers & Distributors, New Delhi, India
8. K.A. Hoffman, Computational Fluid Dynamics, McGraw Hill.

THEORY OF ELASTICITY & PLASTICITY

Module 1:

Linear elasticity; stress, strain, constitutive relations, strain displacement relations, three dimensional stress and strain analysis, compatibility, stress and displacement functions.

Module 2:

Two dimensional problems in Cartesian and polar coordinates, description of an elasticity problem as a boundary value problem, bending of beams-cantilever and simply supported beam.

Module 3:

Torsion of rectangular bars including hollow sections, torsion of a circular and a rectangular section

Module-4: Elements of plasticity, failure & yield criterion, Equations of plasticity, plastic stress-strain relations, flow rule, velocity field, slip lines and plastic flow, incremental plasticity.

Books:

(1**)** S.P.Timoshenko & J.N.Goodier,"Theory of Elasticity", McGraw Hill-1970.
(2) M.Kachanov, "Theory of Plasticity", MIR Publication.
(3) C.R.Calladine, "Plasticity for Engineers", Ellis Horwood, Chichester,U.K.,1985

ENVIRONMENTAL IMPACT ASSESSMENT AND AUDITING

Sustainable Development Framework for Environmental Impact Assessment. screening, Scoping and Base line Studies, Significance and Importance of Impacts, Mitigation aspects, Assessment of alternativees, Public Hearing, Decision Making. Assessment of impacts on physical resources, ecological resources, human use values and quality of life values.

Impact assessment methodologies -various methods, their applicability. Strategic Environmental Assessment. Environmental Management Planning. Disaster management planning.

Concepts of environmental audit, objectives of audit. Types of Audits; Features of Effective auditing; Programme Planning; Organisation of Auditing Programme, pre-visit data collection. Audit Protocol; Onsite Audit; Data Sampling - Inspections - Evaluation and presentation; Exit Interview; Audit Report - Action Plan - Management of Audits.

References

1. Larry, W. C “Environmental Impact Assessment” McGraw Hill Inc. Singapore.
2. Riki Therirvel, E.Wilson, S.Thompson, D.Heaney, D. Pritchard. Earthscan “Strategic Environmental Assessment” London.
3. Alan Gilpin “Environmental Impact Assessment-Cutting edge for the 21st century” CUP, London.
4. Peter Wathern, Unwin Hynman “Environmental Impact Assessment-Theory & Practice”, Syndeny.
5. Paul, A Erickson “A Practical Guide to Environmental Impact Assessment”, Academic Press.

BRANCH-COMPUTER SCIENCE AND ENGINEERING

Specialization: COMPUTER ENGINEERING
COMPUTER SCIENCE AND ENGINEERING
COMPUTER SCIENCE
COMPUTER SCIENCE AND TECHNOLOGY

First Semester							
Theory					**Practical**		
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Adavanced Data Structure And Algorithm	4-0	4	100	50	-	-	-
Advanced Operating System	4-0	4	100	50	-	-	-
Lab-I					8	4	150
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INTERNET OF THINGS (IoT)

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24. James A. Memoh. "Electric Power System Application Of Optimization".
25. Song Y., "Modern Optimization Techniques In Power System"
26. Optimization Research; Prabhakar Pai, Oxford University Press.

ADVANCED COMPUTER ARCHITECTURE

Module – I

Principles of Processor Performance, RISC and CISC Architectures, Pipelining fundamentals, Pipeline Hazards, Superscalar Architecture, Super Pipelined Architecture, VLIW Architecture.

Module – II

Basic Multiprocessor Architecture: Flynn's Classification, UMA, NUMA, Distributed Memory Architecture, Array Processor, Vector Processors, Associative Processor, Systolic architecture.
Interconnection Networks: Static Networks, Network Topologies, Dynamic Networks.

Module –III

Hierarchical Memory Technology: Data and Instruction caches, Multi-level caches, Cache memory mapping policies, Cache Coherence, Cache Performance, Virtual memory, Page replacement techniques, Memory Inter leaving, Memory Management hardware.

Module – IV

Data Flow Computer Architecture: Static Data flow computer, Dynamic Data flow computer, Cluster computers, Distributed computing, Cloud computing.

Reference Books:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design, Elsevier.
2. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann
3. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.
4. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw Hill.
5. Computer Architecture: Parhami, Oxford University Press

ADAVANCED DATA STRUCTURE AND ALGORITHM

MODULE-I:

Heap Structure: Min-Max heap, Leftist heaps, Binomial heaps, Fibonacci heaps, Skew heaps, Lazy binomial heaps, Deap Data structure.

MODULE-II:

Search and Multimedia Structure: Binary Search Tree, AVL Tree, 2-3 Tree, B-Tree, B+ Tree, Red-Black Tree, Segment Tree, k-d Tree, Point Quad Trees, R-Tree, TV-Tree.

MODULE-III:

Asymptotic Notations, Dynamic Programming (LCS, Floyd-Warshall Algorithm, Matrix Chain Multiplication), Greedy Algorithm (Single Source Shortest Path, Knapsack problem, Minimum Cost Spanning Trees), Geometric Algorithm (Convex hulls, Segment Intersections, Closest Pair), Internet Algorithm (Tries, Ukonnen's Algorithm, Text pattern matching), Numerical Algorithm (Integer, Matrix and Polynomial multiplication, Extended Euclid's algorithm)

MODULE-IV:

Polynomial Time, Polynomial-Time Verification, NP Completeness & reducibility, NP Completeness proofs, Cook's theorem

Reference Books:

1. T. H. Cormen, C. E. Leiserson, and R. L. Rivest, "Introduction to Algorithms", PHI.
2. E. Horowitz, S. Sahani and Dinesh Mehta, Fundamentals of Data Structures in C++, Galgotia.
3. Mark Allen Weiss, "Data Structures & Algorithm Analysis in C/C++", Pearson Edu. India.
4. Adam Drozdex, Data Structures and algorithms in C++, Thomason learning.

ADVANCED OPERATING SYSTEM

MODULE-I:

System Architecture Types, Distributed Operating Systems, Issues in Distributed operating Systems, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Global State, Chandy-Lamport's Global State Recording Algorithm,

MODULE-II:

Cuts of a Distributed Computation, Termination Detection, Mutual Exclusion Algorithms, Performance Measures, Non-Token-Based Algorithms, Ricart-Agrawala Algorithm, Maekawa Algorithm, Token-Based Algorithms, Suzuki-Kasami Algorithm, Raymond Tree based Algorithm, Comparative Performance Analysis.

MODULE-III:

Deadlock Handling Strategies, Centralized Deadlock-Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms, Agreement Protocols.

MODULE-IV:

Distributed File Systems, Distributed Shared Memory, Distributed Scheduling, Fault Tolerance, Multiprocessor Operating Systems.

Reference Books:

1. M. Singhal and N. G. Sivaratri, "Advanced concepts in Operating Systems", Tata McGraw Hill.
2. Coulouris, "Distributed Systems: Concepts and Design", Pearson Education.
3. P. K. Sinha "Distributed Operating Systems Concepts and Design" PHI.

BRANCH-ELECTRICAL ENGINEERING

Specialization:ELECTRICAL POWER SYSTEM
ELECTRICAL ENGINEERING.
POWER ELECTRONICS & DRIVES
POWER ELECTRONICS
POWER SYSTEM ENGINEERING
POWER SYSTEMS
ENERGY SYSTEMS ENGINEERING
POWER ELECTRONICS AND ELECTRICAL DRIVES
POWER ELECTRONICS AND POWER SYSTEMS
POWER ENGINEERING AND ENERGY SYSTEMS
POWER AND ENERGY ENGINEERING

First Semester							
Theory					Practical		
Course Name	**Hours/Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
Internet of Things	4-0	4	100	50	-	-	-
Power Conversion Devices And Drives	4-0	4	100	50	-	-	-
Advanced Power Systems	4-0	4	100	50	-	-	-
Smart Electrical Energy System	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 24							

INTERNET OF THINGS (IoT)

MODULE I

Introduction to Internet of Things

Introduction-Definition & Characteristics of IoT , **Physical Design of IoT-** Things in IoT , IoT Protocols, **Logical Design of IoT-** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Enabling Technologies-** Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, **IoT Levels & Deployment Templates.**

MODULE II

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-**Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-**Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle –**Health & Fitness Monitoring, Wearable Electronics

IoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

MODULE III

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, **Case Study on IoT System for Weather Monitoring, Motivation for Using Python**

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, **Exemplary Device: Raspberry Pi**, **About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –** Serial, SPI , I2C , **Programming Raspberry Pi with Python-**Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , **Other IoT Devices-**pcDuino, Beagle Bone Black , Cubieboard

MODULE IV

IoT&Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Text Books:

1. Internet of Things, A Hand Approach, by ArshdeepBahga& Vijay audisetti, University Press.

Reference Books:

1. The Internet of Things, by Michael Millen, Pearson

COMPUTATIONAL METHODS AND TECHNIQUES

MODULE-I:

Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.
Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen'sFeatrure Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.

MODULE-II:

Fuzzy Logic: Basic Concepts of Fuzzy Logic, Fuzzy vs Crisp Set, Linguistic variables,Membership Functions, Operations of Fuzzy Sets, Fuzzy If-Then Rules, Variable Inference Techniques, Defuzzification, Basic Fuzzy Inference Algorithm, Fuzzy System Design, FKBC and PID Control, Antilock Breaking System(ABS), Industrial Applications.

MODULE-III:

Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.
LINEAR Programming: Simplex Method, Duality, Sensitivity Methods
NON-LINEAR Programming: Newton's Method, GRG Method, Penalty Function Method, Augmented Langrange Multiplier Method, Dynamic Programming and Integer Programming, Interior Point Methods, Karmakar's Algorithm, Dual Affine, Primal Affine.

MODULE-IV:

Genetic Algorithm: GA and Genetic Engineering, Finite Element based Optimization, PSO,BFO, Hybridization of Optimization Technique, Application of Optimization Technique for Solving Projects(Project solutions). Implementation of Branch Relevant Industrial Applications by Matlab Code.
Books Recommended:

1. Neural Networks- by Simon Haykin
2. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
3. Neural Networks and Fuzzy Logic – by Bart Kosko
4. An introduction Fuzzy Control – by D.Driankor, H. Hellendorn, M.Reinfrank (Narosa Pub)
5. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
6. Related IEEE/IEE Publications
7. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
8. Ashok D. Begundu&chandrapatla T.R "Optimization concept and application in engineering",Prentice Hall,1999
9. Rao S.S "Engineering Optimization"
10. Gill,Murray and Wright ,"Practical Optimization"
11. James A.Memoh. "Electric Power System Application Of Optimization".
12. Song Y.,"Modern Optimization Techniques In Power System"
13. Optimization Research;PrabhakarPai,Oxford University Press.

POWER CONVERSION DEVICES AND DRIVES

Module-I (8Hrs)

Basic concepts of Modeling: Basic Two-pole Machine representation of Commutator machines, 3-phase synchronous machine with and without damper bars and 3-phase induction machine, Kron's primitive Machine - voltage, current and Torque equations.

Dynamic Analysis of Synchronous Machine: Dynamic performance of synchronous machine, three-phase fault, comparison of actual and approximate transient torque characteristics.

Module- II(12Hrs)

Modeling of Synchronous Machine: Synchronous machine inductances –voltage equations in the rotor's dq0 reference frame- electromagnetic torque-current in terms of flux linkages-simulation of three phase synchronous machine- modeling of PM Synchronous motor

Poly-phase Induction Machines: Introduction, construction and principle of operation,Induction motor equivalent circuit, steady-state performance equations of the induction motor, steady-state performance, Measurement of motor parameters, Dynamic modeling of induction machines.

Module- III(12 Hrs)

Phase controlled rectifiers– Single phase half wave controlled rectifier with R, R-L, R-L with freewheeling diodes.Full wave controlled rectifier with various kind of loads. Half controlled and full controlled bridges with passive and active loads-Input line current harmonics and power factor-Inverter mode of operation.Three phase half wave controlled rectifier with R,R-L an R-L-E loads.Three phase semi and full converters with RL and RLE loads.Input side current harmonics and power factor. Dual converters-Circulating current mode and Non circulating current mode. AC voltage regulators and DC Choppers-Types of ac voltage regulators-single phase full wave ac voltage controllers-single phase transformer tap changers-Multistep transformer tap changer. Three phase ac voltage regulators. Output performance analysis of type A chopper, four quadrant chopper operation.

Module-IV(15 Hrs)

Introduction to motor drives: Components of power electronic Drives- Criteria for selection of Drive components-match between the motor and the load- Thermal consideration- match between the motor and the power electronics converter- characteristics of mechanical systems- stability criteria.

Induction motor drives: Torque speed characteristics of 3-phase induction motor drive, speed control of 3-phase induction motor by varying stator frequency and voltage – impact of non sinusoidal excitation on induction motors- variable frequency converter classifications – variable frequency PWM-VSI drives- variable frequency square wave VSI drives- variable frequency CSI drives-comparison of variable frequency drives- Line frequency variable voltage drives- soft start of induction motors – speed control by static slip power recovery, static Cramer and Scherbius drives.

BOOKS RECOMMENDED :

1. *The Generalized theory of electrical machines (Chapters: 1,2,34,5,8 and 11 by B.Adkins and R.H. Hiiley.*
2. *Principle, Operation and Design of power Transformer By S.B Vasciitnsky.*
3. *The J & P transformer Book (Chapter: 22&23) By S. Austen Stigant and A.C Franklin.*
4. *Power System Stability & Control (Chapters: 8&9) By P.Kundur, McGraw Hill-1994.*
5. *Ned Mohan etial : Power Electronics , John wiley and sous*
6. *R.Krishnan :Electric Motor Drives – PHI publication*
7. *B K Bose :Modern Power Electronics and AC drives, Pearson Education (Asia)*
8. *P C Sen : Power Electronics TMH Publication*
9. *Dubey : Power Electronics Drives- Wiley Eastern*
10. *P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff, "Analysis of Electrical Machinery and Drivesystems", IEEE Press, Second Edition.*

ADVANCED POWER SYSTEMS

Module- I (7 Hrs)

Modeling of Transmission lines & transformers with off-nominal taps. Power flow Analysis- NR and Fast Decoupled methods

Algorithm for short circuit studies, Z Bus Formulation, Unsymmetrical fault analysis using symmetrical components

Module- II(10 Hrs)

Optimal System Operation:

Generation allocation problem formulation, Loss Coefficients, Optimal load flow solution, Hydrothermal Coordination, constraints in Unit- commitment, Unit commitment solution methods.

Turbine & Generator- Load frequency Scheme, Steady state & dynamic analysis in frequency domain for single & two area system

Module-III(16 Hrs)

Power Quality Problems

Voltage Sag and over view of reliability: Characterization of voltage sag , definition, causes of voltage sag , voltage sag magnitude , monitoring, theoretical calculation of voltage sag magnitude , voltage sag calculation in non-radial systems, meshed systems, voltage sag duration. Reliability of power systems

PQ considerations in Industrial Power Systems: voltage sag effects, equipment behavior of power electronic loads, induction motors, synchronous motors, computers, consumer electronics, adjustable speed AC drives and its operation. Mitigation of AC drives, Adjustable speed DC drive and its operation, mitigation methods of DC drives.

Mitigation of Interruptions and Voltage Sags: Overview of mitigation methods- form fault to trip, reducing the number of faults, reducing the fault clearing time changing the power system, installing mitigation equipment, improving equipment immunity, different events and mitigation methods . System equipment interface- voltage source converter , series voltage controller , shunt controller , combined shunt and series controller.

Module- IV(12 Hrs)

Power Pools & Electricity Markets: Inter-area transactions, multi-area power interchanges, Energy brokerage systems, Market design and auction mechanism, Pool versus bilateral markets and price formation, Role of independent generators and system operator

*L*oad characteristics and load forecast: Basic definitions- load definitions, load factor definitions, diversity principle in distribution systems, Load Forecast- factors affecting load forecasting methods, small areas load forecasting, spatial load forecasting methods, simulation, trending and mixed load forecasting methods

BOOKS RECOMMENDED :

1. *Stagg G.W., Eabiad A.H. " Computer methods in Power system analysis." Mc Graw Hill, 1968.*
2. *Nagrath& Kothari, "Modern Power System Analysis"*
3. *Elaerd O.Z, " Electrical Energy System Theory- An Introduction"*
4. " Understanding Power Quality Problems" by Math H J Bollen, IEEE Press.
5. Electrical power quality –R C Dugan, M.F,MGranghar, H.W.Beaty-TMH.
6. A. J. Wood and B. F. Wollenberg, *Power generation, operation and control,* Wiley-Interscience, 2nd Edition, 1996.
7. K. Bhattacharya, M. H. J. Bollen and J. E. Daalder, *Operation of restructured power systems,* Kluwer Academic Publishers, USA, 2001.

SMART ELECTRICAL ENERGY SYSTEM

Module- I (7 Hrs)

Non-renewable reserves and resources; renewable resources, Transformation of Energy. Solar Power: Solar processes and spectral composition of solar radiation; Radiation flux at the Earth's surface. Solar collectors. Types and performance characteristics. Applications.

*SOLAR THERMAL SYSTEM:*Solar Collection Devices; their analysis; Solar Collector Characteristics; Solar Pond; application of solar energy to space heating etc.

Module- II (8 Hrs)

Wind Energy: Wind energy conversion; efficiency limit for wind energy conversion, types of converters, aerodynamics of wind rotors, power - speed and torque - speed characteristics of wind turbines, wind turbine control systems; conversion to electrical power: induction and synchronous generators, grid connected and self excited induction generator operation, constant voltage and constant frequency generation with power electronic control, single and double output systems, reactive power compensation

Module- III (15 Hrs)

Distributed Generation

Standards, DG potential, Definitions and terminologies; current status and future trends, Technical and economical impacts, Definitions and terminologies; current status and future trends, Technical and economical impacts

DG Technologies, DG from renewable energy sources, DG from non-renewable energy sources, Distributed generation applications, Operating Modes, Base load; peaking; peak shaving and emergency power, Isolated, momentary parallel and grid connection

Distribution system performance and operation

Distribution automation and control, Voltage drop calculation for distribution networks, Power loss Calculation, Application of capacitors to distribution systems, Application of voltage regulators to distribution systems

Module- IV (15 Hrs)

Introduction to smart grid:

Introduction to the smart grid, including objectives and functions, views of the smart grid with in the industry, and design criteria.

BOOKS RECOMMENDED :

1. S. N. Bhadra, D. Kastha, S. Banerjee, *Wind Electrical Systems*: Oxford Univ. Press, 2005.
2. S.A. Abbasi, N. Abbasi, *Renewable Energy Sources and Their Environmental Impact:* Prentice Hall of India, 2004.
3. S.P. Sukhatme - Solar Energy: Principles of thermal Collection and Storage,TMH,New Delhi
4. H.P. Garg and Jai Prakash - Solar Energy: Fundamentals and Applications,TMH
5. 5.Ned Mohan et. al : Power Electronics ,John Wiley and Sons
6. *6.P C Sen : Power Electronics , TMH*
7. *G K Dubey et. al :Thyristorised Power Controllers , Wiley Eastern Ltd.*
8. *B K Bose : Modern Power Electronics and AC Drives, Pearson Edn (Asia)*

BRANCH-ELECTRONICS AND COMMUNICATION ENGINEERING

Specialization: COMMUNICATION ENGINEERING
COMMUNICATION SYSTEMS
ELECTRONICS & COMMUNICATIONS ENGINEERING
ELECTRONICS AND TELECOMMUNICATION ENGINEERING
VLSI & EMBEDDED SYSTEMS
VLSI & EMBEDDED SYSTEMS DESIGN
VLSI DESIGN & EMBEDDED SYSTEMS
WIRELESS COMMUNICATION TECHNOLOGY
VLSI AND EMBEDDED SYSTEMS DESIGN
SIGNAL PROCESSING AND COMMUNICATION
SIGNAL PROCESSING AND ENGINEERING

First Semester							
Theory					Practical		
Course Name	**Hours/Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
Internet of Things	4-0	4	100	50	-	-	-
Integrated Circuit Design	4-0	4	100	50	-	-	-
Advanced Communication Techniques	4-0	4	100	50	-	-	-
Advanced Techniques in Signal Processing	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 22							

INTERNET OF THINGS (IoT)

MODULE I

Introduction to Internet of Things

Introduction-Definition & Characteristics of IoT , **Physical Design of IoT-** Things in IoT , IoT Protocols, **Logical Design of IoT-** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Enabling Technologies-** Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, **IoT Levels & Deployment Templates.**

MODULE II

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-** Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-**Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle -**Health & Fitness Monitoring, Wearable Electronics **IoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-**Software Defined Networking , Network Function Virtualization

MODULE III

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, **Case Study on IoT System for Weather Monitoring, Motivation for Using Python**

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, **Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –** Serial, SPI , I2C , **Programming Raspberry Pi with Python-**Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , **Other IoT Devices-** pcDuino, Beagle Bone Black , Cubieboard

MODULE IV

IoT & Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Text Books:

Internet of Things, A Hand Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

Reference Books:

The Internet of Things, by Michael Millen, Pearson

COMPUTATIONAL METHODS AND TECHNIQUES

MODULE-I:

Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.
Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen's Featrure Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.

MODULE-II:

Fuzzy Logic: Basic Concepts of Fuzzy Logic, Fuzzy vs Crisp Set, Linguistic variables, Membership Functions, Operations of Fuzzy Sets, Fuzzy If-Then Rules, Variable Inference Techniques, Defuzzification, Basic Fuzzy Inference Algorithm, Fuzzy System Design, FKBC and PID Control, Antilock Breaking System(ABS), Industrial Applications.

MODULE-III:

Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.
LINEAR Programming: Simplex Method, Duality, Sensitivity Methods
NON-LINEAR Programming: Newton's Method, GRG Method, Penalty Function Method, Augmented Langrange Multiplier Method, Dynamic Programming and Integer Programming, Interior Point Methods, Karmakar's Algorithm, Dual Affine, Primal Affine.
MODULE-IV:

Genetic Algorithm: GA and Genetic Engineering, Finite Element based Optimization, PSO,BFO, Hybridization of Optimization Technique, Application of Optimization Technique for Solving Projects(Project solutions). Implementation of Branch Relevant Industrial Applications by Matlab Code.
Books Recommended:

1. Neural Networks- by Simon Haykin
2. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
3. Neural Networks and Fuzzy Logic – by Bart Kosko
4. An introduction Fuzzy Control – by D. Driankor, H. Hellendorn, M. Reinfrank (Narosa Pub)
5. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
6. Related IEEE/IEE Publications
7. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
8. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering", Prentice Hall,1999
9. Rao S.S "Engineering Optimization"
10. Gill, Murray and Wright ,"Practical Optimization"
11. James A. Memoh. "Electric Power System Application Of Optimization".
12. Song Y., "Modern Optimization Techniques In Power System"
13. Optimization Research; Prabhakar Pai, Oxford University Press.

INTEGRATED CIRCUIT DESIGN

Module I

The CMOS Inverters and CMOS Logic Gates – the Static View:

Introduction to CMOS Inverter, Introduction to Static CMOS Design, The Dynamic Behavior, Power, Energy, and Energy-Delay, Complementary CMOS, Pass-Transistor Logic, Transmission gates, Technology Scaling and its Impact on the Inverter Metrics

Dynamic CMOS Logic, Timing Metrics:

Dynamic CMOS Design, CMOS Logic Design Perspectives, Timing Metrics: Timing Metrics for Sequential Circuits, Classification of Memory Elements

Module-II

Basic Building Blocks:

Inverter with Active Load, Cascode, Cascode with Cascode Load, Source Follower, Threshold Independent Level Shift, Improved Output Stages

Current and Voltage Sources:

Current Mirrors, Current References, Voltage Biasing, Voltage References

CMOS Operational Amplifiers:

General Issues, Performance Characteristics, Basic Architecture, Two Stages Amplifier, Frequency Response and Compensation, Slew Rate

Module-III

Overview of Mixed-Signal Testing – Mixed-signal circuits, Test and diagnostic equipments, Mixed-signal testing challenges, The Test Specification Process – Device datasheets, Generation of test plan, Components of a test program, DC and Parametric Measurements – Continuity, Leakage currents, Power supply currents, DC references and regulators, Impedance measurements, DC offset measurements, DC gain measurements, DC power supply rejection ratio, DC common-mode rejection ratio, Comparator DC tests, Voltage search techniques, DC tests for digital circuits, Measurement Accuracy – Terminology, Calibration and checkers, Dealing with measurement errors, Basic data analysis, Tester Hardware – Mixed-signal tester overview, DC resources, Digital subsystem, AC source and measurement, Time measurement system, Computing hardware.

IDDQ Testing , Design for Testability , Built-In Self-Test , Boundary Scan , Analog Test Bus , System Test and Core Test

Module-IV

Overview of LDMOS, Power MOS, Floating Gate MOS

Emerging Technology: Overview of HEMT, FinFET, Organic FET (OFET), Graphene nano-ribbon field effect transistor (GNRFET).

IC Design for Internet of Everything (IoE): Overview of Analog IC, Digital & Memory IC, Mixed-Signal IC, RF/MM-Wave/Terahertz IC

Text books:

1. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, *Digital Integrated Circuits – A Design Perspective*, 2nd edn., Pearson Education, 2003. ISBN: 8178089912.
2. Behzad Razavi, *Design of Analog CMOS Integrated Circuits*, McGraw-Hill, 2001. ISBN: 0-07-238032-2.
3. Mark Burns and Gordon W. Roberts, *An Introduction to Mixed-Signal IC Test and Measurement*, Oxford University Press, 2001, ISBN: ISBN-10: 0195699262, ISBN-13: 9780195699265
4. Millimetre-Wave Integrator Circuits, by Eoin Carey , Sverre Lidholn, Springer Pub(Chapter-I)
5. Design of C-MOS mm-Wave & Terahertz IC with Metamaterials, by Hao Yu, Yang Shang, CRC Press.
6. Fin-FET modelling for IC Simulation nad Design, 1st edition, by Chauhan & Lu & Sriramkumar & Khandelwal & Darte & Payradosi & Nikhejad & Hu., 2015, Elsevier pub
7. HEMTs & HBTs, by Fazl Ali, Aditya KumarGupta
8. Organic Field – Effect- Transitors , by Zhenan Bao, Jasm Locklin, CRC press
9. Carbon –nano tube & Graphene Nanoribbon Interconnect, by Debiprasad Das , Hafizur Rahaman, CRC Press
10. Research papers in Specific area

Recommended Readings:

1. K. Eshraghian, and N.H.E. Weste, *Principles of CMOS VLSI Design – a Systems Perspective*, 2nd edn., Addison Wesley, 1993.
2. John P. Uyemura, *CMOS Logic Circuit Design*, Springer (Kluwer Academic Publishers), 2001.
3. Ken Martin, *Digital Integrated Circuit Design*, Oxford University Press, 2000.
4. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, and Robert G. Meyer, *Analysis and Design of Analog Integrated Circuit*, John Wiley & Sons, Inc., 4th edn., 2000. ISBN: 0-471-32168-0.
5. Phillip E. Allen and Douglas R. Holberg, *CMOS Analog Circuit Design*, Oxford University Press, 2nd edn., 2002. ISBN: 0-19-511644-5
6. Bapiraju Vinnakota, *Analog and Mixed-Signal Test*, Prentice Hall PTR, 1998, ISBN-10: 0137863101, ISBN-13: 978-0137863105

ADVANCED COMMUNICATION TECHNIQUES

MODULE-I

Digital Modulation Scheme : Representation of Digitally Modulated Signals, MSK, GMSK, Memoryless Modulation Methods; Quadrature Amplitude Modulation, Multidimensional Signaling. Signaling Schemes With Memory; Continuous-Phase Frequency-Shift Keying, Continuous-Phase Modulation. Power Spectrum of Digitally Modulated Signals; Power Spectral Density of a Digitally Modulated Signal With Memory, Power Spectral Density of Linearly Modulated Signals, Power Spectral Density of Digitally Modulated Signals With Finite Memory, Power Spectral Density of Modulated Schemes With a Markov Structure, Power Spectral Density of CPFSK and CPM Signals, Overview of AWGN Channel

Carrier and Symbol Synchronization : Signal Parameter Estimation; The Likelyhood Function, Carrier Recovery and Symbol Synchronization in Signal Demodulation. Carrier Phase Estimation; Maximum Likelyhood Carrier Phase Estimation, The Phase-Locked Loop, Effect of Additive Noise in the Phase Estimate. Symbol Timing Estimation; Maximum Likelyhood Timing Estimation.

MODULE-II

Multichannel and Multicarrier Systems: Multichannel Digital Communications in AWGN Channels; Binary Signals, M-ary Orthogonal Signals. Multicarrier Communications; Single Carrier verses Multicarrier Modulation, Capacity of a Nonideal Linear Filter Channel, OFDM, Modulation & Demodulation in an OFDM, An FFT Algorithm Implementation of an OFDM System.

Principle of multi path propagation, Impulse response model of channels, parameters for mobile multi path channels, concept of fading, Rayleigh and Ricean fading; simulation of fading channels.

Spread spectrum modulation techniques, Equalization Technique – Linear equalizer and Nonlinear equalization, algorithms for adaptive equalization, Multiple Access Techniques: Spread Spectrum Multiple Access – Frequency Hopped multiple Access (FHMA), Code Division Multiple Access (CDMA). Space Division Multiple Access (SDMA), Spectral efficiency of different access technologies, Packet ratio protocols – ALOHA, carrier sense Multiple Access (CSMA/CD, CSMA/CA), Packet reservation Multiple Access (PRMA).

MODULE-III

Error Control Coding: Linear Block Codes: Introduction, Basic definition, equivalent codes, parity - check matrix, decoding, syndrome decoding, Perfect Codes, Hamming Codes, Optimal Linear codes.

Convolution Codes : Introduction, Tree Codes and Trellis Codes, Polynomial description, The Generating function, Matrix Description, Viterbi Decoding, Distance bounds, Turbo Codes, Turbo Decoding.

Trellis Coded Modulation (TCM): Introduction, the concept of coded modulation, Mapping by set Partitioning, Design rules, TCM Decoder.

Coding for Secure Communication, Cryptography : Introduction, encryption techniques, Symmetric cryptography, data encryption standard, Asymmetric Algorithm the RSA Algorithm.

MODULE-IV

Antenna Transmission lines, Micro-strip lines, Wave guides, Microwave networks,

Microwave resonator, Electromagnetic wave Generation Process, Microwave Amplifiers and oscillators, Scattering of electromagnetic waves; Aperture antennas, active antennas, GTD/UTD techniques and its applications to horn and reflector antennas. Broadband antennas. Antenna measurements: Test ranges, near field and far field techniques.

Text Books:

1. Wireless Communications by T. S. Rappaport, 2nd Edition, Pearson Education.
2. Wireless Communications & Network 3G and beyond Itisaha Mishra, Tata Mc-Graw Hill Education Pvt. Ltd.
3. Mobile cellular Telecommunications by W. C. Y. Lee, 2nd Edition, McGraw Hill.
4. W C Y Lee; *Mobile Communication Engineering*, Tata McGraw Hill, India, 2008
5. Ranjan Bose, Information Theory, Coding and Cryptography, 2nd Edn., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2008. ISBN-10: 0-07-066901-5, ISBN-13: 978-0-07-066901-7.
6. John G. Proakis and Masoud Salehi, *Digital Communication*, McGraw-Hill, 5th Edition
7. D.M. Pozar,Microwave Engineering, John-Wiley, 2004.

Reference Books:

1. Wireless Communication by T. L. Singal, Tata Mc-Graw Hill Education Pvt. Ltd.. Wireless Communication and Networks by V. K. Garg, Elsevier.
2. 3G Networks by SumitKasera&NishitNarang, Tata McGraw Hill. Simon Haykin, *Digital Communication*, Willy
3. Tube & Schilling, *Principle of Communication*, PHI
4. R.S. Elliott,Antenna Theory & Design, Wiley-IEEE Press, 2003.

ADVANCED TECHNIQUES IN SIGNAL PROCESSING

MODULE-I

Introduction to DSP System: Representation of DSP algorithms.

Iteration Bound: Data-flow graph representations, Loop bound and iterartion bound, Algorithms for computing iteration bound, Iteration bound of multirate data-flow graphs.

Pipelining and Parallel Processing: Pipelining of FIR digital filters, Parallel processing, Pipelining and parallel processing for low power.

Retiming: Definitions and properties, Solving systems of inequalities, Retiming techniques.

Unfolding: An algorithm for unfolding, Properties of unfolding, Critical path, unfolding and retiming, Applications of unfolding.

Folding: Folding transformation, Register minimization techniques, Register minimization in folding architectures, Folding of multirate systems.

MODULE-II

Winer Filtering: Introduction, The FIR Wiener Filter- Filtering, Linear Prediction, Noise Cancellation, IIR Wiener Filter- Noncausal IIR Wiener Filter, The Causal IIR Wiener Filter, Causal Wiener Filtering, Causal Linear Prediction, Wiener Deconvolution, Discrete Kalman Filter.

Spectrum Estimation: Introduction, Nonparametric Method- The Periodogram, Performance of Periodogram. Parametric Methods- AR Spectrum Estimation, MA Spectrum Estimation, ARMA Spectrum Estimation. Frequency Estimation- Eigen decomposition of the Autocorrelation Matrix, MUSIC.

MODULE III

Adaptive Filtering: Introduction, FIR Adaptive Filters- The Steepest Descent Adaptive Filter, The LMS Algorithm, Convergence of LMS Algorithm, NLMS, Noise Cancellation, LMS Based Adaptive Filter, Channel Equalization, Adaptive Recursive Filter, RLS- Exponentially Weighted RLS, Sliding Window RLS.

MODULE IV

Cardiovascular system: Heart structure, cardiac cycle, **ECG** (electrocardiogram) theory (B.D.), **PCG** (phonocardiogram). **EEG, X-Ray, Sonography, CT-Scan**,The nature of biomedical signals.

Analog signal processing of Biosignals: Amplifiers, Transient Protection, Interference Reduction, Movement Artifact Circuits, Active filters, Rate Measurement. Averaging and Integrator Circuits, Transient Protection circuits.

Time-frequency representations: Introduction, Short-time Fourier transform, spectrogram, wavelet signal decomposition.

Biomedical applications: Fourier, Laplace and z-transforms, autocorrelation, crosscorrelation, power spectral density.

Noise: Different sources of noise, Noise removal and signal compensation.

Text Books:

1. K. K. Parhi, *VLSI Digital Signal Processing Systems*, *Design and Implementation*, Wiley India Pvt. Ltd., New Delhi
2. R S Kandpur, *Handbook of Biomedical Instrumentation*, 2nd Edn, TMH Publication, 2003
3. E. N. Bruce, *Biomedical Signal Processing and Signal Modelling*, John Wiley, 2001.
4. Bernard Widrow and Samuel D. Stearns, *Adaptive Signal Processing*, Pearson Education.
5. Monson H. Hayes, *Statistical Digital Signal Processing & Modeling*, John Wiley & Sons
6. J.G. Proakis, D.G. Manolakis, *Digital Signal Processing*, PHI, New Delhi, 1995.

Recommended Reading:

1. Cromwell, *Biomedical Instrumentation and Measurements*, 2nd Edn, Pearson Education.
2. M. A. kay, *Time Frequency and Wavelets in Biomedical Signal Processing*, IEEE Press,1998.
3. Simon Haykin, *Adaptive Filter Theory*, 4th Edn. Pearson Education.
4. K.P. Keshab, *VLSI Digital Signal Processing Systems: Design and Implementation*, Jacaranda Wiley, 1999.
5. S.J. Orfanidis, Optimum Signal Processing, Mac Millan Publishing Co., USA, 1985.

BRANCH-MECHANICAL ENGINEERING

Specialization: CAD / CAM ENGINEERING
HEAT POWER & THERMAL ENGINEERING
HEAT POWER ENGINEERING
MECHANICAL ENGINEERING (THERMAL & FLUID ENGINEERING)
MECHANICAL SYSTEMS DESIGN & DYNAMICS
MACHINE DESIGN
MECHANICAL ENGINEERING.
MECHANICAL SYSTEM DESIGN
PRODUCTION ENGINEERING
THERMAL ENGINEERING
DESIGN AND DYNAMICS
THERMAL & FLUID ENGINEERING
PRODUCTION ENGINEERING AND OPERATIONAL MANAGEMENT
THERMAL POWER ENGINEERING
SYSTEM DESIGN

First Semester							
Theory					Practical		
Course Name	**Hours/Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
Internet of Things	4-0	4	100	50	-	-	-
Advanced Heat Transfer	4-0	4	100	50	-	-	-
Advanced Mechanics Of Solid	4-0	4	100	50	-	-	-
Production Technology	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 24							

INTERNET OF THINGS (IoT)

MODULE I

Introduction to Internet of Things

Introduction-Definition & Characteristics of IoT , **Physical Design of IoT-** Things in IoT , IoT Protocols, **Logical Design of IoT-** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Enabling Technologies-** Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, **IoT Levels & Deployment Templates.**

MODULE II

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-**Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-**Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle -**Health & Fitness Monitoring, Wearable Electronics

IoT and M2M

Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

MODULE III

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, **Case Study on IoT System for Weather Monitoring, Motivation for Using Python**

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, **Exemplary Device: Raspberry Pi**, **About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –** Serial, SPI , I2C , **Programming Raspberry Pi with Python-**Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , **Other IoT Devices-** pcDuino, Beagle Bone Black , Cubieboard

MODULE IV

IoT & Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Text Books:

2. Internet of Things, A Hand Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

Reference Books:

2. The Internet of Things, by Michael Millen, Pearson

COMPUTATIONAL METHODS AND TECHNIQUES

MODULE-I:

Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.

Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen's Featrure Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.

MODULE-II:

Fuzzy Logic: Basic Concepts of Fuzzy Logic, Fuzzy vs Crisp Set, Linguistic variables,Membership Functions, Operations of Fuzzy Sets, Fuzzy If-Then Rules, Variable Inference Techniques, Defuzzification, Basic Fuzzy Inference Algorithm, Fuzzy System Design, FKBC and PID Control, Antilock Breaking System(ABS), Industrial Applications.

MODULE-III:

Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.

LINEAR Programming: Simplex Method, Duality, Sensitivity Methods

NON-LINEAR Programming: Newton's Method, GRG Method, Penalty Function Method, Augmented Langrange Multiplier Method, Dynamic Programming and Integer Programming, Interior Point Methods, Karmakar's Algorithm, Dual Affine, Primal Affine.

MODULE-IV:

Genetic Algorithm: GA and Genetic Engineering, Finite Element based Optimization, PSO,BFO, Hybridization of Optimization Technique, Application of Optimization Technique for Solving Projects(Project solutions).

Implementation of Branch Relevant Industrial Applications by Matlab Code.

Books Recommended:

14. Neural Networks- by Simon Haykin
15. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
16. Neural Networks and Fuzzy Logic – by Bart Kosko
17. An introduction Fuzzy Control – by D.Driankor, H. Hellendorn, M.Reinfrank (Narosa Pub)
18. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
19. Related IEEE/IEE Publications
20. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
21. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering",Prentice Hall,1999
22. Rao S.S "Engineering Optimization"
23. Gill,Murray and Wright ,"Practical Optimization"
24. James A.Memoh. "Electric Power System Application Of Optimization".
25. Song Y.,"Modern Optimization Techniques In Power System"
26. Optimization Research;Prabhakar Pai,Oxford University Press.

ADVANCED HEAT TRANSFER

Module I

Conduction; Derivation of generalized conduction equation for anisotropic inhomogeneous solids, conductive tensor, concepts of isotropic and homogeneous conductivity; Steady state conduction: Recapitulation of fundamentals analysis and design variable; and cross section and circumferential fins, Analysis of heat conduction in 2-D fins, 2-D and 3-D conduction in solids with complex boundary conditions and heat generation.

Module II

Transient conduction: Recapitulation of transient conduction in simple systems. Analysis of transient heat conduction with complex boundary. Numerical methods: Fundamentals of discrimination treatment of boundary conditions, on linearity of properties, anisotropy and complex boundaries.

Module III

Radiation: radiative properties of surfaces, methods of estimating configuration factors, Radiant energy transfer through absorbing, emitting and scattering media. Combined conduction and radiation systems: fins, Introduction to solar radiation in earth‘s atmosphere.

Module IV

Convection: Energy equation – thermal boundary layer. Forced convection: flow over surfaces – internal flow. Natural convection, combined forced and free convection. Mass Transfer: types – Fick‘s law of diffusion – mass diffusion equation, Equimolar counter diffusion – convective mass transfer. Evaporation of water into air.

Essential Readings:

1. J.P. Holman., *‘Heat and Mass Transfer’*, Tata McGraw Hill, 8th Ed., 1989.
2. D.D. Kern, *‘Extended Surface Heat Transfer’*, New Age International Ltd., 1985.
3. V.S Arpaci – *Conduction Heat Transfer*
4. E.M Sparrow, R.D Cess – *Radiation Heat Transfer*
5. R.Siegal and J.R Howell-*Thermal radiation heat transfer*.
6. Y.A.Sengel, Heat Transfer, Tata McGrawHill
7. Krith, Fundamentals of Heat Transfer Ozisik, H

Supplementary Reading:

1. F.P. Incropera and D. P. Dewit, *‘Fundamentals of Heat and Mass Transfer’*, 4th Ed., John Wiley & Sons, 1998.
3. C.P. Kothandaraman., *‘Fundamentals of Heat and Mass Transfer’*, 2nd Ed., New Age International, 1997.
4. E.R.D Eckert and R.M. Drake, *‘Analysis of Heat and Mass Transfer’*, McGraw Hill, 1980.
5. Kays, W.M. and Crawford W., *‘Convective Heat and Mass Transfer’*, McGraw Hill Inc., 1993.
6. Burmister L.C., *‘Convective Heat Transfer’*, John Willey and Sons, 1983.

ADVANCED MECHANICS OF SOLID

Module-I

Shear center and unsymmetrical bending. Beam columns; Beams on elastic foundations; curved beams, rotating discs and thick cylinders.

Module-II

Virtual work; Minimum potential energy; Hamilton's Principle. Plate theory: Formulation by Hamilton's principle: Bending and buckling of homogenous and Sandwich Plates. Shell theory: Introduction to theory of surface; Formulation by Hamilton's Principle; membrane, bending and buckling analysis of shells of revolution.

Module-III

Stress-strain relations for linearly elastic solids, Generalized Hooke's law. Analysis of three dimensional stresses and strains. Tensor character of stress. Strain-displacement relations, equilibrium equations, compatibility conditions and Airy's stress function, Plane stress and plane strain, simple problems in cartesian and polar co-ordinates.

Module-IV

Solution of axisymmetric problems, Bending of beams and plates, Kirkhhof and Mindlin concept. Torsion problem with St.Venant's approach-Prandtl's approach - Torsion of thin walled open and closed sections & thermal stress.

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Text Books

1. Advanced Mechanics of Materials - F. B. Seely and J. O. Smith. John Wiley and Sons Inc, 2nd edition, 1952.

2. Advanced Mechanics of Materials, 4th edition A. P. Boresi and O. M. Sidebottom. John Wiliey and Sons, 1985.

3. Advanced Mechanics of Solids - L. S. Srinath. Tata Mc-Graw Hill Co., 2005

Reference Books

1. Elementary Mechanics of Solids - P.N. Singh and P.K. Jha. New Age International, 2002.

2. Mechanics of Solids (Vol. 1& 2) - R. Baidyanathan, P.Perumal and S. Lingeswari. Scitch Publications.

3. Timoshenko, S. and Goodier J.N. Theory of Elasticity, McGraw Hill Book Co., Newyork, 1988.

4. J. Chakrabarty, Theory of Plasticity, McGraw-Hill Book Company, New York 1990

5. Irving H.Shames and James,M.Pitarresi, Introduction to Solid Mechanics,Prentice Hall of India Pvt. Ltd., New Delhi -2002.

6.E.P. Popov, Engineering Mechanics of Solids, 2nd Ed., Prentice Hall India, 1998.

7. W.F.Chen and D.J.Han., Plasticity for structural Engineers., Springer-Verlag., NY., 1988.

8. Hoffman and Sachs, *Theory of Plasticity* - McGraw Hill., 2nd ed. 1985

9. Johnson and Mellor, *Engineering Plasticity*- Van-Nostrand., 1st edition, 1983

PRODUCTION TECHNOLOGY

Module-I

Foundry: Fluidity and factors effecting fluidity, Design of gating system, gases in metals and alloys, gas porosity and shrinkage phenomena in casting, direction solidification, risering of casting, riser design, mechanism of feeding, method of risering, feeding distance and feeder heads, use of padding, chills and fine inoculation of C.I., grain refinement principle, casting defects and their elimination.

Module-II

Welding: Heat flow of metals, isothermal contours, cooling rate of welds, heat effects in base metal, residual stress and weld ability test, TIG, MIG, ultrasonic and laser welding, plasma area welding, underwater welding, friction welding, electron beam welding, electros lag and electro gas welding, Explosive welding.

Module-III

Extrusion: Classification, extrusion equipment, load displacement, characteristics, process variables and their optimization, different extrusion dies, extrusion defects, tube extrusion Hydrostatic extension, formality limit diagram.

Module-IV

MEMS: Introduction, history, development, and need of micro-electro-mechanical systems, IC fabrication processes used for MEMS; Mechanical process techniques and process models for micromachining, Introduction to nano-technology processes.

Module-V

Theoretical concepts of plasticity, Yield criteria - Tresca and Von Mises criterion of yielding, Plastic stress strain relationship, Elastic plastic problems in bending and torsion

Text Books:

1. Fundamentals of metal casting technology - P.C. Mukherjee, Oxford and IBH. (Ch. 9,10,11,12)
2. Welding technology, R. Bittle, TMH. (Chap. 3 and 4)
3. Metallurgy of welding - W.H.Bruckner, Pitam. (Chap 1, 2, 10 and12)
4. Mechanical Metallurgy, Dieter, Me Graw Hill, Kogakusha. (Chap. 18, 19, 20 and 22)

Reference Books :

1. Casting properties of metals and alloys - V. Korolkove.
2. Manufacturing properties of metals and Alloys - Alexander and Brewar, Van Nostrand.
3. Manufacturing properties of materials - Campbell, TMH.

BRANCH-METALLURGICAL ENGINEERING

Specialization: METALLURGICAL AND MATERIALS ENGINEERING
INDUSTRIAL METALLURGY

First Semester							
	Theory				Practical		
Course Name	**Hours/Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
Internet of Things	4-0	4	100	50	-	-	-
Physical Metallurgy	4-0	4	100	50	-	-	-
Metallurgical Thermodynamics and Kinetics	4-0	4	100	50	-	-	-
Characterisation of Materials	4-0	4	100	50	-	-	-
Physical Metallurgy and Material Testing Lab					8	4	150
Total							
Total Marks: 900							
Total Credits: 24							

INTERNET OF THINGS (IoT)

MODULE I

Introduction to Internet of Things

Introduction-Definition & Characteristics of IoT , **Physical Design of IoT-** Things in IoT , IoT Protocols, **Logical Design of IoT-** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Enabling Technologies-** Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, **IoT Levels & Deployment Templates.**

MODULE II

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-**Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-**Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle -**Health & Fitness Monitoring, Wearable Electronics

IoT and M2M

Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

MODULE III

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IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, **Case Study on IoT System for Weather Monitoring, Motivation for Using Python**

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What is an IoT Device-Basic building blocks of an IoT Device, **Exemplary Device: Raspberry Pi**, **About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –** Serial, SPI , I2C , **Programming Raspberry Pi with Python-**Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , **Other IoT Devices-** pcDuino, Beagle Bone Black , Cubieboard

MODULE IV

IoT & Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Text Books:

3. Internet of Things, A Hand Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

Reference Books:

3. The Internet of Things, by Michael Millen, Pearson

COMPUTATIONAL METHODS AND TECHNIQUES

MODULE-I:

Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.

Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen's Featrure Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.

MODULE-II:

Fuzzy Logic: Basic Concepts of Fuzzy Logic, Fuzzy vs Crisp Set, Linguistic variables,Membership Functions, Operations of Fuzzy Sets, Fuzzy If-Then Rules, Variable Inference Techniques, Defuzzification, Basic Fuzzy Inference Algorithm, Fuzzy System Design, FKBC and PID Control, Antilock Breaking System(ABS), Industrial Applications.

MODULE-III:

Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.

LINEAR Programming: Simplex Method, Duality, Sensitivity Methods

NON-LINEAR Programming: Newton's Method, GRG Method, Penalty Function Method, Augmented Langrange Multiplier Method, Dynamic Programming and Integer Programming, Interior Point Methods, Karmakar's Algorithm, Dual Affine, Primal Affine.

MODULE-IV:

Genetic Algorithm: GA and Genetic Engineering, Finite Element based Optimization, PSO,BFO, Hybridization of Optimization Technique, Application of Optimization Technique for Solving Projects(Project solutions).

Implementation of Branch Relevant Industrial Applications by Matlab Code.

Books Recommended:

27. Neural Networks- by Simon Haykin
28. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
29. Neural Networks and Fuzzy Logic – by Bart Kosko
30. An introduction Fuzzy Control – by D.Driankor, H. Hellendorn, M.Reinfrank (Narosa Pub)
31. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
32. Related IEEE/IEE Publications
33. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
34. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering",Prentice Hall,1999
35. Rao S.S "Engineering Optimization"
36. Gill,Murray and Wright ,"Practical Optimization"
37. James A.Memoh. "Electric Power System Application Of Optimization".
38. Song Y.,"Modern Optimization Techniques In Power System"
39. Optimization Research;Prabhakar Pai,Oxford University Press.

PHYSICAL METALLURGY (4-0) CREDITS: 04

Module-1 (14 Hours)

Crystallography: Crystalline and amorphous structures, Elements of crystal symmetry, symmetry elements and axes, two, three, four and six fold symmetry, review of atomic bonding in materials, , common crystal systems, crystal structure of metals , representation of planes and directions in crystals, atomic packing in crystals, calculation of packing density, voids in common crystal structures and imperfection in crystals. Metallography: Metallurgical microscope, Specimen preparation, Techniques for microscopic observation. High temperature microscopy, Quantitative metallographic.

Module-II (14 Hours)

Thermodynamics of phase change: Equilibrium, phase stability, evolution of phase diagrams, chemical potential gradient, Atomic model of diffusion, solid solution, Theories of alloying, Hume-Rothery rules, Single component systems, P-T diagrams, Allotropy. Free energy- composition diagram, Binary equilibrium diagrams (Isomorphous, eutectic, eutectoid, monotectic, peritectic, peritectoid, Syntectic systems), Gibbs phase rule, Tie line, Lever rule. Common alloy systems (Pb-Sn, Cu-Zn, Al-Si etc) Ternary system: Ternary phase diagrams, representation, isothermal and vertical sections, Ternary isomorphous and eutectic systems, Tie lines, Two phase, Three phase and four phase equilibrium, Gibb's triangle representation.

Module-III (14 Hours)

Fe-C system: Effects of alloying elements, Formation of Austenite, Decomposition of Austenite, Pearlitic, Bainitic and Martensitic phase transformations, TTT and CCT diagrams, Hardenability, Critical diameter, Jominy end quench Test, Tempering of steel, Temper brittleness, Thermomechanical Treatment, Ausforming, Maraging steels, Processing- structure property relationship in multiphase alloys (steels and cast irons), Rapid solidification processing, Metallic Glasses, Single crystal processing. Nano crystalline materials.

Books for reference:

1. Reedhill R.E., Physical Metallurgy Principles, Affiliated East West Press.
2. R.W.Cahn and Peter Haasen, Physical Metallurgy.
3. Avner S.H., Introduction to Physical Metallurgy, Tata McGraw Hill.
4. Porter D.A. & Easterling K.E., Phase Transformations in Metals and Alloys.
5. Kakani S.L. and Kakani A., Materials Science, New Age International.
6. Clarke & Varney, Introduction to Physical Metallurgy.

METALLURGICAL THERMODYNAMICS AND KINETICS OF MATERIALS(4-0)

Module-I (14 Hours)

General principles: first and second law, mathematical formalism for the thermodynamic description of closed systems with constant composition. Mathematical formalism for the thermodynamic description of systems with variable composition. The chemical potential. Partial properties. -- Relation between integral and partial molar properties. Chemical potential of ideal gases (pure and mixtures) and non-ideal gases (pure and mixtures). Chemical potential of pure liquids and solids and of components in liquid and solid solutions. The activity concept. Standard states and activities. Ideal solutions and non-ideal solutions. Activity coefficients. Properties of solutions. Simple solution models.

Module-II (14 Hours)

Introductory concepts of statistical thermodynamics. The regular solution model. Phase stability and phase diagrams Reaction equilibrium, oxidation and reduction, Ellingham diagrams. Thermodynamics vs. kinetics, homogeneous and heterogeneous reactions; Chemical Reaction Control-rate equation, reaction rate constant, reaction order, non-elementary reactions; Basic concepts of reaction steps, rate of reactions, Order of reaction, Determination of order of reactions. Arrhenius equation in reaction kinetics, Mechanism of reaction and rate controlling steps, Activated complex and its thermodynamic and kinetic aspects, Effect of concentration and temperature on reaction kinetics. Kinetics of heterogeneous reactions.

Module-III (14 Hours)

Solid State Diffusion -Fick's Law, mechanism of diffusion, uphill diffusion, Kirkendall effect, steady and transient diffusion;External Mass Transfer -fluid flow and its relevance to mass transfer, general mass transport equation, concept of mass transfer coefficient, models of mass transfer -film theory and Higbie's penetration theory; Internal Mass Transfer-Ordinary and Knudsen diffusion, Mass transfer with reaction; Adsorption -physical adsorption vs. chemisorption, adsorption isotherms; Langmuir, BET, adsorption as the rate limiting step; gasification of C by CO2, dissolution of N2 in molten steel, porous solids, specific surface area and pore size distribution;

Applications in extractive metallurgy, e.g. iron and steel making, copper making

Applications in physical metallurgy, e.g. solid phase transformations and equilibria in metallic alloys, cemented carbides etc

Books for reference:

1. Gaskell D.R., Metallurgical Thermodynamics.

2. Darken and Gurry, Physical Chemistry of Metals

3. Ragone, David V. Thermodynamics of Materials. Vol. 1. New York, NY: Wiley,

4. Porter, David A., and K. E. Easterling. Phase Transformations in Metals and Alloys. 2nd ed. New York, NY: Chapman & Hall,

5. Balluffi, Robert W., Samuel M. Allen, and W. Craig Carter. Kinetics of Materials. Hoboken, NJ: J. Wiley & Sons,

CHARACTERIZATION OF MATERIALS (4-0)

CREDITS: 04

Module I (12 Hours)

Introduction, Classification of characterization techniques for materials: macro and micro-characterization structure of solids. Bulk averaging techniques: Thermal characterization techniques: Theory, Instrumentation, methodology, applications. DTA, DTA, DSC, TGA, Dilatometry, resistivity/ conductivity. Diffraction methods: X-ray diffraction, X-ray topography, residual stress measurement techniques, small angle X-ray and neutron scattering.

Module II (12 Hours)

Electron microscopy techniques: Scanning electron microscope, Modes of operation, Study of surface topography and elemental composition analysis, Electron probe analysis (EPMA/ EDX, WDS) and Auger Spectroscopy. Transmission electron microscopy, Imaging and different modes, bright and dark field imaging, selected area diffraction (SAED) pattern, specimen preparation techniques. Advanced microscopic techniques: AFM, FIM, STM etc.

Module III (12 Hours)

Chemical characterization techniques: Principle underlying techniques, Emission spectroscopy, Atomic absorption spectroscopy, X-ray spectrometry, infrared spectroscopy and Raman spectroscopy. Chromatography techniques: Principles of gas chromatography, mass spectrometry, liquid and ion chromatography. Surface characterization techniques: principles underlying techniques of ELES, Auger Spectroscopy,

Books for reference:

1. Materials Characterization, Metals Handbook, Vol 10, ASM
2. Kaufman E.N., Characterization of Materials, Wiley Publishers
3. Barett, C.S. and Massalski, T.B., Structure of Metals, Pergamon Press, Oxford.
4. Cullity B.D., Elements of X-ray Diffraction, Addison-Wesley, 1978
5. Williams, D.B. and Barry Carter C., Transmission Electron Microscopy, Plenum Press.
6. Goldstein J.I., Lyman C. E., Scanning Electron Microscopy and X-Ray Microanalysis.
7. Machenzie R.C., Differential Thermal Analysis.
8. Phillips Victor A. Modern Metallographic Techniques and their application.

PHYSICAL METALLURGY AND MATERIALS TESTING LAB

A minimum of 16 nos. of experiments to be conducted from the suggested list given below:

1. Annealing treatment of a cold worked steel and comparison of the annealed microstructure with the cold worked structure.
2. Normalizing treatment of steel and comparison of the microstructure with annealed structure.
3. To study the quenched structures of steel - quenched in oil, water and brine solution.
4. To study the quenched and tempered structures of steel -
(i) low temperature tempering.
(ii) medium temperature tempering.
(iii) high temperature tempering.
5. To study the recrystallization behaviour of pure metal (iron / copper).
6. To study the effect of time and temperature on grain size of a metal (grain growth) (iron/ copper).
7. To study the nucleation rate and growth rate of pearlite in eutectoid steel.
8. To study the susceptibility of a steel to harden by quenching (hardenability) by Jominy test.
9. Pack carburizing of 0.2% carbon steel and to measure the diffusion coefficient of carbon in steel.
10. To study the microstructure of tool steels, stainless steels and other high alloy steels.
11. Austempering of steels and S G cast irons.
12. To carry out age hardening of non ferrous alloys.
13. Determination of hardenability of steels.
14. To determine the Vickers Hardness Number of the given Samples.
15. To determine the Brinell Hardness Number of the given Samples.
16. To determine the Rockwell Hardness of the given samples.
17. To determine the impact strength of the given samples by Charpy and Izod Impact Tests.
18. To determine the tensile properties of the given materials using Universal Testing Machine (UTM) -yield strength, tensile strength, % elongation, % reduction of area.
19. To determine the compression strength of the given sample.
20. To determine the fatigue strength of the given sample.
21. To determine the drawability of aluminium / steel sheet by Erichsen cup test.
22. To study the ultrasonic flaw detector and determine the cracks within a sample.
23. To determine the cracks in a sample using the magnetic crack detector.

BRANCH-NANO TECHNOLOGY

Specialization: NANO TECHNOLOGY

First Semester							
Theory					**Practical**		
Course Name	**Hours/Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
Internet of Things	4-0	4	100	50	-	-	-
Physics and Chemistry of Nanomaterials	4-0	4	100	50	-	-	-
Elements of Material Science and properties of Nanomaterials	4-0	4	100	50	-	-	-
Synthesis and Applications of Nanomaterials	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 24							

INTERNET OF THINGS (IoT)

MODULE I

Introduction to Internet of Things

Introduction-Definition & Characteristics of IoT , **Physical Design of IoT-** Things in IoT , IoT Protocols, **Logical Design of IoT-** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Enabling Technologies-** Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, **IoT Levels & Deployment Templates.**

MODULE II

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-**Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-** Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle -**Health & Fitness Monitoring, Wearable Electronics **IoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-**Software Defined Networking , Network Function Virtualization

MODULE III

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, **Case Study on IoT System for Weather Monitoring, Motivation for Using Python**

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, **Exemplary Device: Raspberry Pi**, **About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –** Serial, SPI , I2C , **Programming Raspberry Pi with Python-**Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , **Other IoT Devices-** pcDuino, Beagle Bone Black , Cubieboard

MODULE IV

IoT & Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Text Books:

Internet of Things, A Hand Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

Reference Books:

The Internet of Things, by Michael Millen, Pearson

COMPUTATIONAL METHODS AND TECHNIQUES

MODULE-I:

Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.
Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen's Featrure Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.

MODULE-II:

Fuzzy Logic: Basic Concepts of Fuzzy Logic, Fuzzy vs Crisp Set, Linguistic variables, Membership Functions, Operations of Fuzzy Sets, Fuzzy If-Then Rules, Variable Inference Techniques, Defuzzification, Basic Fuzzy Inference Algorithm, Fuzzy System Design, FKBC and PID Control, Antilock Breaking System(ABS), Industrial Applications.

MODULE-III:

Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.
LINEAR Programming: Simplex Method, Duality, Sensitivity Methods
NON-LINEAR Programming: Newton's Method, GRG Method, Penalty Function Method, Augmented Langrange Multiplier Method, Dynamic Programming and Integer Programming, Interior Point Methods, Karmakar's Algorithm, Dual Affine, Primal Affine.

MODULE-IV:

Genetic Algorithm: GA and Genetic Engineering, Finite Element based Optimization, PSO,BFO, Hybridization of Optimization Technique, Application of Optimization Technique for Solving Projects(Project solutions).
Implementation of Branch Relevant Industrial Applications by Matlab Code.
Books Recommended:

14. Neural Networks- by Simon Haykin
15. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
16. Neural Networks and Fuzzy Logic – by Bart Kosko
17. An introduction Fuzzy Control – by D. Driankor, H. Hellendorn, M. Reinfrank (Narosa Pub)
18. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
19. Related IEEE/IEE Publications
20. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
21. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering", Prentice Hall,1999
22. Rao S.S "Engineering Optimization"
23. Gill, Murray and Wright ,"Practical Optimization"
24. James A. Memoh. "Electric Power System Application Of Optimization".
25. Song Y., "Modern Optimization Techniques In Power System"
26. Optimization Research; Prabhakar Pai, Oxford University Press.

PHYSICS AND CHEMISTRY OF NANOMATERIALS

"Will be uploaded soon"

ELEMENTS OF MATERIAL SCIENCE AND PROPERTIES OF NANOMATERIALS

"Will be uploaded soon"

SYNTHESIS AND APPLICATIONS OF NANOMATERIALS

"Will be uploaded soon"

BRANCH- PLASTICS ENGINEERING

1st Semester

Specialization: PLASTICS ENGINEERING

First Semester							
	Theory				Practical		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
Internet of Things	4-0	4	100	50	-	-	-
Polymeric Materials	4-0	4	100	50	-	-	-
Additives and Compounding	4-0	4	100	50	-	-	-
Plastics Processing Technology	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 24							

INTERNET OF THINGS (IoT)

MODULE I

Introduction to Internet of Things

Introduction-Definition & Characteristics of IoT , **Physical Design of IoT-** Things in IoT , IoT Protocols, **Logical Design of IoT-** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Enabling Technologies-** Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, **IoT Levels & Deployment Templat**
es.

MODULE II

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-**Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-**Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle -**Health & Fitness Monitoring, Wearable Electronics

IoT and M2M

Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

MODULE III

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Inf
ormation Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, **Case Study on IoT System for Weather Monitoring, Motivation for Using Python**

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What is an IoT Device-Basic building blocks of an IoT Device, **Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –** Serial, SPI , I2C , **Programming Raspberry Pi with Python-**Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , **Other IoT Devices-** pcDuino, Beagle Bone Black , Cubieboard

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4. Internet of Things, A Hand Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

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MODULE-I:

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40. Neural Networks- by Simon Haykin
41. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
42. Neural Networks and Fuzzy Logic – by Bart Kosko
43. An introduction Fuzzy Control – by D.Driankor, H. Hellendorn, M.Reinfrank (Narosa Pub)
44. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
45. Related IEEE/IEE Publications
46. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
47. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering",Prentice Hall,1999
48. Rao S.S "Engineering Optimization"
49. Gill,Murray and Wright ,"Practical Optimization"
50. James A.Memoh. "Electric Power System Application Of Optimization".
51. Song Y.,"Modern Optimization Techniques In Power System"
52. Optimization Research; Prabhakar Pai,Oxford University Press.

POLYMERIC MATERIALS

1. Introduction to Polymeric Materials, Techniques of Polymerization, Molecular weight and its distribution, Molecular Architecture (Linear, Branched, Cross-linked) / Tacticity, Amorphous and Crystalline Polymers, Glass and Melting Transitions., Liquid Crystalline Polymers, Conducting polymers.
2. Sources and manufacturer of raw materials for polymers [C_1 – C_6].
3. Comparative properties and applications :

   Thermoplastics : Polyolefin's (polythylene's, polypropylene, vinyl polymers and copolymers, styrene-homo and copolymers, Acrylic homo and co-polymers, cellulosics, nylons, aromatic polyamides and polyimides, PET, PBT and aromatic polyesters, fluoro polymers, polycrbonates, polyacetals, aromatic polyether/ polysulfones / polyphynelens / polyetheretherketone / polyurethanes / Thermoplastics / Thermosets).
4. Comparative properties and applications

   Thermosetting plastics : Formaldehyde resins (PF/UF/MF), Epoxy resins, unsaturated polyesters, silicones.

TEXT BOOKS :

1. J.A.Brdyson, "Plastics Materials", Butterworth Heinnemann, Oxford, 7th edition (1999).
2. Fred W.Billmeyer, Jr., "Text Book of Polymer Science", John Wiley and Sons, Singapore
3. P.Ghosh, "Polymer Science and Technology of Plastics and Rubbers – New Edition.

ADDITIVES AND COMPOUNIDNG

1. Introduction to additives- Technological requirements, classification of additives, chemistry, function and mechanism, principles of mixing.
2. Fillers : Coupling agents, plasticizers and softeners, lubricants, flow promoters.
3. Antiageing additives : Antioxidants, antiozonants, stabilizers (UV/Thermal etc), UV absorbers, Flame retardants, coloring materials, blowing agents, cross-linking agents, toughening agents.
4. Mixing and compounding techniques : EQUIPMENTS : Batch mixers and continuous mixers, two / three roll mills, Intermix, ribbon blender, planetary mixer, single screw and multiple screw mixer, extruders.

   Principles and operating details of the above mentioned equipments.

Text Books :

1. R.Gachter and H. Muller, “Plastics Additives Hand Books”, Hanser Publications, Munich (1993).
2. J.A. Brydson, “Plastics Materials” Buterworth – Heinmann, Oxford (1999).
3. J.Murphy, “The additives for Plastics Hand Book”, Elsevier, Odxford (1996).

PLASTICS PROCESSING TECHNOLOGY

1. Extrusion : Introduction and Principles – Single screw, specifications, types of screw (single/twin, extruder parts and their functions); products defects, causes and remedies. Extrusion blow molding and stretch blow molding-process sequences, the machine, multiple cavity blow molding, co-extrusion, preform production, comparison between blow and stretch blow molding.
2. Injection : Introduction and principles, components-functions, process variables, product defects and remedies. Injection blow moulding, Thermoplastics and thermosetting comparative behaviors.
3. Compression and transfer moldings: Introduction and principles, machine process and process variable, product defects and remedies, comparison between the above – mentioned process.
4. Rotational molding and thermoforming process: Principle and practices.

TEXT BOOKS:

1. D.H.Maron-Jones, "Polymer Processing", Chapman and Hall, London(1989) or newer edition.
2. W.Michaeli, "Plastics Processing – An Introduction" Hanser Publishers, New York (1992).
3. Seymour S.Schwartz and Sidney H.Goodman, 'Plastics Materials and Process, Van Nostrand Reinhold Co., New York (1982).

BRANCH- POLYMER NANOTECHNOLOGY

1st Semester

Specialization: POLYMER NANOTECHNOLOGY

First Semester							
	Theory				Practical		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
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Internet of Things	4-0	4	100	50	-	-	-
Polymer Chemistry & Physics	4-0	4	100	50	-	-	-
Introduction to Nanotechnology	4-0	4	100	50	-	-	-
Polymeric Nanomaterials Processing Techniques & their Applications	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 24							

INTERNET OF THINGS (IoT)

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56. An introduction Fuzzy Control – by D.Driankor, H. Hellendorn, M.Reinfrank (Narosa Pub)
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60. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering",Prentice Hall,1999
61. Rao S.S "Engineering Optimization"
62. Gill,Murray and Wright ,"Practical Optimization"
63. James A.Memoh. "Electric Power System Application Of Optimization".
64. Song Y.,"Modern Optimization Techniques In Power System"
65. Optimization Research; Prabhakar Pai,Oxford University Press.

POLYMER CHEMISTRY & PHYSICS

Module I (10 hours)
Functionality, bi-functional and poly functional systems, classification and nomenclature of polymers, branching and crosslinking, glassy and crystalline states, thermodynamics of crystallization, kinetics of melting, crystal morphology, free volume, time - temp equivalency, distribution of molecular size, stoichiometric imbalance.

Module II (8 hours)
Molecular weight, molecular weight distribution, polydispersity, degree of polymerization, molecular weight determination, viscosity of polymers solutions, molecular weight dependence of viscosity and size of polymer molecules.

Module III (12 hours)
Types of polymerization, polymerization techniques, copolymers and stereo-regular polymers, reactivity ratios, copolymer composition and microstructure, Price - Alfrey equation, Flory - Huggins theory, polymer fractionation, Mark - Hownick equation, diffusion coefficient and friction factor.

Module IV (10 hours)
Elastic deformation, shear modulus and compliances, Maxwell model, Voigt model, dynamic viscoelasticity, molecular theory for viscoelasticity - Rouse model,
Coefficient of viscosity, viscosity measurement, Power Law for pseudoplastic liquids, effect of shearing forces, segmental friction factor, Bueche theory, Reptation model.

Text Books

5. Gedde Ulf. W. Polymer Physics, Chapman & Hall London (1995)
6. Rodriguez, Ferdinand, Principles of Polymer Systems Mc. Craw – Hill, International Book Co. International Student Edn. 1985.
7. Cowie; JMG Polymers: Chemistry & Physics of Modern Materials, Nelson Thornes ltd. Chelterham, 2001
8. Hiemenz; Paul C. Polymer Chemistry- The Basic Concepts; Marcell & Deckker, Inc. New York (1984)

Reference Books

4. Principles of Polymer Chemistry, Paul J Flory
5. JL Fried, Polymer Science & Technology

INTRODUCTION TO NANOTECHNOLOGY

Module I (10 hours)

Importance and emergence of nanotechnology, challenges, current and future research. Size dependence of properties, crystal structure, energy bands, insulators, semiconductors and conductors, gaps of semiconductors, Fermi surfaces, localized particles.

Module II (12 hours)

Laws of thermodynamics applied to nanoscale systems; activity and the equilibrium constant; solutions; phase relations; heterogeneous equilibria; free-energy-composition diagrams and their relation to phase transitions; phase diagrams.

Module III (12 hours)

Polymer based nanocrystals, supramolecular structures, polypeptide nanowire, and protein nanoparticles. Microelectromechanical systems (MEMS)

Nanoelectromechanical systems (NEMS): fabrication and application, molecular and supramolecular switches. Optical and vibrational spectroscopy, luminescence, quantum wells, wires and dots.

Module IV (10 hours)

Metal nanoclusters, semiconductor nanoparticles, rare gas and molecular clusters: synthesis and properties, carbon molecules and clusters, applications of carbon nanotubes. Nanostructured materials: solid disordered nanostructures, natural nanocrystals, zeolites, photonic crystals, nanostructured multilayers.

Text Books

5. Introduction to Nanotechnology - Charles P Poole Jr, Frank J Owens
6. Mark Ratner, Daniel Ratner. - Upper Saddle River, Nanotechnology: A Gentle Introduction to the next Big Idea, c2003, Prentice hall.
7. Callister, William D. Jr., Fundamentals of Materials Science and Engineering: An Integrated Approach 2nd Ed., John Wiley and Sons, 2003
8. Nanotechnology Understanding Small Systems, Rogers Pennathur Adams, CRC Press, Taylor & Francis Group.

Reference Books

4. Robert K, Ian H, Mark G, Nanoscale Science and Technology, John Wiley & sons Ltd.,2005
5. Edward l Wolf. - Weinheim, Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, c2004, Wiley
6. S. N. Sahu, R. K. Choudhury, and P. Jena, Nano-scale Materials: From Science to Technology, Nova Science Publishers, 2006.
7. Yannick Champion, Hans-Jörg Fecht, Nano-Architectured and Nanostructured Materials: Fabrication, Control and Properties, Wiley-VCH,2005.
8. Robert K, Ian H, Mark G, Nanoscale Science and Technology, John Wiley & sons Ltd.,2005

POLYMERIC NANOMATERIALS PROCESSING TECHNIQUES & THEIR APPLICATIONS

Module I (12 hours)

Processing of Nanoparticles - Binding mechanisms in Nanoparticles, Dispersion of Nanoparticles, Stabilization of Nanoparticles. Processing and fabrication of polymer nanocomposites - Melt blending, Solvent casting, In-situ polymerization, Solution polymerization, Template synthesis, High shear mixing.

Module II (10 hours)

Homogenoeous/heterogeneous nucleation, plasma promoted nucleation, Cold Plasma Methods, Atomic layer deposition fundamentals, Laser ablation, Vapour – liquid – solid growth, particle precipitation aided CVD.

Module III (12 hours)

Processes for producing ultrafine powders - Mechanical grinding; Wet Chemical Synthesis of nanomaterials-sol-gel process, Liquid solid reactions. Gas Phase synthesis of nanomaterials-Furnace, Flame assisted ultrasonic spray pyrolysis; Gas Condensation Processing (GPC), Chemical Vapour Condensation(CVC).

Module IV (12 hours)

Polymer nanocomposites with structural, gas barrier and flame retardant properties, carbon fiber reinforced polymer composites, elastomer and thermoplastic elastomer nanocomposites for propulsion systems, water borne fire-retardant Nanocomposites, hybrid composites for cosmetics, protective and decorative coatings.

Text Books

5. Chung; Deborah D. L., Composite Materials: Science and Applications, Spinger International Edition, Springer-Verlag, London (2004)-Indian Edition 2006
6. Ishida; Hatsud, Characterization of Composite Materials, Butterworth Heinemann, Boston (1994).
7. Fundamentals of Fiber Reinforced Composite Materials, AR Bunsell, J Renard, Institute of Physics, Series in Materials Science & Engg.
8. Introduction to Nanotechnology - Charles P Poole Jr, Frank J Owens
9. Chu; Paul K. and Liu; Xuanyong (Eds.), Biomaterials Fabrication and Processing Handbook, CRC Press, Boca Raton (2008)

Reference Books

4. Carl C. Koch, Nano-structured materials: Processing, Properties and Potential Applications, Noyes Publishers & William Andrews Publishers, New York 2002
5. Guozhong Cao, Nanostructures and Nanomaterials, Imperial College Press, London 2004
6. Mechanical Metallurgy - George E Dieter
7. Mechanical Behaviour of Materials - Thomas H Courtany
8. B. T. Astrom, Manufacturing of Polymer Composites, Chapman and Hall, London 1995
9. T. G. Gutowski, Advanced Composites Manufacturing, John Wiley and Sons, New York 1997
10. T J Pinnavaia, G M Beall Hardcover, Polymer-Clay Nanocomposites, December 2000, Wiley

BRANCH-TEXTILE ENGINEERING

Specialization: TEXTILE CHEMICAL PROCESSING

First Semester							
Theory					Practical		
Course Name	**Hours/Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
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Internet of Things	4-0	4	100	50	-	-	-
Advanced Textile Materials	4-0	4	100	50	-	-	-
Characterisation of Polymers & Fibrous Materials	4-0	4	100	50	-	-	-
Clothing Science & Technology	4-0	4	100	50	-	-	-
Material Testing Lab.					8	4	150
Total							
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INTERNET OF THINGS (IoT)

MODULE I

Introduction to Internet of Things

Introduction-Definition & Characteristics of IoT , **Physical Design of IoT-** Things in IoT , IoT Protocols, **Logical Design of IoT-** IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , **IoT Enabling Technologies-** Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, **IoT Levels & Deployment Templates.**

MODULE II

Domain Specific IoTs

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, **Cities-**Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, **Environment-**Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy-** Smart Grids , Renewable Energy Systems , Prognostics , **Retail-**Inventory Management , Smart Payments , Smart Vending Machines , **Logistics-**Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture-** Smart Irrigation ,Green House Control ,**Industry -**Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,**Health & Lifestyle -**Health & Fitness Monitoring, Wearable Electronics **IoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-**Software Defined Networking , Network Function Virtualization

MODULE III

IoT Platforms Design Methodology

IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, **Case Study on IoT System for Weather Monitoring, Motivation for Using Python**

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, **Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces –** Serial, SPI , I2C , **Programming Raspberry Pi with Python-**Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , **Other IoT Devices-** pcDuino, Beagle Bone Black , Cubieboard

MODULE IV

IoT & Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and data-intensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Text Books:

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COMPUTATIONAL METHODS AND TECHNIQUES

MODULE-I:

Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.
Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen's Featrure Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.

MODULE-II:

Fuzzy Logic: Basic Concepts of Fuzzy Logic, Fuzzy vs Crisp Set, Linguistic variables, Membership Functions, Operations of Fuzzy Sets, Fuzzy If-Then Rules, Variable Inference Techniques, Defuzzification, Basic Fuzzy Inference Algorithm, Fuzzy System Design, FKBC and PID Control, Antilock Breaking System(ABS), Industrial Applications.

MODULE-III:

Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.
LINEAR Programming: Simplex Method, Duality, Sensitivity Methods
NON-LINEAR Programming: Newton's Method, GRG Method, Penalty Function Method, Augmented Langrange Multiplier Method, Dynamic Programming and Integer Programming, Interior Point Methods, Karmakar's Algorithm, Dual Affine, Primal Affine.

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Genetic Algorithm: GA and Genetic Engineering, Finite Element based Optimization, PSO,BFO, Hybridization of Optimization Technique, Application of Optimization Technique for Solving Projects(Project solutions).
Implementation of Branch Relevant Industrial Applications by Matlab Code.
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27. Neural Networks- by Simon Haykin
28. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
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30. An introduction Fuzzy Control – by D. Driankor, H. Hellendorn, M. Reinfrank (Narosa Pub)
31. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
32. Related IEEE/IEE Publications
33. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
34. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering", Prentice Hall,1999
35. Rao S.S "Engineering Optimization"
36. Gill, Murray and Wright ,"Practical Optimization"
37. James A. Memoh. "Electric Power System Application Of Optimization".
38. Song Y., "Modern Optimization Techniques In Power System"
39. Optimization Research; Prabhakar Pai, Oxford University Press.

ADVANCED TEXTILE MATERIALS

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CHARACTERISATION OF POLYMERS & AMP; FIBROUS MATERIALS

"Will be uploaded soon"

CLOTHING SCIENCE & TECHNOLOGY

"Will be uploaded soon"

MATERIAL TESTING LAB.

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BRANCH - APPLIED ELECTRONICS & INSTRUMENTATION ENGINEERING.

Specialization: APPLIED ELECTRONICS & INSTRUMENTATION ENGINEERING.
ELECTRONICS & INSTRUMENTATION ENGINEERING

First Semester							
Theory					Practical		
Course Name	**Hours/Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
Internet of Things	4-0	4	100	50	-	-	-
Instrumentation Devices and Systems	4-0	4	100	50	-	-	-
Process Dynamics and Control	4-0	4	100	50	-	-	-
Control System Design	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 22							

INTERNET OF THINGS (IoT)

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INSTRUMENTATION DEVICES AND SYSTEMS

"Will be uploaded soon"

PROCESS DYNAMICS AND CONTROL

"Will be uploaded soon"

CONTROL SYSTEM DESIGN

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