CREDIT DISTRIBUTION STRUCTURE FOR M.TECH ADMISSION BATCH 2016-17

1ST SEMESTER				2ND SEMESTER			
CODE	**SUBJECT**	**L-T-P**	**CREDIT**	**CODE**	**SUBJECT**	**L-T-P**	**CREDIT**
	COMPUTATIONAL METHODS AND TECHNIQUES	3-1-0	4		SPECILIZATION CORE I	3-1-0	4
	INTERNET OF THINGS	3-1-0	4		SPECILIZATION CORE II	3-1-0	4
	BRANCH SPECILIZATION CORE -I	3-1-0	4		ELECTIVE -I (SPECILIZATION RELATED)	3-1-0	4
	BRANCH SPECILIZATION CORE- II	3-1-0	4		ELECTIVE -II (DEPATMENTAL REALTED)	3-1-0	4
	BRANCH SPECILIZATION CORE- III	3-1-0	4		ELECTIVE- III (FROM ANY DEPATMENT)	3-1-0	4
CREDITS (THEORY)			**20**	**CREDITS (THEORY)**			**20**
PRACTICALS/SESSIONALS				**PRACTICALS/SESSIONALS**			
	LAB I	0-0-4	4		LAB II	0-0-4	4
					DESIGN PROJECTS	0-0-4	4
CREDITS (PRACTICALS/SESSIONALS)			**4**	**CREDITS (PRACTICALS/SESSIONALS)**			**8**
TOTAL SEMESTER CREDITS			**24**	**TOTAL SEMESTER CREDITS**			**28**
TOTAL CUMULATIVE CREDITS			**24**	**TOTAL CUMULATIVE CREDITS**			**52**

3RD SEMESTER				4TH SEMESTER			
CODE	**SUBJECT**	**L-T-P**	**CREDIT**	**CODE**	**SUBJECT**	**L-T-P**	**CREDIT**
	RESEARCH METHODOLOGY	3-1-0	4				
	IPR (INTELLECTUAL PROPERTY RIGHTS)	3-1-0	4				
CREDITS (THEORY)			**8**				
PRACTICALS/SESSIONALS				**PRACTICALS/SESSIONALS**			
	PRE DESSERATION WORK EVALUATION		9		DESSERATION EVALUATION AND OPEN DEFENCE		17
CREDITS (PRACTICALS/SESSIONALS)			**9**	**CREDITS (PRACTICALS/SESSIONALS)**			**17**
TOTAL SEMESTER CREDITS			**17**	**TOTAL SEMESTER CREDITS**			**17**
TOTAL CUMULATIVE CREDITS			**69**	**TOTAL CUMULATIVE CREDITS**			**86**

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 Hands on Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

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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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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.

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 IntegratedApproach" 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-BIOTECHNOLOGY

1st Semester

Specialization:BIOTECHNOLOGY

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	-	-	-
Biomolecules and Metabolic Regulations	4-0	4	100	50	-	-	-
Bioprocess and Bio separation Technology	4-0	4	100	50	-	-	-
Genetic Engineering	4-0	4	100	50	-	-	-
Lab-I					8	4	150
Total							
Total Marks: 900							
Total Credits: 24							

INTERNET OF THINGS (IoT)

MODULE I

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Domain Specific IoTs

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MODULE IV

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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.

BIOMOLECULES AND METABOLIC REGULATIONS

Module-I

Macromolecular structure and dynamics: Configurations and conformations of macromolecules; interaction of biological macromolecules with water and nonaqueous environments; non-covalent (weak) forces that stabilize protein and nucleic acid structure; simulation of the structure of biological macromolecules including energy minimization, molecular dynamics and free energy methods. Statistical thermodynamics of biological macromolecules: Partition functions, structural transitions in polypeptides and proteins including coil helix transitions, Structural transitions in polynucleic acids and DNA including melting and annealing of polynucleotide duplexes, helical transitions of double stranded DNA, prediction of helical structures in genomic DNA. Biophysical techniques for analysis of biomolecules – Chromatography, X-ray crystallography, NMR, Mass spectrophotometry and UV spectrometry.

Module-II

Carbohydrate and lipid metabolism-Glycolysis, Krebs cycle, ETS, Energetics and regulation of these pathways, HMP pathway and its importance, Gluconeogenesis, Mechanism of Oxidative Phosphorylation, Fatty acid oxidation and their metabolic routes of carbon, biosynthesis of lipids (fatty acids and sterols), Glycogen metabolism. Protein metabolism: Oxidative deamination, decarboxylation,and transamination reactions, Urea cycle, Aminoacid synthesis by microorganisms. Central role of Glutamine. Synthesis of Nucleotides, and salvage pathways.

Module-III

Integration of metabolism and concept of metabolic regulation: Elucidation of metabolic pathways; Logic and integration of central metabolism; Major pathway and strategies of energy metabolism, entry/ exit of various biomolecules from central pathways; Principles of metabolic regulation; Regulatory steps; Signals and second messengers.Organ (Brain, Muscle, Liver) specialization, Metabolic adaptation, Metabolic changes associated with plant development and senescence and its regulation.

BIOPROCESS AND BIOSEPARATION TECHNOLOGY

Module-I

Concepts of Bioprocess and its parameters: Introduction to bioprocess, Instrumentation and operation of bioreactor; Culture-specific design aspects: Plant/Mammalian cell culture reactors. Biomass clarification and disruption; Membrane-based techniques; Extraction; Adsorption and Chromatography Kinetic models: Stoichiometric analysis; Unstructured Models of growth, substrate utilization and product formation, Transient growth Kinetics, Structured kinetic Models of growth and product formation. Measurement and control of Bioprocess: On and off-line sensors for a modern bioreactor, Analysis of cell and medium composition,

Module-II

Bioreactor Design, Analysis and Applications: Ideal and Non-Ideal reactors, mixing and residence time distribution studies in a bioreactor. Packed Bed, Bubble columns, fluidized bed and trickle bed bioreactors, Immobilized cell based bioreactor; Bioreactor design for animal cell culture, Bioreactor design for waste treatment. Bioseparation-I: Theory, Numericals and Applications of Separation of cells and other insolubles from fermented broth. Microfiltration, Ultrafiltration and Nanofiltration, Centrifugation (batch, continuous).

Module-III

Bioseparation-II: Theory, Numericals and Applications of 1. Chromatography: Adsorption chromatography, Ion- exchange, gel-filtration, affinity, high pressure / performance liquid chromatography (HPLC), hydrophobic interaction chromatography. Reverse phase (RP) and thin layer chromatography (TLC). 2. Separation of soluble bio-products: Liquid-liquid extraction, aqueous two-phase extraction, precipitation, adsorption. .

GENETIC ENGINEERING

Module-I

Restriction enzymes, modification enzymes, DNA and RNA markers, Linker, adapter, MCS and its application in r-DNA technology, Gene cloning vectors- Plasmids, Bacteriophages, Phagemids, Cosmids, Artificial chromosomes (BAC, PAC, YAC). cDNA synthesis and cloning-mRNA entrapping and reverse transcription, , c-DNA Library construction and screening. Genomic DNA library-construction and screening. Alternative strategies of Gene cloning- Cloning interacting genes, Two and three hybrid systems. Cloning differentially expressed genes.

Module-II

Nucleic acid purification, yield analysis, Nucleic acid amplification and its applications, Restriction mapping of DNA fragments and Map construction, Nucleic acid sequencing- strategies and methodologies, Nucleic acid micro arrays and DNA Chips, DNA Finger printing and Footprinting. Gene regulation analysis-DNA transfection, Northern blot, Primer extension, SI mapping, RNase protection assay, Reporter assays and Phage display

Module-III

Protein Engineering- strategies and applications, Processing recombinant proteinspurification and refolding, characterization of recombinant proteins, stabilization of proteins. Site-directed mutagenesis, Expression strategies for Heterologous genesVector engineering and codon optimization, Cassette construction, host-engineering, in vitro transcription and translation, expression in bacteria, expression in yeast, expression in insects and insect cells, expression in mammalian cells, expression in plants. T-DNA and transposon tagging, Gene knockout technologies-Targeted gene replacement, chromosome engineering. Gene therapy-Vector engineering, Strategies of gene delivery, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing.

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,
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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							
Total Marks: 900							
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INTERNET OF THINGS (IoT)

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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.

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		
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 Computer Architecture	4-0	4	100	50	-	-	-
Adavanced Data Structure And Algorithm	4-0	4	100	50	-	-	-
Advanced Operating System	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 Hands on 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:

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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.

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++, 2nd Ed, University Press.
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
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Power Conversion Devices And Drives	4-0	4	100	50	-	-	-
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Total Credits: 24							

INTERNET OF THINGS (IoT)

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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 Hands on 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- Eigendecomposition 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, BeagleBone 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 Hands on 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
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.

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

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, BeagleBone 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 Hands on 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)
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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.

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 Ramanspectroscopy.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.**

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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:

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

PHYSICS AND CHEMISTRY OF NANOMATERIALS

Unit-I PHYSICAL PROPERTIES: Melting point and phase transition process- quantum-size-effect (QSE).

Size-induced metal-insulator-transition (SIMIT)- nano-scale magnets, transparent magnetic materials, and ultrahigh-density magnetic recording materials-chemical physics of atomic and molecular clusters.

PHYSICAL CHEMISTRY OF SOLID SURFACES: Surface energy – chemical potential as a function of surface curvature-Electrostatic stabilization- surface charge density-electric potential at the proximity of solid surface-Van der Waals attraction potential.

Unit-II CHEMISTRY ASPECTS: Photochemistry; photoconductivity; Electrochemistry of NanomaterialsDiffusion in Nanomaterials; Nanoscale Heat Transfer; Catalysis by gGold Nanoparticles; Transport in Semiconductor Nanostructures; Transition Metal Atoms on Nanocarbon Surfaces; Nanodeposition of Soft Materials; Nanocatalysis.

Unit –III NANOSTRUCTURES: Electronic Structure of Nanoparticles- Kinetics in Nanostructured MaterialsZero dimensional, one-dimensional and two dimensional nanostructures- clusters of metals and semiconductors, nanowires, nanostructured beams, and nanocomposites- artificial atomic clusters-Size dependent properties-size dependent absorption spectra-phonons in nanostructures.

Unit-IV NANOSYSTEMS: Nanoparticles through homogeneous nucleation-Growth controlled by diffusiongrowth controlled by surface process-influences lof reduction reagents- Solid state phase segregationkinetically confined synthesis of nanoparticles-template based synthesis.

References:

1. K.W. Kolasinski, “Surface Science: Foundations of Catalysis and Nanoscience”, Wiley, 2002.
2. Joel I. Gersten, “The Physics and Chemistry of Materials”, Wiley, 2001.
3. A.S. Edelstein and R. C. Cammarata, “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Pub., 1998.
4. S.Yang and P.Shen: “Physics and Chemistry of Nanostructured Materials”, Taylor & Francis, 2000.
5. G.A. Ozin and A.C. Arsenault, “Nanochemistry : A chemical approach to nanomaterials”, Royal Society of Chemistry, 2005.

SYNTHESIS AND APPLICATIONS OF NANOMATERIALS

UNIT-I BULK SYNTHESIS: Synthesis of bulk nano-structured materials –sol gel processing – Mechanical alloying and mechanical milling- Inert gas condensation technique – Nanopolymers – Bulk and nano composite materials.

UNIT-II CHEMICAL APPROACHES: Self-assembly, self-assembled monolayers (SAMs). LangmuirBlodgett (LB) films, clusters, colloids, zeolites, organic block copolymers, emulsion polymerization, templated synthesis, and confined nucleation and/or growth. Biomimetic Approaches: polymer matrix isolation, and surface-templated nucleation and/or crystallization. Electrochemical Approaches: anodic oxidation of alumina films, porous silicon, and pulsed electrochemical deposition.

UNIT-III PHYSICAL APPROACHES: Vapor deposition and different types of epitaxial growth techniques- pulsed laser deposition, Magnetron sputtering - Micro lithography (photolithography, soft lithography, micromachining, e-beam writing, and scanning probe patterning).

UNIT-IV NANOPOROUS MATERIALS: Nanoporous Materials – Silicon - Zeolites, mesoporous materials - nanomembranes and carbon nanotubes - AgX photography, smart sunglasses, and transparent conducting oxides –molecular sieves – nanosponges.

APPLICATION OF NANOMATERIALS: Molecular Electronics and Nanoelectronics – Nanobots-Biological Applications – Quantum Devices – Nanomechanics - Carbon Nanotube – Photonics-Nano structures as single electron transistor –principle and design.

Reference:

1. S.P. Gaponenko, Optical Properties of semiconductor nanocrystals, Cambridge University Press, 1980.
2. W.Gaddand, D.Brenner, S.Lysherski and G.J.Infrate(Eds.), Handbook of NanoScience, Engg. and Technology, CRC Press, 2002.
3. K. Barriham, D.D. Vvedensky, Low dimensional semiconductor structures: fundamental and device applications, Cambridge University Press, 2001.
4. G. Cao, Nanostructures & Nanomaterials: Synthesis, Properties &Applications , Imperial College Press, 2004.
5. J.George, Preparation of Thin Films, Marcel Dekker, Inc., New York. 2005.NTPC103

ELEMENTS OF MATERIAL SCIENCE AND PROPERTIES OF NANOMATERIALS

Unit-I Solid State Physics (Overview): Amorphous, crystalline, crystals, polycrystals, symmetry, Unit Cells, Crystal Structures (Bravais Lattices), , Crystallographic Directions, Crystallographic Planes, Miller Indices, Bragg's Law, X-ray Diffraction.

Imperfections of crystal structure: point defects, Grain boundaries, phase boundaries, Dislocations Screw, Edge and Mixed Dislocations generation of defects by quenching, by plastic deformation and by radiation, interaction between point defects and dislocations

Unit-II Electronic Properties, Classification of materials: Metal, Semiconductor, Insulator, Band structures, Brillouin zones, Mobility, Resistivity, Relaxation time, Recombination centers, Hall effects.

Unit –III Confinement and transport in nanostructure, Current, reservoirs, and electron channels, conductance formula for nanostructures, quantized conductance. Local density of states. Ballistic transport, Coulomb blockade, Diffusive transport, Fock space. Dielectric properties: Polarisation, Ferroelectric behaviour.

Unit-IV Optical Properties, Photoconductivity, Optical absorption & transmission, Photoluminescence, Fluorescence, Phosphorescence, Electroluminescence.

References:

1. Introduction to Solid State Physics -C. Kittel
2. Solid State Physics- A.J. Dekker
3. Solid State Physics -R.K Puri and V.K.Babar
4. The Physics and Chemistry of Solids - Stephen Elliott & S. R. Elliott
5. Scanning Probe Microscopy: Analytical Methods (NanoScience and Technology)- Roland Wiesendanger
6. Advanced X-ray Techniques in Research and Industries - A. K. Singh (Editor)
7. X-Ray Diffraction Procedures: For Polycrystalline and Amorphous Materials, 2nd Ed.- Harold P. Klug, Leroy E. Alexander
8. Transmission Electron Microscopy: A Textbook for Materials Science (4-Vol Set)- David B. Williams & C. Barry Carter
9. Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM - Ray F. Egerton
10. Structures and Properties of Solid State Materials – B. Viswanathan.
11. Basic Solid State Chemistry – Anthony R. West.

BRANCH-PLASTIC 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	-	-	-
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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							
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INTERNET OF THINGS (IoT)

MODULE I

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es.

MODULE II

Domain Specific IoTs

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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.

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Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.
LINEAR Programming: Simplex Method, Duality, Sensitivity Methods
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1. Neural Networks- by Simon Haykin
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4. An introduction Fuzzy Control – by D.Driankor, H. Hellendorn, M.Reinfrank (Narosa Pub)
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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
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.

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**
Computational Methods and Techniques	4-0	4	100	50	-	-	-
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)

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 Hands on Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

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

COMPUTATIONAL METHODS AND TECHNIQUES

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5. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI)
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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
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.

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

1. Gedde Ulf. W. Polymer Physics, Chapman & Hall London (1995)
2. Rodriguez, Ferdinand, Principles of Polymer Systems Mc. Craw – Hill, International Book Co. International Student Edn. 1985.
3. Cowie; JMG Polymers: Chemistry & Physics of Modern Materials, Nelson Thornes ltd. Chelterham, 2001
4. 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

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

Reference Books

1. Robert K, Ian H, Mark G, Nanoscale Science and Technology, John Wiley & sons Ltd.,2005
2. Edward l Wolf. - Weinheim, Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, c2004, Wiley
3. S. N. Sahu, R. K. Choudhury, and P. Jena, Nano-scale Materials: From Science to Technology, Nova Science Publishers, 2006.
4. Yannick Champion, Hans-Jörg Fecht, Nano-Architectured and Nanostructured Materials: Fabrication, Control and Properties, Wiley-VCH,2005.
5. 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 ChemicalSynthesis of nanomaterials-sol-gel process, Liquid solid reactions. Gas Phase synthesis of nanomaterials-Furnace, Flame assisted ultrasonic spray pyrolysis; GasCondensation 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

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

Reference Books

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

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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.**

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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.

CHARACTERISATION OF POLYMERS & AMP; FIBROUS MATERIALS

ModuleI : Introductory: (5 hours)

Basic textile polymers, thermoplastic and thermosetting polymers,Degree of polymerization and conditions that influences polymer characteristics and fibre performances, glass transition temperature. Orientation and crystalinity,

ModuleII : Spectroscopy: (10 hours)

Infrared spectroscopy. Introduction, experimental techniques, Infrared spectra of natural and synthetic fibres. Identification of fibres using IR. FTIR spectroscopy. Xray diffraction and Fluorescence. Principle, working procedure of X- ray diffraction technique. X-ray diffraction of natural and synthetic fibres.

Xray Fluorescence and its application to textile related materials. NMR and Mass Spectroscopy: Principle,working procedure and application of NMR and MassSpectroscope.

ModuleIII: ChromatographicMethods : (10 hours)

Theoretical considerations of chromatography. Gas chromatography– Instrumentation, qualitative analysis, quantitative analysis, theory and applications. High Pressure Liquid Chromatography– Instrumentation and applications.

ModuleIV : ElectronMicroscopy (5 hours)

Basic theory of electron microscopy. Imaging system, image-translating system of electron microscope. Principle, working procedure and application of scanning Electron Microscope and Transmission electron microscope.

ModuleIV : Thermal Analysis: (5 hours)

Instrumentation, qualitative analysis, quantitative analysis, theory and applications of DTA, DSC, TGA .

Reference books:

1. InstrumentalMethodsofAnalysis7thEditionbyH.H.Willard;L.L.Merritt,JohnADean, FrankASettle,Jr.CBSPublishers&DistributionDelhi.
2. InstrumentalMethodsofChemicalAnalysis5thEditionbyGalenW.Ewing.
3. BasicConceptsofAnalyticalChemistry,2ndEditionbyS.M.Khopkar
4. TheAnalyticalChemistryofSyntheticdyesEditedbyK.Venkataraman.Wiley–InterscicencePub.JohnWiley&SonsNewYork.
5. HandBookofTextileTestingPart1to4,BureauofIndianStandards.
6. InstrumentalAnalysisofCottonCellulose&ModifiedCottonCellulose–RobertT.O'Connor.
7. TextileLaboratoryManual–W–GarnerVol.I&II.
8. PhysicalMethodsofInvestigatingTextiles–EDR.MeredithJ.W.S.Hearle.
9. HandbookofEnvironmentalHealth&Safety–Principles&Practices–HermanKoren,MichaelBisesiVol.-I&II.
10. TextileTesting&ItsRoleinTextileBusinesswithSpecialReferencetoEco FriendlyTextiles&Eco-Testing–Dr.G.S.Nadiger&S. Subramanian.
11. VibrationalSpectroscopyTheory&Applications–D.N.Sathyanarayana.
12. AnalyticalMethodsforaTextileLaboratory–J.W.Weaver.
13. MassSpectroscopy–E.Constantin&A.Schanell.
14. ProfilesinAnalysisofChemicals–Dr.N.F.Desai.
15. IntroductiontoElectronMicroscopy–SaulWischnitzer.
16. X-rayDiffractionMethodsinPolymerScience–AlexanderLerayE.

CLOTHING SCIENCE & TECHNOLOGY

UNIT I DIMENTIONAL STABILITY

Hygral expansion - Relaxation shrinkage - Felting shrinkage - methods of measuring dimensional stability to dry cleaning and dry heat.

SERVICEABILITY: Snagging - Pilling - Abrasion resistance - Tearing strength - Tensile strength - Bursting strength -Corrosive strength - Launderability - Crock resistance - Flammability - Scorching - Fusing - Static electricity - Seam strength and slippage

UNIT II COMFORT

Thermal comfort & conductivity - Air permeability - Water vapour permeability - moisture transport - wetting - wicking - sensorial comfort - water absorption - water repellency – oil repellency – soil resistance.

AESTHETICS: Colour - colour fastness - shade variation – colour measurement

UNIT III FABRIC HANDLE

Bending - Drape - Crease recovery - fabric thickness - Shear - Bias extension - formability - fabric friction - objective evaluation of fabric hand by KES and FAST

UNIT IV INTRODUCTION TO DESIGN LOGIC OF TEXTILE PRODUCTS

Classification of textile products and components.

YARN DESIGN: Material, technology, and specifications - yarn design elements - design based on structure and material properties

FABRIC DESIGN: Material, technology, and specifications - Fabric design elements - design based on structure and material properties

UNIT V DESIGN OF APPAREL FABRICS

Design of women's & Girl's wear - fabric types and materials for European, American and Indian styles - design of men's and boy's wear - fabric type and materials for European, American and Indian styles – Tailorability of fabrics – tailorability of woven and knitted garments – tailorability of leather garments – tailorability of fur garments.

REFERENCES:

1. Booth J.E-Principles of textile testing,Newenes,Butterworths,London,1983
2. Mastuida T., and Suresh M.N., -Design logic of textile products, Textile Progress, Textile Institute,Manchester,1997
3. Saville B.P-Physical testing of textiles, The Textile Institute, Wood head publishing limited, Cambridge, 1999
4. Hearle J.W.S., Textile Design-Journal of the Textile Institute (special issue), The Textile

1. Institute, Manchester, 1989

5. Pradip V.Mehta - An Introduction to quality control for the Apparel industry, ASQC Quality Press, Mareel Dekker inc., New York, 1982
6. Jacob Solinger - Apparel Manufacturing Analysis, Textile Book Publisher, New York, 1988
7. Wingate L.B and Mohler J.F-Textile fabrics and their selection, Prentice Hall, New Jercy, 1984
8. Postle R., Kawabata.S and Niwa.M.,-Objective Evaluation of Fabrics, Textile Machinery Society of Japan, Osaka, 1983.

ADVANCED TEXTILE MATERIALS (3-0-0)

Module-I

Introduction to Composites : Theory, Types, Properties ; High Performance fibers, thermoplastic and thermosetting Resins; Composite Manufacturing and Applications;

Module-II

Coated and laminated Textiles: materials, formulations, techniques and applications ; Protective Textiles- Materials, design, principles and evaluation for protection against fire, harmful radiation, chemicals and pesticides;

Module-III

Sportswear: design, testing and materials – fibers , yarns, fabrics for temperature control and moisture management; Medical textiles: Classification, types and products, Health and Hygiene Textiles- protection against microbes, Wound management- dressings, suture and bandages, Implants and drug delivery systems ;

Module-IV

Definition and Classification of Functional and Smart textiles ;Smart and Intelligent Textiles : Passive and Active functionality, stimuli sensitive textiles, Electronic Textiles : wearable computers, flexible electronics.

MATERIAL TESTING LAB.

Yarn Testing (any four)

1. To determine the hank of a Drawing sliver and Roving by using physical balance
2. To determine the count of a yarn by using physical/electronic balance.
3. To measure the TPI of given yarn sample using Twist Tester.
4. To determine the Count and CSP by using Knowle's balance and lea strength tester
5. To determine the single yarn strength.
6. To measure U% /CV% of a yarn

Fabric Testing (any Six)

1. To characterize a woven fabric with respect to its dimensional properties: Thread density, yarn number, yarn crimp, weave, cover factor, weight(GSM), areal density, skewness, thickness
2. To determine the tensile strength of a woven fabric by strip test method. Draw load-elongation curve of a woven fabric.
3. To determine the tear strength of a fabric using Elmendorf tear tester or ballistic tester.
4. To determine the bursting strength of a fabric using hydraulic bursting tester.
5. To determine the abrasion resistance of a fabric.
6. To determine the bending length and flexural rigidity of a woven fabric using the Shirley tester.
7. To determine the crease recovery of fabric and observe the effect of loading time and recovery time on crease recovery.
8. To determine the drape coefficient of woven and knitted fabric using the drape meter.

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: 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 Hands on Approach, by Arshdeep Bahga & Vijay audisetti, University Press.

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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
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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.

INSTRUMENTATION DEVICES AND SYSTEMS

Module – I (12 Hours)

Chemical Sensors Physical Sensors – Surface Micro Machined Capacitive Pressure sensor, Integrated flow sensor, Chemical and Biochemical Sensors – Conductivity sensor, Hydrogen Sensitive MOSFET, Tri-Oxide Sensors, Schottky diode type sensor, Solid Electrolyte, Electrochemical Sensors. Sensor Matrix for Two dimensional measurement of concentrations.

Module – II (14 Hours)

Optical Sensors Holography, Echolocation and bio holography, Sensors used in space and environmental applications. Application in meteorology, natural resources application sensor used in Instrumentation methods. Biomedical Sensors Biological Sensors in Human Body – Different types of Transducer system – Physiological Monitoring – chemo receptors – Hot and cold receptors – sensors for smell, sound, vision taste.

Module – III (14 Hours)

Aerospace Sensor Gyroscope laser and fibre optic gyroscopes, accelerometers. Laser, Aerospace application of laser, Resolvers, Altimeters, Angle of attack sensors, servos. Advanced Sensor Design Sensor design a sensor characteristics, Design of signal conditioning devices for sensors. Design of 2& 4 wire transmitters with 4 – 20 mA output. Pressure Sensor using SiSi bonding, Catheter pressure sensors, TIP pressure sensors, Highpressure sensors, Silicon accelerometers.

Textbooks:

1. Sabaree Soloman, Sensors Hand Book, McGraw Hill, 1998.
2. J.G. Webster, Medical instrumentation Application and Design, Houghton Mifilin Co.
3. Carr and Brown, Introduction to Medical Equipment Technology, Addison Wesley, 1999.

Recommended Reading:

1. Culshaw B and Dakin J (Eds), Optical Fibre Sensors, Vol. 1 & 2, Artech House, Norwood, 1989.
2. P. Garnell, Guided Weapon Control Systems, Pergamon Press, 1980.

PROCESS DYNAMICS AND CONTROL

Module – I (13 Hours)

Design aspects of Process Control System Classification of variables, Design elements of a control system, control aspects of a process. The input – output model, degrees of freedom and process controllers. Modes of operation of P, PI and PID controllers. Effect of variation of controller variables. Typical control schemes for flow, pressure, temperature and level processes.

Module – II (13 Hours)

Control System components: I/P and P/I converters - Pneumatic and electric actuators - valve positioner - control valve Characteristics of control valve - valve body - globe, butterfly, diaphragm ball valves - control valve sizing - Cavitation, flashing in control valves - Response of pneumatic transmission lines and valves. Actuators – Pneumatic, Hydraulic, Electrical/ Electronic.

Module – III (14 Hours)

Dynamic behavior of feedback controlled process: Stability considerations. Simple performance criteria, Time integral performance criteria: ISE, IAE, ITAE, Selection of type of feedback controller. Adaptive Control, Gain Scheduling Adaptive Control, Model – reference adaptive control, self tuning regulator. Logic of feed forward control, problems in designing feed forward controllers, feedback control, Ratio Control, Cascade Control.

Textbooks:

1. Curtis Johnson, Process Control Instrumentation Technology, Prentice Hall of India.

2. George Stephanopoulos, Chemical Process Control, Prentice Hall of India.

3. F.G. Shinkskey, Process Control Systems, McGraw-Hill Publications

CONTROL SYSTEM DESIGN

Module – I (12 Hours)

Introduction: Application of software and simulink for control system design, Review of compensation technique and choice of optimum parameters to obtain desired performance, Absolute stability and relative stability concepts. Design of Linear Control Systems: Transient and steady state response; Polar, Bode, Root locus plots; Reshaping of these plots to obtain desired response, Initial condition and forced response, A simple lag – lead design.

Module – II (14 Hours)

Design of Control Systems by State Variable Techniques: Controllability, Observability; Stability by using computer methods; solution of state and output equations of closed loop systems. Pole placement design, Observer design. Linear / quadratic optimal control. Full and reduced order observers. Design of Nonlinear Control Systems: Phase plane technique, Describing Function method for nonlinearities like saturation, dead space, ON/OFF (Ideal Relay type nonlinearity). Simulation techniques.

Module – III (14 Hours)

PID Controller: Use of digital computer as a compensator device, basic computer control scheme, tunable PID controller, Ziegler – Nichol's method, Simulation of multiloop control system using P, PI, PD, PID controller and finding the system response. Standard compensator structures (P, PD, PI and PID control). Design of Digital Control System: Technique and methodology; Computation of digital equivalent of the analog controller, simulation of performance of the design. Digital controller design, Regulator and observer design; Digital servo for inverted pendulum.

Textbooks:

1. G. C. Goodwin, S. F. Graebe, M. E. Salgado, Control System Design, Prentice Hall of India, 2001.
2. George Ellis, Control System Design Guide – A Practical Guide, 3rd Edition, Academic Press, 2005 Indian Reprint, ISBN: 81-8147-596-8.
3. Norman S. Nise, Control Systems Engineering, 3rd Edition, Wiley.

Recommended Reading:

1. M. Gopal, Digital Control and State Variable Method, Tata McGraw Hill.
2. Hadi Saadat, Computational Aids in Control System Using MATLAB, McGraw Hill International.
3. Ogata K., Modern Control Engineering, 4th Edition, Prentice Hall
4. Ogata K. System Dynamics, 3rd Edition, Prentice Hall
5. M. Gopal, Control Systems Principles and Design, 2nd Edition, Tata McGraw Hill

BRANCH-ELECTRICAL ENGINEERING(PT)

Specialization: INDUSTRIAL POWER CONTROL AND DRIVES(PT)

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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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							
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INTERNET OF THINGS (IoT)

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3. Neural Networks and Fuzzy Logic – by Bart Kosko
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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"
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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. *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

Load 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 RECOMMENDE :

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-ELECTRICAL & ELECTRONICS ENGINEERING

Specialization: ELECTRICAL AND ELECTRONICS ENGINEERING
ELECTRICAL & ELECTRONICS ENGINEERING (POWER SYSTEM 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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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
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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. *10.P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff, "Analysis of Electrical Machinery and Drivesystems", IEEE Press, Second Edition.*

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

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 within 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-(PT) ENVIRONMENTAL SCIENCE & ENGINEERING

Specialization: ENVIRONMENTAL SCIENCE & ENGINEERING (PT)

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	-	-	-
Water Supply Engineering	4-0	4	100	50	-	-	-
Waste Water Engineering	4-0	4	100	50	-	-	-
Environmental Chemistry & Microbiology	4-0	4	100	50	-	-	-
Lab-I (Environmental Engg Laboratory-1)					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, Survei
llance, 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

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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

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COMPUTATIONAL METHODS AND TECHNIQUES

MODULE-I:

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MODULE-III:

Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions.
LINEAR Programming: Simplex Method, Duality, Sensitivity Methods
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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.

WATER SUPPLY ENGINEERING

Module I: Different types of supply and treatment, Water requirements, Surface Water and Ground water.

Module II: Water quality and drinking water standards, Determination of reservoir capacity, Transportation and distribution of water. Pumping and design considerations for pumps, Water treatment systems,

Module III: Distribution system design and analysis, Optimization of pipe network systems, Distribution reservoirs and service storage,

Module IV: Physicochemical processes, Sedimentation, Coagulation, Flocculation, Granular media filtration Disinfection, Water softening, Adsorption and ion exchange processes.

Books for reference:

1. Water Supply Engineering, S.K. Garg, Khana Publishers.
2. Water Supply Engineering, B.C. Punmia, Laxmi Publications.
3. Environmental Engineering: A Design Approach, Sincero & Sincero, PHI.
4. Water and Wastewater Technology, Hammer & Hammer, PHL

WASTE WATER ENGINEERING

Module I: Waste waters-Sources, nature and characteristics, Estimation of quantities of waste water flow rate and fluctuations, quantities of storm water, Combined and separate sewerage systems, their relative merits, Design of combined and separate systems.

Module II: Sewer materials, Sewer appurtenances, Construction and maintenance of sewers and pumping of sewage, Analysis of waste water-determination of BOD, COD, Solids and volatile solids and their significance, BOD progression and its formulations.

Module III: Design of waste water treatment systems-Primary, secondary and tertiary treatments, screens, grit chambers, sedimentation tanks, chemical precipitation, Biological treatment-objectives.

Module IV: Methods and design of activated sludge and trickling filter units, Sewage sludge-its treatment, disposal and reuse, Effluent standards and its disposal.

Books for reference:

1. Sewage Disposal and Air Pollution Engineering, S.K. Garg, Khana Publishers.
2. Wastewater Engineering, B.C. Punmia, Laxmi Publications.
3. Wastewater, Treatment, Disposal and Reuse, Mtcalf & Eddy
4. Water and Wastewater Technology, Hammer & Hammer, PHL

ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY

Module I: Introduction, Review of basic concepts in chemistry, chemical thermodynamics, concept of chemical equilibrium, Equilibrium constants and activity.

Module II: Reaction kinetics, acid and basis, polyprotic acids and bases, acidity, alkalinity, carbonate system, pH-CT, buffers, and solubility reactions.

Module III: Electrochemistry and electrochemical cells, nuclear chemistry, nitrogen chemistry and chlorination.

Module IV: Introduction, the bacteria, the fungi, the algae, protozoa and other higher forms, viruses, pathogens and disease, microbial growth and enumeration, environmental influences, control of microorganisms.

Books for reference:

1. Environmental Chemistry, Sawer and Mccarty, TMH.
2. Microbiology for Environmental Scientists and Engineers, A.F. Gaudy, McGraw-Hill Int Edition.
3. Environmental Chemistry, Benerjee, PHI
4. Microbiology Demystified, Betsy, Tom, Keogh and James, TMH

ENVIRONMENTAL ENGG LABORATORY-1

Physical, chemical and bacteriological analysis of water and wastewaters.

BRANCH-INDUSTRIAL ENGINEERING & MANAGEMENT

Specialization: INDUSTRIAL ENGINEERING & MANAGEMENT

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	-	-	-
Decision Modelling – I	4-0	4	100	50	-	-	-
Production Planning and Inventory Control	4-0	4	100	50	-	-	-
Phi Work System Design	4-0	4	100	50	-	-	-
Lab-I					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.**

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Domain Specific IoTs

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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.

DECISION MODELLING – I

Use of quantitative techniques in decision making, Elements of linear algebra, Linear programming and Simplex method, Artificial variable, Duality in LP, Sensitivity analysis Network flows: Shortest path, minimum spanning tree, maximum flow and minimum cost flow problems; Transportation problem, Degeneracy, Assignment problem, Transhipment Model Integer Programming: 0-1 and mixed integer programming problem formulation, Branch and Bound method, Cutting-plane method Game theory: Two person Zero-sum game, Saddle point, Mixed strategies, Use of dominance, Subgames method, Linear programming method

Books:

1. Operation Research: An Introduction, Taha H A, PHI

2. Operation Research, Phillips, Rabindran and Solberg, "John Wiley & Sons

3. Introduction to Operation Research, Hiller F S and Lieberman G J

PRODUCTION PLANNING AND INVENTORY CONTROL

Generalised model of a production system, Different kinds of production systems, mass, batch job and cellular production Layout: Optimisation in Product and Process layout; FMS; Manufacturing Strategies Demand forecasting: Moving Average and Exponential Smoothing methods, Multiple regression method, Error in forecasting Decisions in the life cycle of a production system, Evaluation of investments in new product and services, risk analysis using decision trees, product mix decisions Aggregate planning, Operation planning and control, Scheduling, Comparison of dispatch rules, Johnson rule Inventory control: EOQ and EBQ, EOQ Sensitivity, Backordering, Determination of safety stock, P and Q System, Joint cycle for multiple products Materials Requirements Planning (MRP): Independent and dependent items, Master production schedule, MRP Inputs and outputs, Bill of Material, MRP Computation, EOQMRP comparison, MRP Types, Capacity planning and control, JIT in production planning and planning

Books:

1. Manufacturing Planning and Control, Vollman, Berry, Whybark & Jacobs, TMH

2. Production Planning and Inventory Control, Narasimhan S L, Mcleavey D W, Billington PJ,

PHI WORK SYSTEM DESIGN

Work Study Fundamentals: Productivity and Work Study, Definitions, Scope, and History of Work Study, Analysis of Work Content. Method Study: Process Analysis, Process and Activity Charts, Operation Analysis, Basic procedure, Micro Motion Study, Principles of Motion Economy. Work Measurement: Purposes and uses, Basic procedure, Techniques – Work Sampling, Stop-Watch Time Study, Rating and Allowances, Setting Standard Times for Jobs, Standard Data, Predetermined Time Standards. Ergonomics: Fundamental Concepts, Issues in Worksystem Design, Measuring Work by Physiological means, Work Posture, Fatigue Measurement and Evaluation, Environmental Factors and Work Systems, Industrial Product Design. Job Evaluation: Basic concepts, Objective and Subjective methods, Compensation Schemes, Relationship of Work Study to Incentive Schemes, Wage Incentive Plans.

Books:

1. Motion and Time Study, Barnes R M

2. Motion and Time Study, Mundel M, PHI

3. Introduction to Work Study, ILO

BRANCH-CHEMICAL ENGINEERING

Specialization:CHEMICAL ENGINEERING.

First Semester							
Theory					Practical		
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Advanced Heat Transfer	4-0	4	100	50	-	-	-
Advanced Fluid Mechanics	4-0	4	100	50	-	-	-
Advanced Mass Transfer	4-0	4	100	50	-	-	-
Lab-I					4	2	150
Total							
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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

4Credits

MODULE-1

General equation of heat conduction. Application of general heat conduction equation under steady state heat conduction with internal heat generation in large slab, cylinder, hollow cylinder

etc. Transient heat conduction numerical and analytical methods for the solution of transient heat conduction problems. Series-parallel resistances and contact resistances in heat transfer concept of conduction shape factor, critical radices and optimum thickness of insulation.

MODULE-2

Free convective heat transfer under different situations and application of dimensional analysis to estimate the convective heat transfer coefficients. Forced convective heat transfer in laminar transition and Turbulent zone.

MODULE-3

Heat transfer factor Reynolds No. plot. Analogy equation for Heat Momentum Transfer. Convective heat transfer in molten method. Boiling heat transfer with particular reference to Nucleate and film boiling and estimation of boiling heat transfer coefficient. Heat transfer from condensing vapors. Nusselt equation for film type condensation of vapors over vertical surfaces and inclined tubes.

MODULE-4

Selection and design of condensers, single pass and multipass heat exchangers. Radiation heat transfer. Estimation of view factors and emmisivity factors for different situation. Radiation shield and radiation error in pyrometry. Combined conduction, convention and radiation heat transfer. Convection and Radiation heat transfer furnaces.

TEXTBOOKS:

1. McCabe W. L. & Smith J. C. & Harriot P, Unit Operations of Chemical Engineering (5th Edition),McGraw Hill, New York.
1. Mc Adams, W. H., Heat Transmission.
2. A. Domkundware, A course on heat and mass transfer, Dhanpat Ray and sons publication
3. Kern D. Q., Process Heat Transfer
4. R.K Rajput, Heat and mass transfer, S. Chand publication
5. Gupta, C. P. & Prakash, R., Engineering Heat Trasnfer (6th Edition) Nom Chand & Bros., Roorkee (1994).

ADVANCED FLUID MECHANICS

4Credits

MODULE-1

Basic Concepts and Fundamentals, Governing Equations of Fluid Motion

MODULE-2

Exact Solution of Navier-Stokes Equations, Potential Flows, Laminar Boundary Layers

MODULE-3

Elements of Stability Theory, Turbulent Flow, Compressible Flow

MODULE-4

Fluidization and analysis of different phases, Elutriation and Entrainment.

TEXT BOOKS

1. DiazoKunji and O. Levenspiel, "Fluidization Engg". 2nd Ed., Butterworth Heinemann, 1991.
2. Batchelor G.K, An Introduction to Fluid Dynamics, Cambridge University Press, 1983.
3. Fox W. Robert, McDonald T. Alan, Introduction to Fluid Mechanics, Fourth Edition, John Wiley & Sons, 1995.
4. Pijush K. Kundu and Ira M. Cohen, Fluid Mechanics, Fourth Edition, Academic Press (ELSEVIER), 2008.
5. Frank M. White, Fluid Mechanics, Tata McGraw-Hill, Singapore, Sixth Edition, 2008.

ADVANCED MASS TRANSFER

4Credits

MODULE 1

Molecular diffusion in solid, liquid and gas; Fick's law; Mass transfer coefficient; Film theory; Penetration theory; Surface renewal theory; Surface stretch theory; Analogy of mass, heat and momentum transfer

MODULE 2

Vapour liquid equilibria; Simple distillation; Equilibrium distillation; Rectification; Determination of number of equilibrium stages by adopting McCabe-Thiele method and Ponchon-Savarit method; Algebraic method to determine the number of equilibrium stages; Multi-component azeotropic and extractive distillation, Approximate column sizing: Column diameter, Plate spacing, downcomers,

MODULE 3

Liquid flow pattern; Liquid-Liquid extraction cascade configurations: cocurrent cascades, countercurrent cascades, crosscurrent cascades. And Liquid-liquid extraction with ternary systems: general design considerations, Hunter-Nash graphical equilibrium stage method.

MODULE 4

Equilibrium- based methods for multi-component distillation: Theoretical model for equilibrium stage, Equation tearing procedures like tridiagonal matrix algorithm, bubble-point method for distillation; In-out method; MESH equation

Textbooks and References:

1. Treybal, R. E., 1980 *Mass-Transfer Operation*. McGraw Hill Education (India) Private Limited. New Delhi
2. Seader, J. D., Henley, E. J., 2006 *Separation Process Principle.* John Wiley & Sons, New Delhi
3. Sinnott, R. K., 1993 *Chemical Engineering Design*: Coulson & Richardson's Chemical
4. Engineering Series Volume six, Butterworth-Heinemann, IndiaMcCabe, W. L., Smith, J. C., Harriott, P., 1993 Unit Operations of Chemical Engineering, McGraw-Hill International Edition, Singapore.
5. Charles D.Holland, *Multi-component Distillation*, Prentice Hall of India Pvt. Ltd., 1965.
6. B. K. Dutta, *Principles of Mass Transfer and Separation Process*

ADVANCED CHEMICAL ENGINEERING LAB-1

ADVANCED HEAT TRANSFER LAB

List of Experiments

1. To find thermal conductivity of composite walls.
2. To find out the overall heat transfer coefficient in counter flowdouble pipe heat exchanger.
3. To find out the overall heat transfer coefficient in parallel flow double pipe heat exchanger.
4. To determine overall heat transfer coefficient of a shell and tube heat exchanger.

ADVANCED MASS TRANSFER LAB

List of Experiments

1. To verity Rayleigh's equation through simple distillation for binary mixture of water and ethanol.
2. To determine the vapour – liquid equilibrium curve for carbon tetrachloride-air system.
3. To draw the rate of drying curve using Tray dryer.

ADVANCED FLUID DYNAMICS LAB

List of Experiments

1. To determine minimum fluidization velocity and pressure drop in a fluidized bed.
2. To find out the flow rate of fluid flowing in a pipe using venture and orifice meter.
3. To verify the Bernoulli's Equation using Bernoulli's Appara

BRANCH-CONSTRUCTION TECHNOLOGY AND MANAGEMENT

Specialization:CONSTRUCTION TECHNOLOGY AND MANAGEMENT

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	-	-	-
Construction Economic and Finance	4-0	4	100	50	-	-	-
Project Planning and Management	4-0	4	100	50	-	-	-
Material Technology	4-0	4	100	50	-	-	-
Lab-I(Material Testing Lab)					4	2	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 Hands on 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.

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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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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)
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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.

CONSTRUCTION ECONOMICS AND FINANCE

Construction accounting - Income statement - Depreciation and amortization - Engineering economics -Benefit-cost analysis - Replacement analysis - Break even analysis - Risks and uncertainties and management decision in capital budgeting - Taxation and inflation - Work pricing - contract - bidding and award – revision - escalation - Turnkey activities - Project appraisal and yield - Working capital management – International finance - Budgeting and budgetary control - Performance - appraisal.

Reading:

1. Danny Myers, Construction Economics: A New Approach, Taylor and Francis Publisher, 2004
2. Ofori, G, The Construction Industry Aspects of its economics and Management, Singapore University Press, 1990

PROJECT PLANNING AND MANAGEMENT

UNIT-1

Project Planning and Scheduling - Processes of project planning, scheduling - progress control - project planning and scheduling techniques -

UNIT-2

Network Scheduling Techniques - Use of computer based models - Principles of Project management - Resource Management and Inventory - Implementation of Project Planning Management - Analysis and design of planning and control system

UNIT-3

Disputes and Claims Management -Use of computer based project management tools

REFERENCE

1. Callahan, M. T., Quackenbush, D. G., and Rowings, J. E., Construction Project Scheduling, McGraw- Hill, New York, 1992.
2. Cleland, D. I. and Ireland, L. R., Project Management: Strategic Design and Implementation, 4th Edition, McGraw Hill, New York, 2002

MATERIAL TECHNOLOGY

Cement and Concrete:

Portland Cement: Chemical Composition, hydration of cement, structure of hydrated cement, mechanical strength of cement gel, water held in hydrated cement paste and heat of hydration. Cements of different types. Factors affecting the strength of concrete. Elasticity, shrinkage and creep of concrete

Durability of concrete:

Permeability of concrete, chemical attack of concrete, air-entrained concrete and thermal properties of concrete. Mechanical test of hardened concrete. light weight and high density concrete. Mix Design. Statistical quality control: Biaxial strength of concrete, Fiber reinforced concrete.

Metals:

Behaviour of common constructional metals in tension and compression. True stress-strain curve for mild steel in simple tension. Theories of failure and yield surfaces.

Fatigue Properties:

Nature of fatigue failure, fatigue strength for completely reversed stresses, fatigue strength with super imposed static stress and factor influencing fatigue strength.

Temperature and creep properties:

Low temperature properties, high temperature properties, creep stress -time-temperature relation for simple tension, mechanics of creep in tension. structure of materials and imperfection, deformation of crystals and theory of dislocation.

Reference Books:

1. Concrete Technology, M.L.Gambhir, Tata Mc-Graw-Hill, New Delhi,2002
2. Concrete Technology, M S Shetty, S.Chand Publisher, 2013
3. Properties of Concrete, A M Neville-Pearson Education,2008
4. Mechanical Behaviour of Engineering Materials, AJ Martin

MATERIAL TESTING LABORATORY

NDT Tests: Rebound hammer test, Ultrasonic Pulse Velocity Test, Pull out test

BRANCH-CIVIL ENGINEERING

2nd Semester

Specialization: Structural Engineering/ Structural and Foundation Engineering

Second Semester							
Theory					**Practical**		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Advanced Reinforced Concrete Design	4-0	4	100	50	-	-	-
Specialization Core-2 Matrix Methods of Analysis of Structure	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Structural Dynamics 2.Advanced Steel Structure 3. Bridge Engineering 4.Earthquake Resistance Design of Structure	4-0	4	100	50	-	-	-
Elective II (Departmental related) 1.Advance Construction Materials 2. Offshore Engineering 3. Tall Structures 4.Optimization Methods & its Application in Civil Engineering	4-0	4	100	50	-	-	-
Elective III(from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

BRANCH-CIVIL ENGINEERING

2nd Semester

Specialization: Water Resource Engineering & Management/ Water Resource Engineering

Second Semester							
Theory					**Practical**		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Ground Water Hydrology	4-0	4	100	50	-	-	-
Specialization Core-2 Free Surface Flow	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Advanced Fluid Mechanics 2. Applied Hydrology 3.Fluvial Hydaulics 4. Ground Improvement Engineering	4-0	4	100	50	-	-	-
Elective II (Departmental related) 1. Design of Irrigation Structure 2. GIS & Remote Sensing 3. Irrigation & Drainage 4.Water Resources System & Management	4-0	4	100	50	-	-	-
Elective III(from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

BRANCH-CIVIL ENGINEERING

2nd Semester

Specialization: Transportation Engineering

Second Semester							
Theory					**Practical**		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Geometric Design of Highways	4-0	4	100	50	-	-	-
Specialization Core-2 Transportation Systems Planning	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Advanced Railway Engineering 2.Planing & Design of Airport 3. Bridge Engineering 4.Ground Improvement Engineering	4-0	4	100	50	-	-	-
Elective II(Departmental related) 1.Advance Construction Materials 2. Mass Transit Systems 3. Traffic Engineering & Traffic Flow Theory 4.Transportation & Environment	4-0	4	100	50	-	-	-
Elective III(from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

BRANCH-CIVIL ENGINEERING

2nd Semester

***Specialization:** Soil Mechanics and Foundation Engineering/ Soil Mechanics*

Second Semester							
	Theory				Practical		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Advanced Soil Mechanics	4-0	4	100	50	-	-	-
Specialization Core-2 Ground Improvement Technique	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Stability Analysis of Slopes, embankments & Dams 2.Ground Water & Flow Through Porous Media 3.Earth Retaining structure 4.Earthquake Geotechnical Engineering	4-0	4	100	50	-	-	-
Elective II (Departmental related) 1.Subsoil Exploration & Soil Testing 2. Dynamics of Soils & Foundation 3.Strength & Deformation Behavior of Soil 4.Optimization Methods & its Application in Civil Engineering	4-0	4	100	50	-	-	-
Elective III (from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

BRANCH-CIVIL ENGINEERING

2nd Semester

Specialization: Geotechnical Engineering

Second Semester							
Theory					**Practical**		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Advanced Geo-Mechanics	4-0	4	100	50	-	-	-
Specialization Core-2 Ground Improvement Technique	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Stability Analysis of Slopes, embankments & Dams 2.Ground Water & Flow Through Porous Media 3.Rock Mechanics 4.Soil Dynamics & Geotechnical Earthquake Engineering	4-0	4	100	50	-	-	-
Elective II (Departmental related) 1. Subsoil Exploration & Soil Testing 2. Soil Stabilization by Admixture 3.Reinforced Soil Structure 4.Optimization Methods & its Application in Civil Engineering	4-0	4	100	50	-	-	-
Elective III(from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

DETAILED SYLLABUS OF SECOND SEMISTER M.TECH 2016-17 ADDMISSION BATCH

BRANCH-CIVIL ENGINEERING

Specialization: Geotechnical Engineering

Second Semester							
	Theory				Practical		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Advanced Geo-Mechanics	4-0	4	100	50	-	-	-
Specialization Core-2 Ground Improvement Technique	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Stability Analysis of Slopes, embankments & Dams 2.Ground Water & Flow Through Porous Media 3.Rock Mechanics 4.Soil Dynamics & Geotechnical Earthquake Engineering	4-0	4	100	50	-	-	-
Elective II (Departmental related) 1. Subsoil Exploration & Soil Testing 2. Soil Stabilization by Admixture 3.Reinforced Soil Structure 4.Optimization Methods & its Application in Civil Engineering	4-0	4	100	50	-	-	-
Elective III(from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

ADVANCED GEOMECHANICS

Module I

Soils, rocks and groundwater: geology and genesis of soils, principle of effective Stress, indices and phase relationships, groundwater flow.

Module II

Stress and strain analysis: Mohr circles, failure criteria, soil laboratory tests,

Module III

Shear strength and stiffness of sands: stress-strain, volume change and shearing in sands, critical state and stress paths, consolidation,

Module IV

Shear strength and stiffness of clays: compression and consolidation, drained and un-drained shear strength, critical state and stress paths.

References:

1. Wood, D.M., Soil Behaviour and Critical State Soil Mechanics, Cambridge University Press, 1991.
2. Bolton, M.D., A Guide to Soil Mechanics, Cambridge University Press, 1991.
3. Salgado, R., The Engineering of Foundations, McGraw Hill, 2008.
4. Atkinson, 'Critical State Soil Mechanics'

GROUND IMPROVEMENT TECHNIQUES

Module I

Principles of ground improvement. Mechanical modification, properties of compacted soil, compaction control tests.

Module II

Hydraulic modification, dewateringsystems, filtration, drainage and seepage control with geo-synthetics, preloadingand vertical drains, Electric-kinetic dewatering, chemical modification.

Module III

Modificationby admixtures, stabilization using industrial wastes, grouting, modification byinclusion and confinement, soil reinforcement, flexible geo-syntheticsheet reinforcement, anchorage.

Module IV

Reinforcement techniques, bearing capacity improvement, slope stability, retaining walls and pavements.

References

1. Hausmann, M.R., Engineering Principles of Ground Modification, McGraw Hill,1990.
2. Jones, C.J.E.P., Reinforcement and Soil Structures, ButterworthPublications, 1996.
3. Koerner, R.M., Designing with Geosynthetics, Prentice Hall Inc. 1998.

STABILITY ANALYSIS OF SLOPES, EMBANKMENTS AND DAMS

Module I

Landslide phenomenon: Types and causes of slope failures, Practical applications; Stability analysis of infinite slopes with or without water pressures;

Module II

Stability analysis of finite and infinite slopes: concept of factor of safety, pore pressure coefficients, Mass analysis, Wedge methods, friction circle method; Method ofslices, Bishop's method, Janbu's method;

Module III

Effect of seepage, submerged and sudden draw down conditions; Design of slopes in cutting, Embankments and Earth dams;

Module IV

Site Investigation: Reconnaissance, Preliminary and detail investigation, Investigation for foundations; Advances in stability analysis of slopes.

References

1. L. W Abramson, T. S Lee, S Sharma and G M Boyce, Slope Stability and Stabilization Methods, Willey Inter science publications
2. B M Das, Principles of Geotechnical Engineering, Thomson Brooks/Cole
3. T W. Lambe and R V Whitman, Soil Mechanics, John Wiley & sons
4. V N S Murthy, Principles of Soil Mechanics and Foundation Engineering, UBS Publishers Private Ltd.

GROUND WATER AND FLOW THROUGH POROUS MEDIA

Module I

Soil Water: Modes of occurrence of water in soils. Adsorbed water, capillary water, Capillary potential, capillary tension and soil suction. Effective and Neutral pressures in soil;

Module II

Flow through porous Media: Darcy's law and measurement of permeability in laboratory and field. Steady State flow solutions of Laplace's equation, Plane problems, 3-dimensional problems, Partial cut-offs, uplift pressure,

Module III

Consolidation theory: one and three dimensional consolidation, Secondary consolidation.

Module IV

Ground water Hydraulics: Water table in regular materials, Geophysical exploration for locating water table. Confined water, Equilibrium conditions, Non-equilibrium conditions, Water withdrawal from streams, Method of ground water imaging.

References:

1. D.K.Todd, Groundwater Hydrology, John wiley and Sons
2. H. M. Raghunath, Ground Water, Willy Eastern Ltd.
3. C. Fitts, Ground Water Science, Elsevier Publications, U. S. A.
4. P. P. Raj, Geotechnical Engineering, Tata McGraw-Hill
5. A. Jumikis, Soil Mechanics, East West Press Pvt Ltd.

ROCK MECHANICS

Module I

Rock: Formation of rocks, Physical properties, Classification of rocks and rock masses, Static Elastic constants of rock;

Module II

Rock Testing: Laboratory and Field tests; Discontinuities in Rock Masses: Discontinuity orientation, Effect of discontinuities on strength of rock;

Module III

Strength Behaviour: Compression, Tension and Shear, Stress-Strain relationships, Rheological behaviour; Strength/ Failure Criterion: Coulomb, Mohr, Griffith theory of brittle strength and other strength criteria. Stresses in rock near underground openings;

Module IV

Application of rock mechanics in Civil Engineering: Rock tunnelling, Rock slope stability, bolting, blasting, grouting and rock foundation design.

References

1. W. Farmer, Engineering Behaviour of Rocks, Chapman and Hall Ltd.
2. R. E. Goodman, Introduction to Rock Mechanics
3. P.R. Sheorey, Empirical Rock Failure Criteria, Balkema, Rotterdam, 1997
4. V.S. Vutukuri and R D Lama, Hand Book on Mechanical Properties

SOIL DYNAMICS AND GEOTECHNICAL EARTHQUAKE ENGINEERING

Module I

Soil Dynamics: Introduction: Soil mechanics and soil dynamics, problems of dynamic loading on soil structure.
Theory of vibrations: Introduction, definitions, properties of simple harmonic motion, free vibrations of spring mass system, Equations for free and forced vibrations with and without viscous damping.

Module II

Dynamic Soil Properties: Introduction, measurement of dynamic soil properties (laboratory and field tests - Stress and strain controlled cyclic triaxial tests, seismic reflection and refraction test, seismic up-hole/down hole test, dilatometer and pressure meter tests, seismic cone penetration test, suspension logging test), stress-strain behaviour of cyclically loaded soils, strength of cyclically loaded soils.

Module III

Geotechnical Earthquake Engineering: Introduction, background, seismic hazards; ground shaking, structural hazards, liquefaction, landslides, lifeline hazards, tsunami hazards, mitigation of seismic hazards, significant historical earthquakes. Seismology and earthquakes: Internal structure of the earth, continental drift and plate tectonics, faults, elastic rebound theory, other sources of seismic activity location of earthquakes, size of earthquakes (intensity, magnitude and energy).
Seismic Liquefaction: Introduction, Flow liquefaction and cyclic mobility, liquefaction susceptibility (historical, geologic, and compositional). Initiation of liquefaction due to excess pore water pressure, effects of liquefaction (alteration of ground motion, development of sand boils, settlement and instability).

Module IV

Bearing Capacity Analysis: Introduction, punching shear failure approach for cohesive and cohesion-less soils, Terzaghi's method for both cohesion-less and cohesive soils.
Ground Improvement Techniques for Remediation of seismic hazards: introduction, densification techniques (Vibro-technique, dynamic compaction, blasting, grouting and mixing and drainage techniques).

References:

1.Geotechnical Earthquake Engineering by Steven L. Kramer, Low Price Edition,Pearson Education, www.pearsoned.co.in
2. Soil Dynamics by Shamsher Prakash, McGraw-Hill Book Company
3. Soil Behaviour in Earthquake Geo-technics by Kenji Ishihara, Clarendon Press, Oxford
4.Theory of Vibrations with Applications by W. T. Thomson and M. D. Dahleh,Low Price Edition, Pearson Education, www.pearsoned.co.in

Subsoil Exploration & Soil Testing

Module-I

Problems and phases of foundation investigations: Geophysical sounding, drilling and accessible explorations.

Module-II

Sample requirements, sampling methods and equipment. Handling, preservation and transportation of samples.

Module-III

Sample preparation, laboratory tests, analysis of results and interpretation, importance of in-situ testing.

Module-IV

Performing various in-situ tests. Precautions and interpretation, site evaluation and reporting, block vibration test.

References:

1. Head, K.H., Manual of Soil Laboratory Testing, Vols. 1 to 3, 1981.

2. Compendium of Indian Standards on Soil Engineering, Parts 1 and II, 1987– 1988.

SOIL STABILISATION BY ADMIXTURES

Module I

Principles of soil stabilization, role of admixtures, purpose based classification of soils.

Module II

Methods of stabilization – lime, cement, bitumen and special chemicals, mechanisms, uses and limitations.

Module III

Use of fly ash and other waste materials.

Module IV

Methods and applications of grouting. Application to embankments, excavations, foundations and sensitive soils.

References:

1. Ingles, O.G., and Metcalf, J.B., Soil Stabilization, Principles and Practice,Butterworths, 1972.
2. Bowen, R., Grouting in Engineering Practice, Allied Science Publishers Ltd.,1975.

REINFORCED SOIL STRUCTURES

Module I

PRINCIPLES AND MECHANISMS OF SOIL REINFORCEMENT
Historical Background, Principles, Concepts and Mechanisms of reinforced earth.

REINFORCING MATERIALS AND THEIR PROPERTIES
Materials used in reinforced soil structures, fill materials, reinforcing materials metal strips, Geotextile, Geogrids, Geomembranes, Geocomposites and Geojutes, Geofoam, Natural fibres - facing elements – Properties and methods of Testing.

Module II

DESIGN OF SOIL REINFORCEMENT
Reinforcing the soil-Geotextiles and Geogrids – Embankments and slopes – reinforced walls – bearing capacity – Road way reinforcement – slop stabilization.

Module III

DESIGN FOR SEPARATION, FILTRATION AND DRAINAGE
Geotextiles - requirement for design of separation – Filtration – General behaviour - Filtration behind retaining wall, under drains, erosion control and silt fence – drainage design – Liners for liquid containment – Geomembrane and Geosynthetic clay liners.

Module IV

DURABILITY OF REINFORCEMENT MATERIALS
Measurement of corrosion factors, resistivity - redox potential, water content, pH, Electrochemical corrosion, bacterial corrosion – influence of environmental factors on the performance of Geosynthetic materials.

REFERENCES:

1. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.
2. Jones, C.J.F.P., Earth Reinforcement and Soil Structures, Earthworks, London, 1982.
3. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.
4. Muller, W.W. HDPE Geomembranes in Geotechnics, Springer, New York2007.
5. John, N.W.M., Geotextiles, John Blackie and Sons Ltd., London, 1987.
6. Gray, D.H., and Sotir, R.B., Biotechnical and Soil Engineering SlopeStabilization: Apractical Guide for Erosion control, John Wiley & Son Inc. New York, 1996.
7. RamanathaAyyar , T.S., Ramachandran Nair, C.G. and Balakrishna Nair, N.,Comprehensive Reference Book on Coir Geotextile, Centre for Developmentfor Coir Technology, 2002.
8. Siva Kumar Babu, G.L., An Introduction to Soil Reinforcement and Geosynthetics University Press (India), Pvt. Ltd., Hyderabad, 2006.

OPTIMIZATION METHODS AND ITS APPLICATIONS IN CIVIL ENGINEERING

Module I

Introduction: Need for engineering optimal design, Optimum design formulation: Design variable, objective function and constraints; unconstrained optimization methods Single variable optimization methods: Region elimination method – Golden Section search, Interval halving method; Gradient based method – Newton-Raphson, bisection and secant method.

Module II

Multi variable optimization methods: Direct search method: Hooke-Jeeves pattern search, simplex reflection search, Powell's conjugate direction search. Gradient Based methods: Cauchy's steeped descent, Newton's method, Levenberg Marquardt's method, Fletcher- Reeve method; constrained optimization methods Kuhn Tucker condition, Penalty function method, Augmented Lagrangian method, sequential unconstrained minimization, cutting plane method;

Module III

Introduction to Evolutionary algorithms: Need for evolutionary algorithms, Type of evolutionary methods, Introduction to Genetic algorithm (GA), Difference and similarities between GA and traditional methods. Basic operations of GA: reproduction, crossover, mutation and elitism. Binary coded and real coded GA;

Module IV

Application of Optimization techniques: Water resource planning management, Structural Optimization, Transportation planning and Management, Slope stability and optimal dimensioning of foundations. Multi-objective optimization models.

References

1. J.S. Arora, Introduction to Optimum Design, Elsevier, 2nd Edition, 2004.
2. K. Deb, Optimization for Engineering. Design: Algorithms & Examples, Prentice Hall India, 2006
3. S.S. Rao, Engineering Optimization: Theory & Practice, New Age International (P) Ltd, 3rd Edition, 1996, Reprint: June, 2008
4. K. Deb, Multi-Objective Optimization Using Evolutionary Algorithms, John Wiley, 2003

COMPOSITE STRUCTURES

Module I:

Introduction: definition and characteristics, fibres, matrices, fibre reinforced composites, advantages and limitations, basic concepts and characteristics: isotropy, orthotropic, classification, lamina and laminate, micromechanics and micromechanics, constituent materials and properties.

Module II:

Elastic behaviour of unidirectional lamina: specially orthotropic and transversely isotropic material, relation between mathematical and engineering constants, stress strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, transformation of stress-strain relations in terms of engineering constants.

Module III:

Elastic behaviour of multidirectional laminates, symmetric and balanced laminates, design considerations, computational procedure for finding engineering elastic properties, stress and failure analysis of multidirectional laminates.

Module IV:

Bending of laminated composite plates, thin laminated plate theory, deflection of all edges simply supported rectangular symmetric cross-ply laminate, two opposite edges simply supported.

Books:

1. I.M. Daniel & O. Ishai, “Engineering Mechanics of Composite Materials", Oxford Press
2. S.W.Tsai&H.T.Hahn, "Introduction to Composite Materials: Techonomic Pub. Co.INC, USA.
3. P.K.Sinha,"A short term course on Composite Materials and Structures"-1996

HYDRO POWER ENGINEERING

Module I:

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Module II:

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Module III:

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels. Turbines: Introduction, types of turbines, hydraulic features, turbine size, constructional features of turbines, layout arrangements, hydraulic of turbines, basic flow equations, draft tubes, cavitations in turbines, governing of turbines, characteristics of turbines, illustrative examples.

Module IV:

Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house. Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house. Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

References:

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books
2. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
3. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal (Laxmi Publications Private Limited)

NON-CONVENTIONAL ENERGY

Module I

Introduction various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

Module II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

Module III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

Module IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

References Books:

1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.
2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.
4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International. 5.
C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.

ADVANCED NUMERICAL METHODS

Module I:

Introduction to digital computers & Programming - an overview; Errors - polynomial approximations and interpolations - Numerical differentiation & Integration;

Module II:

Evaluation of single and multiple integrals, Newton's method, variational and weightened residual methods. Matrices – Linear equations, Eigenvalues and Eigenvectors - nonlinear equations,

Module III:

Harmonic and biharmonic equations - solutions, convergence, completeness & stability.

Module IV:

Initial and boundary value problems of finite difference method, Implicit & Explicit scheme.

Referrences

1. Jain M.K, SRK Iyenge and RK Jain."Numerical Methods for Scientific & Engg.Computation".
2. Mathews J. H "Numerical Methods for Mathematics, Science and Engineering".
3. Gerld C.F and PO Wheatley "Applied Numerical Analysis".
4. Gupta S.C and V. K. Kapoor "Fundamentals of Applied Statistic", Sultan Chand & Sons.
5. Johnson R.A " Probability and Statistics for Mngineers.
6. Rajeshwaran S, "Numerical Methods in Science & Engineering (A Practical Approach)",Willey Publication.

Green Building Concepts

Module I

Environmental implications of buildings energy, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transporation Energy for Building Materials; Maintenance Energy for Buildings.

Module II

Implications of Building Technologies Embodied Energy of Buildings: Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

Module III

Comforts in Building: Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

Module IV

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Unit V Green Composites for buildings: Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

TEXT BOOKS

[1] K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
[2] Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
[3] Green My Home!: 10 Steps to Lowering Energy Costs and Reducing Your Carbon Footprint, by Dennis C. Brewer, ISBN:9781427798411, Publisher: Kaplan Publishing, Publication Date: October 2008.
[4] B. Givoni, Man, Climate and Architecture Elsevier, 1969.
[5] T. A. Markus and E. N. Morris Buildings Climate and Energy. Pitman, London, 1980. Arvind Kishan et al (Ed)
[6] Climate Responsive Architecture. TataMcGraw Hill, 2001.
[7] Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.
[8] O. H. Koenigs Berger, T. G. Ingersoll, Alan Mayhew and S. V. Szokolay. Manual of Tropical Housing and Building. Orient Long man, 1975.

REFERENCE BOOKS

[1] Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
[2] Michael F. Ashby Materials and the Environment, Elsevier, 2009.
[3] Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
[4] Mili M. Ajumdar (Ed) Energy Efficient Building in India. Teri and Mnes, 2001/2002.
[5] T. N. Seshadri et al Climatological and Solar Data for India. CBRI and SaritaPrakashan, 1968. 34
[6] Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

[7] The New Solar Electric Home: The Photovoltaics How-To Handbook, by Joel Davidson, ISBN: 9780937948095, Publisher: Aatec Publications, Publication Date: July 1987.

BRANCH-CIVIL ENGINEERING

Specialization: Soil Mechanics and Foundation Engineering/Soil Mechanics

Second Semester							
	Theory				**Practical**		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Advanced Soil Mechanics	4-0	4	100	50	-	-	-
Specialization Core-2 Ground Improvement Technique	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Stability Analysis of Slopes, embankments & Dams 2.Ground Water & Flow Through Porous Media 3.Earth Retaining structure 4.Earthquake Geotechnical Engineering	4-0	4	100	50	-	-	-
Elective II (Departmental related) 1.Subsoil Exploration & Soil Testing 2. Dynamics of Soils & Foundation 3.Strength & Deformation Behavior of Soil 4.Optimization Methods & its Application in Civil Engineering	4-0	4	100	50	-	-	-
Elective III (from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

ADVANCED SOIL MECHANICS

Module I

Introduction: Origin of soil and its types, mineralogy and structure of clay minerals, X-ray and Differential Thermal Analysis; structure of coarse grained soil, behavior of granular and cohesive soils with respect to their water content

Module II

Consolidation: Steady State flow, 2D and 3D seepage, transient flow; Compressibility and rate of consolidation, one, two, and three dimensional consolidation theories; Sand drains

Module III

Critical state soil mechanics: Critical State Line, Hvorslev Surface, Yield Surfaces: Modified Cam-clay and Original Cam-clay; Elastic and plastic analysis of soil:- Constitutive relationships of soil; failure theories. Limit analysis-Upper bound theorems, lower bound theorems, limit equilibrium methods

Module IV

Soil Stabilization: Classification of stabilizing agents and stabilization processes. Nature and surface characteristics of soil particles. Concepts of surface area and contact points. Inorganic stabilizing agents. Strength improvement characteristic of soft and sensitive clay, Marine clay and waste material.

References:

1. B M Das, Advanced Soil Mechanics, Taylor and Francis
2. R F Scott, Principles of Soil Mechanics, Addison & Wesley.

GROUND IMPROVEMENT TECHNIQUES

Module I

Principles of ground improvement. Mechanical modification, properties of compacted soil, compaction control tests.

Module II

Hydraulic modification, dewatering systems, filtration, drainage and seepage control with geosynthetics, preloading and vertical drains, Electri-kinetic dewatering, chemical modification.

Module III

Modification by admixtures, stabilization using industrial wastes, grouting, modification by inclusion and confinement, soil reinforcement, flexible geosysthetic sheet reinforcement, anchorage.

Module IV

Reinforcement techniques, bearing capacity improvement, slope stability, retaining walls and pavements.

References

1. Hausmann, M.R., Engineering Principles of Ground Modification, McGraw Hill,1990.
2. Jones, C.J.E.P., Reinforcement and Soil Structures, ButterworthPublications, 1996.
3. Koerner, R.M., Designing with Geosynthetics, Prentice Hall Inc. 1998.

STABILITY ANALYSIS OF SLOPES, EMBANKMENTS AND DAMS

Module I

Landslide phenomenon: Types and causes of slope failures, Practical applications; Stability analysis of infinite slopes with or without water pressures

Module II

Stability analysis of finite and infinite slopes: concept of factor of safety, pore pressure coefficients, Mass analysis, Wedge methods, friction circle method; Method of slices, Bishop's method, Janbu's method

Module III

Effect of seepage, submerged and sudden draw down conditions; Design of slopes in cutting, Embankments and Earth dams

Module IV

Site Investigation: Reconnaissance, Preliminary and detailed investigation, Investigation for foundations ; Advances in stability analysis of slopes.

Text Books:

1. L. W Abramson, T. S Lee, S Sharma and G M Boyce, Slope Stability and Stabilization Methods, Willey Interscience publications
2. B M Das, Principles of Geotechnical Engineering, Thomson Brooks/Cole

Reference Books:

1. T W. Lambe and R V Whitman, Soil Mechanics, John Wiley & sons
2. V N S Murthy, Principles of Soil Mechanics and Foundation Engineering, UBS Publishers Private Ltd.

GROUND WATER AND FLOW THROUGH POROUS MEDIA

Module I

Soil Water: Modes of occurrence of water in soils. Adsorbed water, capillary water, Capillary potential, capillary tension and soil suction.

Module II

Effective and Neutral pressures in soil; Flow through porous Media: Darcy's law and measurement of permeability in laboratory and field.

Module III

Steady State flow solutions of Laplace's equation, Plane problems, 3-dimensional problems, Partial cut-offs, uplift pressure, consolidation theory –one and three dimensional consolidation .

Module IV

Secondary consolidation; Ground water Hydraulics: Water table in regular materials, Geophysical exploration for locating water table. Confined water, Equilibrium conditions, Non-equilibrium conditions, Water withdrawal from streams, Method of ground water imaging.

Text Books:

1. D.K.Todd, Groundwater Hydrology, John wiley and Sons
2. H.M. Raghunath, Ground Water, Willy Eastern Ltd.

Reference Books:

1. C. Fitts, Ground Water Science, Elsevier Publications, U. S. A.
2. P. P. Raj, Geotechnical Engineering, Tata McGraw-Hill

EARTH RETAINING STRUCTURES

Module I

Earth Pressure: Fundamental relationships between the lateral pressures and the strain with a back fill. Rankine and Coulomb theories, Active, passive and pressure at rest; Backfill with broken surface, wall with broken back, concentrated surcharge above the back fill, earth pressure due to uniform surcharge, earth pressure of stratified backfills, saturated and partially saturated backfill. Passive earth pressure in engineering practice. Assumption and conditions, point of application of passive earth pressures

Module II

Bulkheads: Definition and assumptions, conditions of end supports and distribution of active earth pressure and bulkheads, bulkheads with free and fixed earth supports, equivalent beam method, Improvements suggested by Rowe, Tschebotarioff's method, Anchorage of bulkheads and resistance of anchor walls, spacing between bulkheads and anchor walls, resistance of anchor plates, Consideration of effects of ground water, seepage, surcharge loading together with possibility of shallow and deep sliding failures on retaining structure

Module III

Sheet Pile wall: Free earth system, fixed earth system, Dead man ; Tunnel and Conduit: Stress distribution around tunnels, Types of conduits, Load on projecting conduits

Module IV

Arching and Open Cuts: Arching in soils, Braced excavations, Earth pressure against bracings in cuts, Heave of the bottom of cut in soft clays; Reinforced earth retaining structures- Design of earth embankments and slopes ; Recent advances in Earth retaining structures.

Text Books:

1. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.
2. J. Bowel, Foundation Engineering , Analysis and Design. McGrwHill

Reference Books:

1. P. Raj, Geotechnical Engineering, Tata McGraw Hill
2. R F Craig, Soil Mechanics, Chapman and Hall (ELBS)

EARTHQUAKE GEOTECHNICAL ENGINEERING

Module I

Earthquakes: Causes and characteristics (magnitude, intensity, accelarograms), response spectra, attenuation of ground motion. Estimation of seismic hazards (deterministic and probabilistic); Introduction to vibratory motion: Waves in Elastic Medium

Module II

Dynamics of Discrete: Systems, Vibration of single and multiple degree of freedom systems. Free and forced vibrations (regular and irregular excitation)

Module III

Dynamic properties of soils: Determination of site characteristics, local geology and soil condition, site investigation and soil test, Laboratory and in-situ tests; Site response to earthquake. Seismic Microzonation; Liquefaction of soils: Fundamental concept of liquefaction, assessment of liquefaction susceptibly from SPT and CPT

Module IV

Seismic response of soil structure system, seismic bearing capacity of shallow foundation, design of pile foundation in liquefiable ground. Pseudo-static analysis and design of earth retaining structures and soil slopes. Estimation of earthquake-induced deformation.

Text Books:

1. S.L. Kramer, Geotechnical Earthquake Engineering, Pentice Hall, international series, Pearson Education (Singapore) Pvt. Ltd., 2004.
2. S.Saran, Soil Dynamics and Machine Foundation, Galgotia publications Pvt. Ltd., New Delhi 1999.

Reference Books:

1. A. Ansal, Recent Advances in Earthquake Geotechnical Engineering and Microzonation, Springer, 2006.
2. I. Towhata, Geotechnical Earthquake Engineering, Springer, 2008.

Subsoil Exploration & Soil Testing

Module-I

Problems and phases of foundation investigations: Geophysical sounding, drilling and accessible explorations.

Module-II

Sample requirements, sampling methods and equipment. Handling, preservation and transportation of samples.

Module-III

Sample preparation, laboratory tests, analysis of results and interpretation, importance of in-situ testing.

Module-IV

Performing various in-situ tests. Precautions and interpretation, site evaluation and reporting, block vibration test.

References:

1. Head, K.H., Manual of Soil Laboratory Testing, Vols. 1 to 3, 1981.

2. Compendium of Indian Standards on Soil Engineering, Parts 1 and II, 1987– 1988.

DYNAMICS OF SOILS AND FOUNDATIONS

Module I

Vibration of elementary systems, Analysis of systems with Single degree and multi-degree of freedom. Natural frequencies of continuous systems

Module II

Elastic Constants of soil and their experimental determination. Effect of vibration on soil properties; Bearing capacity of dynamically loaded foundations

Module III

Principles of Machine foundation design, Experimental and analytical determination of design parameters

Module IV

Design of foundations for turbines, vertical and horizontal reciprocating engines, forge hammers, Effect of machine foundation on adjoining structures, vibration isolation.

Text Books:

1. S. Saran, Soil Dynamics and Machine Foundations, Galgotia Publications Private Ltd.1999
2. N. S. V. Kameswara Rao, Vibration Analysis and Foundation Dynamics, Wiley New Delhi, 1998

Reference Books:

1. B M Das, Principles of Soil Dynamics, Thomsons Engineering, 1992
2. K.G. Bhatia, Foundations For Industrial Machines, D-CAD Publishers, 2008
3. A Major, Vibration Analysis and Design of Foundations for Machines and Turbines: Dynamical Problems in Civil Engineering, AkademiaiKiado Budapest Collets Holding Ltd., 1962

STRENGTH AND DEFORMATION BEHAVIOUR OF SOIL

Module I

Introduction: Physico-Chemical aspects, Failure theories, Yield criteria, Elastic and Plastic analysis of soil, Mohr's diagram. ;

Module II

Stresses in Soil: Description of state of stress and strain at a point, stress distribution problems in elastic half pace. Boussinessqu, WestergardMindlin and Kelvin problems. Distribution of contact pressure.

Module III

Analysis of Elastic settlement. ; Soil Plasticity.;
Shear Strength of Soils: Experimental determination of shear strength, Types of tests based on drainage conditions and their practical significance, Skempton's and Henkel's pore water pressure coefficients, Stress path, Shear strength of unsaturated soils, Row's stress dilatancy theory.

Module IV

Constitutive Models: Constitutive Models in Soil Mechanics: Isotropic Elastic, Anisotropic Plasticity and Viscous Models. Representing Soil Behaviour using these Models. ; Advances in Constitutive models.

Text Books:

1. A.P.S. Selvadurai, Plasticity&Geomechanics, Cambridge University Press, 2002
2. W.F. Chen, Limit Analysis & Soil Plasticity, Elsevier Scientific, 1975.

Reference Books:

1. C. S. Desai and J. T. Christian, Numerical Methods in Geotechnical Engineering, McGrew Hill, New York.
2. R. F. Scott, Principles of Soil Mechanics, Addison & Wesley

OPTIMIZATION METHODS AND ITS APPLICATIONS IN CIVIL ENGINEERING

Module I

Introduction: Need for engineering optimal design, Optimum design formulation: Design variable, objective function and constraints; unconstrained optimization methods Single variable optimization methods: Region elimination method – Golden Section search, Interval halving method; Gradient based method – Newton-Raphson, bisection and secant method.

Module II

Multi variable optimization methods: Direct search method: Hooke-Jeeves pattern search, simplex reflection search, Powell's conjugate direction search. Gradient Based methods: Cauchy's steeped descent, Newton's method, Levenberg Marquardt's method, Fletcher- Reeve method; constrained optimization methods Kuhn Tucker condition, Penalty function method, Augmented Lagrangian method, sequential unconstrained minimization, cutting plane method;

Module III

Introduction to Evolutionary algorithms: Need for evolutionary algorithms, Type of evolutionary methods, Introduction to Genetic algorithm (GA), Difference and similarities between GA and traditional methods. Basic operations of GA: reproduction, crossover, mutation and elitism. Binary coded and real coded GA;

Module IV

Application of Optimization techniques: Water resource planning management, Structural Optimization, Transportation planning and Management, Slope stability and optimal dimensioning of foundations. Multi-objective optimization models.

References

1. J.S. Arora, Introduction to Optimum Design, Elsevier, 2nd Edition, 2004.
2. K. Deb, Optimization for Engineering. Design: Algorithms & Examples, Prentice Hall India, 2006
3. S.S. Rao, Engineering Optimization: Theory & Practice, New Age International (P) Ltd, 3rd Edition, 1996, Reprint: June, 2008
4. K. Deb, Multi-Objective Optimization Using Evolutionary Algorithms, John Wiley, 2003

COMPOSITE STRUCTURES

Module I:

Introduction: definition and characteristics, fibres, matrices, fibre reinforced composites, advantages and limitations, basic concepts and characteristics: isotropy, orthotropic, classification, lamina and laminate, micromechanics and micromechanics, constituent materials and properties.

Module II:

Elastic behaviour of unidirectional lamina: specially orthotropic and transversely isotropic material, relation between mathematical and engineering constants, stress strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, transformation of stress-strain relations in terms of engineering constants.

Module III:

Elastic behaviour of multidirectional laminates, symmetric and balanced laminates, design considerations, computational procedure for finding engineering elastic properties, stress and failure analysis of multidirectional laminates.

Module IV:

Bending of laminated composite plates, thin laminated plate theory, deflection of all edges simply supported rectangular symmetric cross-ply laminate, two opposite edges simply supported.

Books:

1. I.M. Daniel & O. Ishai, “Engineering Mechanics of Composite Materials", Oxford Press
2. S.W.Tsai&H.T.Hahn, "Introduction to Composite Materials: Techonomic Pub. Co.INC, USA.
3. P.K.Sinha,"A short term course on Composite Materials and Structures"-1996

HYDRO POWER ENGINEERING

Module I:

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Module II:

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Module III:

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels. Turbines: Introduction, types of turbines, hydraulic features, turbine size, constructional features of turbines, layout arrangements, hydraulic of turbines, basic flow equations, draft tubes, cavitations in turbines, governing of turbines, characteristics of turbines, illustrative examples.

Module IV:

Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house. Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house. Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

References:

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books
2. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
3. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal (Laxmi Publications Private Limited)

NON-CONVENTIONAL ENERGY

Module I

Introduction various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

Module II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

Module III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

Module IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.
Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

References Books:

1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.
2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.
4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International. 5.
C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.

ADVANCED NUMERICAL METHODS

Module I:

Introduction to digital computers & Programming - an overview; Errors - polynomial approximations and interpolations - Numerical differentiation & Integration;

Module II:

Evaluation of single and multiple integrals, Newton's method, variational and weightened residual methods. Matrices – Linear equations, Eigenvalues and Eigenvectors - nonlinear equations,

Module III:

Harmonic and biharmonic equations - solutions, convergence, completeness & stability.

Module IV:

Initial and boundary value problems of finite difference method, Implicit & Explicit scheme.

Referrences

1. Jain M.K, SRK Iyenge and RK Jain."Numerical Methods for Scientific & Engg.Computation".
2. Mathews J. H "Numerical Methods for Mathematics, Science and Engineering".
3. Gerld C.F and PO Wheatley "Applied Numerical Analysis".
4. Gupta S.C and V. K. Kapoor "Fundamentals of Applied Statistic", Sultan Chand & Sons.
5. Johnson R.A " Probability and Statistics for Mngineers.
6. Rajeshwaran S, "Numerical Methods in Science & Engineering (A Practical Approach)",Willey Publication.

Green Building Concepts

Module I

Environmental implications of buildings energy, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transporation Energy for Building Materials; Maintenance Energy for Buildings.

Module II

Implications of Building Technologies Embodied Energy of Buildings: Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

Module III

Comforts in Building: Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

Module IV

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Unit V Green Composites for buildings: Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

TEXT BOOKS

[1] K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
[2] Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
[3] Green My Home!: 10 Steps to Lowering Energy Costs and Reducing Your Carbon Footprint, by Dennis C. Brewer, ISBN:9781427798411, Publisher: Kaplan Publishing, Publication Date: October 2008.
[4] B. Givoni, Man, Climate and Architecture Elsevier, 1969.
[5] T. A. Markus and E. N. Morris Buildings Climate and Energy. Pitman, London, 1980. Arvind Kishan et al (Ed)
[6] Climate Responsive Architecture. TataMcGraw Hill, 2001.
[7] Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.
[8] O. H. Koenigs Berger, T. G. Ingersoll, Alan Mayhew and S. V. Szokolay. Manual of Tropical Housing and Building. Orient Long man, 1975.

REFERENCE BOOKS

[1] Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
[2] Michael F. Ashby Materials and the Environment, Elsevier, 2009.
[3] Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
[4] Mili M. Ajumdar (Ed) Energy Efficient Building in India. Teri and Mnes, 2001/2002.
[5] T. N. Seshadri et al Climatological and Solar Data for India. CBRI and SaritaPrakashan, 1968. 34
[6] Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

[7] The New Solar Electric Home: The Photovoltaics How-To Handbook, by Joel Davidson, ISBN: 9780937948095, Publisher: Aatec Publications, Publication Date: July 1987.

BRANCH-CIVIL ENGINEERING

Specialization: Structural Engineering/ Structural and Foundation Engineering

Second Semester							
	Theory				Practical		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Advanced Reinforced Concrete Design	4-0	4	100	50	-	-	-
Specialization Core-2 Matrix Methods of Analysis of Structure	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Structural Dynamics 2.Advanced Steel Structure 3. Bridge Engineering 4.Earthquake Resistance Design of Structure	4-0	4	100	50	-	-	-
Elective II (Departmental related) 1.Advance Construction Materials 2. Offshore Engineering 3. Tall Structures 4.Optimization Methods & its Application in Civil Engineering	4-0	4	100	50	-	-	-
Elective III(from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

ADVANCED REINFORCED CONCRETE DESIGN

Module I:
Limit state design concepts in flexure, shear, torsion and combined stresses. Slender column

Module II:
Safety and serviceability, control of cracks and deflections.

Module III:
Yield line theory analysis of slabs, work and equilibrium methods.

Module IV:
Introduction to limit design of beams and frames. General principles and philosophies of design with special references to the codal provisions. Serviceability and stability requirements.

Books:

1) Park & Paunlay,"Reinforced Concrete Structures".
2) Ramakrishna & Arthur,"Ultimate strength design for structural concrete".
3) B.I.S. Codes

MATRIX METHODS OF ANALYSIS OF STRUCTURES

Module I:
Introduction, equilibrium, static and kinematic indeterminacy, kinematics, virtual work, concepts of stiffness and flexibility, analysis by displacement and force methods.

Module II:
Application of flexibility method to beams and plane trusses.

Module III:
Application of stiffness method to beams, plane frames and plane trusses.

Module IV:
Application of stiffness method to space truss, space frames and grids, basic concepts associated with computer implementation of stiffness method.

Books:

1. H.C.Martin," Introduction to Matrix Methods of Structural Analysis.
2. M.B.Kanchi, "Matrix Methods of Structural Analysis", New Age International Publishers, New Delhi Kardestuncer ,
3. "Elementary Matrix Analysis of Structures" Gere & Weaver,"Matrix Structural Analysis'

STRUCTURAL DYNAMICS

Module I:

Oscillatory motion; harmonic motion, periodic motion, vibration terminology,Free vibration; equations of motion-natural frequency, energy method, principle of virtual work, viscously damped free vibration, Coulomb damping, Harmonically excited vibration; forced harmonic vibration, energy dissipated by damping, equivalent viscous damping, structural damping, vibration measuring instruments

Module II:

Transient vibration; impulse excitation, arbitrary excitation, Laplace transform formulation, response spectrum, Introduction to multi degree of freedom systems; normal mode vibration, forced harmonic vibration, vibration absorber, vibration damper.

Module III:

Properties of vibrating systems, flexibility matrix, stiffness matrix, stiffness to beam elements, eigen values and eigen vectors, modal matrix, modal damping in forced vibration, normal mode summation, normal mode vibration of continuous beams, vibrating string, longitudinal vibration of rods, torsional vibration of rods, Euler equation for beam, effect of rotary inertia and shear deformation.

Module IV:

Random vibrations, random phenomena, time averaging and expected value, frequency response function.

Books:

W.T.Thomson, "Theory of Vibration with Applications" (2) R.W. Clough & J.Penzien, " Dynamics of Structures", McGraw Hill

ADVANCED STEEL STRUCTURE

Module I:

Properties of steel: mechanical properties, hysteresis, ductility; Hot-Rolled Sections: compactness and non-compactness, slenderness, residual stresses; Design of steel structures:

Module II:

Inelastic bending – curvature, plastic moments, design criteria - stability , strength, drift; Stability criteria: stability of beams - local buckling of compression flange & web, lateral-torsional buckling,

Module III:

Stability of columns - slenderness ratio of columns, local buckling of flanges and web, bracing of column about weak axis, method of design - allowable stress design, plastic design, load and resistance factor design; Strength Criteria: beams – flexure, shear, torsion, columns - moment magnification factor, effective length, P-M interaction, bi-axial bending, joint panel zones; Drift criteria: P-Δ effect,

Module IV:

Deformation-based design; Connections: types – welded, bolted, location - beam-column, column-foundation, splices.

TALL STRUCTURES

Module I:

Structural systems and concepts. Matrix and approximate methods, analysis of tall building frames, lateral load analysis, multi bay frames, gravity loads, settlement of foundation.

Module II:

Foundation-superstructure interaction. Earthquake effects and design for ductility. Analysis of shear walls - plane shear walls, infilled frames, coupled frames, frames with shear walls.

Module III:

Principle of three dimensional analysis of tall buildings; Perforated cores, pure torsion in thin tubes, bending and warping of perforated cores.

Module IV:

Analysis of floor system in tall buildings, Vierendal girders, diagrid floors, elastic stability of frames and shear walls. Analysis of thermal stresses.

Reference Books:

1. Tall buildings - B. S. Taranath:
2. Handbook of Concrete Structures - Mark Fintel
3. Tall buildings - Coull and Smith
4. Design of Multi-storeyed structures - U. H. Variani
5. Tall Chimneys: Design & Construction - S. N. Manohar
6. Transmission Line Structures - Santhakumar & Murthy
7. IS:6533 (Part 2) –Code of Practice for Design and Construction of Steel Chimney
8. IS:4998 (Part 1)- Criteria for Design of Reinforced Concrete Chimneys

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Module I:

Characteristics of earthquakes; Earthquake response of structures; Seismology, seismic risk and hazard, Soil dynamics and seismic inputs to structures, Characterization of ground motion; lateral load calculation, base shear

Module II:

Earthquake intensity and magnitude; Recording instruments and base line correction; Predominant period and amplification through soil; Response spectrum, analysis, Spectral analysis,

Module III:

Idealization of structural systems for low, medium and high rise buildings; Nonlinear and push over analysis, Dynamic soil-structure interaction. Earthquake design philosophy,

Module IV:

Concept of earthquake resistant design; Code provisions of design of buildings; Reinforcement detailing for members and joints, retrofitting and strengthening of structures, concept of base isolation design and structural control.

Text Book:

1. Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2nd edition, 1992
2. Earthquake Resistant Design: Shrikhandee & Agarwal-PHI Publ
3. Newmark N.M. and Rosenblueth E., 'Fundamentals of Earthquake Engg.', Prentice Hall, 1971.
4. David Key, 'Earthquake Design Practice for Buildings', Thomas Telford, London, 1988.
5. Wiegel R.L., 'Earthquake Engg.', Prentice Hall, 1970.
6. Blume J.A., Newmark N.M., Corning L.H., 'Design of Multi-storied Buildings for Earthquake ground motions', Portland Cement Association, Chicago, 1961.
7. Proc. World Conferences on Earthquake Engg., 1956-1992.
8. I.S. Codes No. 1893, 4326, 13920 etc.

ADVANCED CONSTRUCTION MATERIALS

Module I:

Fresh concrete and its rheology. Mechanical, deformational behavior and microstructure of hardened concrete. Creep and shrinkage. Testing of concrete. mix design and properties of concrete; High strength concrete; High density and lightweight concretes; admixtures

Module II:

Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concreting under extreme weather conditions, High strength concrete. Changes in concrete with time, Corrosion of concrete in various environments. Corrosion of reinforcing steel. Ferro-cement, material and properties.

Module III:

Foams and light weight materials, fibrereinforced concrete. Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete. Polymers in Civil Engineering, Polymers, fibres and composites,

Module IV:

Fibre reinforced plastic in sandwich panels, modeling. Architectural use and aesthetics of composties. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building, Polymer concrete composites.

Books:

1. Neville A.M., 'Properties of concrete', 3rd ed., 1985, ELBS Lea F.M.,
2. 'Chemistry of cement and concrete', 3rd ed., 1970, Edward Arnold Proceedings of recent seminars etc. and journals.

OFFSHORE STRUCTURES

Module I:

Design of offshore platforms : Introduction, fixed and floating platforms. case studies and general features-elements of hydrodynamics and wave theory-fluid structure interaction, Steel, concrete and hybrid platforms.

Module II:

Design criteria. Environmental loading. Wind, wave and current loads after installation. Stability during towing. Foundations : Site investigations. Piled foundation. Foundations for gravity structures.

Module III:

Behaviour under dynamic loading. Static and dynamic analysis of platforms and components.

Module IV:

Dynamic response in deterministic and in deterministic environment, codes of practice, analysis of fixed platform and semisubmersible related topics.

References:

1. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.

2. --American Petroleum Institute, API RP-2A, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms.

3. McClelland, B & Reifel, M. D., Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986. 4. Graff, W. J., Introduction to Offshore Structures, Gulf Publ. Co.1981

5. Reddy, D. V and Arockiasamy, M., Offshore Structures Vol. 1& 2, Kreiger Publ. Co.1991.

6. Morgan, N., Marine Technology Reference Book, Butterworths, 1990.

BRIDGE ENGINEERING

Module I:

Introduction and selection of type of bridges, longitudinal arrangement and economical span, bridge components, Design preliminaries: Layout, types of loads including wind and seismic loads, standard specifications for road bridges, substructures, superstructures, IRC provisions on loads and stresses, specification for single/double multi lane railway and road bridges, Abutments, piers and their foundations .

Module II:

Design of reinforced concrete slab culvert, box culvert bridge.

Module III:

Tee beam and slab bridge deck, design of prestressed concrete bridge.

Module IV:

Design of balanced cantilever bridge, design of continuous bridge, Introduction to long span bridges.

Books:

1) N.K.Raju, " Design of bridges", Oxford & IBH Publishing Co. pvt. ltd. D.J.Victor, " Essentials of bridge engineering", Oxford &IBH Publishing Co. pvt. ltd. Indian Road Congress Codes No.5,6,18,21,24, Jamnagar House, Shah Jahan Road, New Delhi.

STRUCTURAL OPTIMISATION

Module I:

Formulation of different types of structural optimization problems; Optimality criteria based structural optimizations;

Module II:

Computation of derivatives of response quantities w.r.t. design variables; Classical optimization;

Module III:

Lagrange multiplier technique and Kuhn-Tucker conditions;

Module IV:

Solution of NLP by direct methods and by series of unconstrained optimization problems and by series of linear programming problems.

Books:

1. S.S. Rao, Optimization, Theory and Applications, 2nd Edition, Wiley Eastern Ltd., New Delhi, 1991.
2. J.S. Arora, Introduction to Optimum Design, McGraw-Hill Book Company, New York, 1989.
3. A.J. Morris (Editor), Foundations of Structural Optimization - A Unified Approach; John Wiley and Sons, Chichester, 1982.

COMPOSITE STRUCTURES

Module I:

Introduction: definition and characteristics, fibres, matrices, fibre reinforced composites, advantages and limitations, basic concepts and characteristics: isotropy, orthotropic, classification, lamina and laminate, micromechanics and micromechanics, constituent materials and properties.

Module II:

Elastic behaviour of unidirectional lamina: specially orthotropic and transversely isotropic material, relation between mathematical and engineering constants, stress strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, transformation of stress-strain relations in terms of engineering constants.

Module III:

Elastic behaviour of multidirectional laminates, symmetric and balanced laminates, design considerations, computational procedure for finding engineering elastic properties, stress and failure analysis of multidirectional laminates.

Module IV:

Bending of laminated composite plates, thin laminated plate theory, deflection of all edges simply supported rectangular symmetric cross-ply laminate, two opposite edges simply supported.

Books:

1. I.M. Daniel & O. Ishai, “Engineering Mechanics of Composite Materials", Oxford Press
2. S.W.Tsai & H.T.Hahn, "Introduction to Composite Materials: Techonomic Pub. Co.INC, USA.
3. P.K.Sinha,"A short term course on Composite Materials and Structures"-1996

HYDRO POWER ENGINEERING

Module I:

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Module II:

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Module III:

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels. Turbines: Introduction, types of turbines, hydraulic features, turbine size, constructional features of turbines, layout arrangements, hydraulic of turbines, basic flow equations, draft tubes, cavitations in turbines, governing of turbines, characteristics of turbines, illustrative examples.

Module IV:

Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house. Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house. Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

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2. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
3. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal (Laxmi Publications Private Limited)

NON-CONVENTIONAL ENERGY

Module I

Introduction various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

Module II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

Module III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

Module IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.
Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

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1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.
2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.
4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International. 5.
C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.

ADVANCED NUMERICAL METHODS

Module I:

Introduction to digital computers & Programming - an overview; Errors - polynomial approximations and interpolations - Numerical differentiation & Integration;

Module II:

Evaluation of single and multiple integrals, Newton's method, variational and weightened residual methods. Matrices – Linear equations, Eigenvalues and Eigenvectors - nonlinear equations,

Module III:

Harmonic and biharmonic equations - solutions, convergence, completeness & stability.

Module IV:

Initial and boundary value problems of finite difference method, Implicit & Explicit scheme.

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1. Jain M.K, SRK Iyenge and RK Jain."Numerical Methods for Scientific & Engg.Computation".
2. Mathews J. H "Numerical Methods for Mathematics, Science and Engineering".
3. Gerld C.F and PO Wheatley "Applied Numerical Analysis".
4. Gupta S.C and V. K. Kapoor "Fundamentals of Applied Statistic", Sultan Chand & Sons.
5. Johnson R.A " Probability and Statistics for Mngineers.
6. Rajeshwaran S, "Numerical Methods in Science & Engineering (A Practical Approach)",Willey Publication.

Green Building Concepts

Module I

Environmental implications of buildings energy, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transporation Energy for Building Materials; Maintenance Energy for Buildings.

Module II

Implications of Building Technologies Embodied Energy of Buildings: Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

Module III

Comforts in Building: Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

Module IV

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Unit V Green Composites for buildings: Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

TEXT BOOKS

[1] K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
[2] Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
[3] Green My Home!: 10 Steps to Lowering Energy Costs and Reducing Your Carbon Footprint, by Dennis C. Brewer, ISBN:9781427798411, Publisher: Kaplan Publishing, Publication Date: October 2008.
[4] B. Givoni, Man, Climate and Architecture Elsevier, 1969.
[5] T. A. Markus and E. N. Morris Buildings Climate and Energy. Pitman, London, 1980. Arvind Kishan et al (Ed)
[6] Climate Responsive Architecture. TataMcGraw Hill, 2001.
[7] Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.
[8] O. H. Koenigs Berger, T. G. Ingersoll, Alan Mayhew and S. V. Szokolay. Manual of Tropical Housing and Building. Orient Long man, 1975.

REFERENCE BOOKS

[1] Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
[2] Michael F. Ashby Materials and the Environment, Elsevier, 2009.
[3] Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
[4] Mili M. Ajumdar (Ed) Energy Efficient Building in India. Teri and Mnes, 2001/2002.
[5] T. N. Seshadri et al Climatological and Solar Data for India. CBRI and Sarita Prakashan, 1968. 34
[6] Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

[7] The New Solar Electric Home: The Photovoltaics How-To Handbook, by Joel Davidson, ISBN: 9780937948095, Publisher: Aatec Publications, Publication Date: July 1987.

BRANCH-CIVIL ENGINEERING

Specialization: Transportation Engineering

Second Semester							
Theory					**Practical**		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Geometric Design of Highways	4-0	4	100	50	-	-	-
Specialization Core-2 Transportation Systems Planning	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Advanced Railway Engineering 2.Planing & Design of Airport 3. Bridge Engineering 4.Ground Improvement Engineering	4-0	4	100	50	-	-	-
Elective II(Departmental related) 1.Advance Construction Materials 2. Mass Transit Systems 3. Traffic Engineering & Traffic Flow Theory 4.Transportation & Environment	4-0	4	100	50	-	-	-
Elective III(from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

GEOMETRIC DESIGN OF HIGHWAYS

Highway capacities and speeds on rural and urban roads, Special aspects of horizontal and vertical alignments, Interrelationships between geometric elements in rural and urban roads, Variations in geometric standards between plains and hilly regions, Special curves, Design aspects of intersections and grade separations, Traffic rotaries, Flyovers and cloverleaf junctions.

Essential Reading:

1. C. S. Papacostas, P. D. Prevedouros, *Transportation Engineering and Planning*, PHI Publication, 3rd edition , 2002

2. L.R. Kadiyalli, *Traffic Engineering and Transport Planning*, Khanna Publishers, 7th edition, 2008.

Supplementary Reading:

1. P.H. Wright, K.K. Dixon, *Highway Engineering*, John Willey, 2004

2. C.J. Khisty and B. Lall, *Transportation Engineering*, PHI Publication, 3 ed., 2006 Relevant IRC and other Codes and specifications

3. J.G. Schoon, *Geometric Design Projects for Highways: An Introduction, American Society of Civil Engineers* (ASCE Press), 2nd Edition, 2002

TRANSPORTATION SYSTEMS PLANNING

Brief Description of urban and regional transportation systems, Definition of a system ; System analysis: scope and limitations, Transportation planning based upon system analysis, Survey and analysis of existing conditions, Models for trip generation, trip distribution, traffic assignment and modal split ; Analysis of future conditions, Plan synthesis and evaluation.

Essential Reading:

1. L.R. Kadiyalli, Traffic Engineering and Transport Planning, Khanna Publishers, 7th edition, 2008

2. C. S. Papacostas, P. D. Prevedouros, Transportation Engineering and Planning, PHI Publication, 3rd edition , 2002.

Supplementary Reading:

1. M.J. Bruton, Introduction to Transportation Planning (Built Environment), Routledge, 1992.

2. J.D. Fricker and R. K. Whitford, Fundamentals of Transportation Engineering: A Multimodal System Approach, Pearson Education, PH, 2005

3. Ortuzar & Willumsen, Modeling Transport, John Wiley, 1990

ADVANCED RAILWAY ENGINEERING

Track and track stresses, Train resistances and hauling power of locomotives ; Railway track components: Important features, Railway curves, Superelevation, Gradients and grade compensation, Points and crossing and their design approaches. ; Construction and maintenance of railway track, Control of train movements; Signals and interlocking, Modernisation of railways and future trends; Track standards and track rehabilitation.

Essential Reading:

1. J.S. Mundrey, Railway Track Engineering, Tata McGraw Hill Co. Ltd., 3rd Edition, 2000.

2. M.M. Agarwal, Railway Track Engineering, Standard Publishers, 1st Ed. 2005.

Supplementary Reading:

1. S. Chandra and Aqarwal, Railway Engineering, Oxford University Press, 1st Ed. Feb 2008.

2. A.D. Kerr, Fundamentals of Railway Track Engineering, Simmons Boardman Pub Co (December 30, 2003)

PLANNING AND DESIGN OF AIRPORTS

Classification of airports- ICAO standards ; Planning for airport- Airport components- Zoning laws ; Runways- orientation and geometric design- Runway patterns ; Taxiways- alignment- geometry and turning radius- exit taxiways ; Aprons- planning and design ; Design principles of critical, semi-critical, non-critical airport pavements- FAA and PCA methods ; Airport hangars- their planning and design criteria ; Airport landscaping, grading and drainage- general aspects ; Airport terminal and amenities ; Airport lighting and marking.

Essential Reading:

1. N.J. Ashford, P.H. Wright, Airport Engineering, 3rd Edition, 1992, John Wiley

2. R.M. Horonjeff, F.X. Mc Kelvey, W.J Sproule, Seth Young, Planning and Design of Airports, TMH International Publishers, Fifth Edition, 2009

Supplementary Reading:

1. Khanna, Arora and Jain, Planning and Design of Airports, Nemchand Bros., 2001

2. Wells, Alexander; Young, Seth, Airport Planning & Management, McGraw Hill,5th Edition, July,2009

3. De N. Richard, & Odoni, Airport Systems: Planning, Design, and Management, McGraw Hill Amedeo, 1st Edition, 2004.

BRIDGE ENGINEERING

Introduction, historical review, engineering and aesthetic requirements in bridge design. Introduction to bridge codes. Economic evaluation of a bridge project. Site investigation and planning;. Scour - factors affecting and evaluation. Bridge foundations - open, pile, well and caisson. Piers, abutments and approach structures; Superstructure - analysis and design of right, skew and curved slabs. Girder bridges - types, load distribution, design. Orthotropic plate analysis of bridge decks. Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges. Methods of construction of R.C Bridges, Prestressed concrete bridges and steel bridges Fabrication, Lounching & creation. Design and construction of construction joints (use of relevant codes of practice are permitted in the examination).

Essential Reading:

1. V. K. Raina, Concrete Bridges Practice – Analysis, Design and Economics, Shroff Publications, New Delhi 2nd Ed. 2005.

2. Vazirani, Ratwani and Aswani, Design of Concrete Bridges, Khanna Publishers , 2nd Ed. 2008.

Supplementary Reading:

1. IRC codes for Road bridges- IRS Sec –I , II, III

2. IRS Codes of Practice for Railway bridges.

3. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.

Ground Improvement Engineering

Module I

Introduction, typical situations where ground improvement becomes necessary, historical review of methods adopted in practice, current status and the scope in the Indian context.

Module II

Methods of ground improvement, mechanical compaction, dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, dynamic consolidation, design aspects of stone columns, use of admixtures, injection of grouts, design guidelines and quality control, design examples on preloading with sand drains, road designs with geo-synthetics.

Module III

Reinforced earth, basic mechanism, constituent materials and their selection; engineering applications – shallow foundations on reinforced earth, design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth.

Module IV

Geotextiles, selection and engineering applications, design examples, stabilisation/improvement of ground using geomembranes, geocells, geonets, geosynthetic walls.
Soil nailing, construction of underground structures, landslide controls, deep vertical cuts, contiguous piles.
Problematic soils, use of ply soils, improvement of saline soils, improvement of black cotton soils.

References:

1) Moseley, M. P. and Kirsch K.,"Ground Improvement", Spon press.
2) Mittal, Satyendra, "Ground Improvement Engineering", Vikas publishing house
3) Koerner, R.M., "Designing with Geosynthetics"' Prentice hall.
4) Saran, S., "Reinforced Soil and Its Engineering Applications", I.K. international.
5) Rao, G.V., Geosynthetics – An Introduction, Sai Master geoenvironmental services.
6) Jones, CJFP, "Earth Reinforcement and soil structure", Thomas Telford.
7) Shukla, S.K., Yin, Jian-Hua, "Fundamentals of Geosynthetic Engineering", Taylor & Francis.

ADVANCED CONSTRUCTION MATERIALS

Module I:

Fresh concrete and its rheology. Mechanical, deformational behavior and microstructure of hardened concrete. Creep and shrinkage. Testing of concrete. mix design and properties of concrete; High strength concrete; High density and lightweight concretes; admixtures

Module II:

Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concreting under extreme weather conditions, High strength concrete. Changes in concrete with time, Corrosion of concrete in various environments. Corrosion of reinforcing steel. Ferro-cement, material and properties.

Module III:

Foams and light weight materials, fibrereinforced concrete. Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete. Polymers in Civil Engineering, Polymers, fibres and composites,

Module IV:

Fibre reinforced plastic in sandwich panels, modeling. Architectural use and aesthetics of composties. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building, Polymer concrete composites.

Books:

1. Neville A.M., 'Properties of concrete', 3rd ed., 1985, ELBS Lea F.M.,
2. 'Chemistry of cement and concrete', 3rd ed., 1970, Edward Arnold Proceedings of recent seminars etc. and journals.

MASS TRANSIT SYSTEMS

Mass Transit concepts- Trip interchanges and assignments ; Urban transportation problems,Modes of mass transit- their planning, construction and operation, Case studies of existing mass transit systems ; Technical and economic evaluation of mass transit projects

Essential Readings:

1. C. S. Papacostas, P. D. Prevedouros, Transportation Engineering and Planning, PHI Publication, 3rd edition, 2002

2. S. Grava, Urban Transportation Systems, Mc. Graw Hill Professional, 1st Ed. 2002

Supplementary Readings:

1. J.D. Fricker, & R.K. Whitford, Fundamentals of Transportation Engineering, Pearson, PH, 2004

2. V.R. Vuchic, Urban Transit Systems and Technology, John Wiley & Sons, February 2007

3. C.A. O'Flaherty, Transport Planning and Traffic Engineering, Arnold, 1997

4. J. E. Anderson, Transit Systems Theory, Lexinton Books, USA

TRAFFIC ENGINEERING AND TRAFFIC FLOW THEORY

Traffic surveys: Speed, volume, delay, origin and destination, parking ; Traffic controls: Traffic signs, signals, road marking and other traffic control aids ; Traffic safety: Accidents, causes and prevention ; Traffic flow theory: Light hill and Witham's theory, the queuing theory and its application to traffic engineering problems, car flow theory ; Simulations of traffic: scanning technique

Essential Reading:

1. L.R. Kadiyalli, Traffic Engineering and Transport Planning, Khanna Publishers, 7th edition, 2008.

2. C.A.O'Flaherty, Transport Planning and Traffic Engineering, Arnold, 1997

Supplementary Reading:

1. R. P. Roess, E. S. Prassas, & W.R. Mc Shane, Traffic Engineering, Prentice Hall, 3rd Edition, 2004

2. May, Traffic Flow Fundamentals, Prentice Hall, 1989

3. F. L. Mannering, Principles of Highway Engineering and Traffic Analysis, 4th Edition, 2008, John Wiley.

TRANSPORTATION AND ENVIRONMENT

The Road Environment: human factors in road user behavior, vehicle characteristics, driver, road and environment. Environmental Factors: impacts and mitigation measures of air quality, noise, severance, visual intrusion, impact on water quality, use of limited resources, impact on flora & fauna, vibration, dust ; Transport related pollution; Technology Vision-2020; Urban and non urban traffic noise sources, Noise pollution; Energy related aspects of different transport technologies. Traffic calming, Measures, Road transport related air pollution, sources of air pollution, effects of weather conditions, Vehicular emission parameters, pollution standards, measurement and analysis of vehicular emission; Imitative measures; EIA requirements of Highways projects, Procedure; MOEF World Bank/EC/UK guidelines ; EIA practices in India.

Essential Reading:

1. K. Wark, C.F. Warner, & W.T. Davis, Air Pollution: Its Origin and Control, Prentice Hall. 3rd Ed. 1997.

2. R.W. Boubel, Fundamentals of Air Pollution, Academic Press, 4th Ed. 2007.

Supplementary Reading:

1. D. Vallero, Fundamentals of Air Pollution, Academic Press, 4th Ed. 2007.

2. L. Canter, Environmental Impact Assessment, McGraw-Hill International, 2nd Ed. 1995.

COMPOSITE STRUCTURES

Module I:

Introduction: definition and characteristics, fibres, matrices, fibre reinforced composites, advantages and limitations, basic concepts and characteristics: isotropy, orthotropic, classification, lamina and laminate, micromechanics and micromechanics, constituent materials and properties.

Module II:

Elastic behaviour of unidirectional lamina: specially orthotropic and transversely isotropic material, relation between mathematical and engineering constants, stress strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, transformation of stress-strain relations in terms of engineering constants.

Module III:

Elastic behaviour of multidirectional laminates, symmetric and balanced laminates, design considerations, computational procedure for finding engineering elastic properties, stress and failure analysis of multidirectional laminates.

Module IV:

Bending of laminated composite plates, thin laminated plate theory, deflection of all edges simply supported rectangular symmetric cross-ply laminate, two opposite edges simply supported.

Books:

1. I.M. Daniel & O. Ishai, “Engineering Mechanics of Composite Materials", Oxford Press
2. S.W.Tsai & H.T.Hahn, "Introduction to Composite Materials: Techonomic Pub. Co.INC, USA.
3. P.K.Sinha,"A short term course on Composite Materials and Structures"-1996

HYDRO POWER ENGINEERING

Module I:

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Module II:

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Module III:

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels. Turbines: Introduction, types of turbines, hydraulic features, turbine size, constructional features of turbines, layout arrangements, hydraulic of turbines, basic flow equations, draft tubes, cavitations in turbines, governing of turbines, characteristics of turbines, illustrative examples.

Module IV:

Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house. Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house. Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

References:

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books
2. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
3. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal (Laxmi Publications Private Limited)

NON-CONVENTIONAL ENERGY

Module I

Introduction various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

Module II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

Module III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

Module IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

References Books:

1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.

2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.

3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.

4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International. 5. C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.

ADVANCED NUMERICAL METHODS

Module I:

Introduction to digital computers & Programming - an overview; Errors - polynomial approximations and interpolations - Numerical differentiation & Integration;

Module II:

Evaluation of single and multiple integrals, Newton's method, variational and weightened residual methods. Matrices – Linear equations, Eigenvalues and Eigenvectors - nonlinear equations,

Module III:

Harmonic and biharmonic equations - solutions, convergence, completeness & stability.

Module IV:

Initial and boundary value problems of finite difference method, Implicit & Explicit scheme.

Referrences

1. Jain M.K, SRK Iyenge and RK Jain."Numerical Methods for Scientific & Engg.Computation".
2. Mathews J. H "Numerical Methods for Mathematics, Science and Engineering".
3. Gerld C.F and PO Wheatley "Applied Numerical Analysis".
4. Gupta S.C and V. K. Kapoor "Fundamentals of Applied Statistic", Sultan Chand & Sons.
5. Johnson R.A " Probability and Statistics for Mngineers.
6.Rajeshwaran S, "Numerical Methods in Science & Engineering (A Practical Approach)",Willey Publication.

GREEN BUILDING CONCEPTS

Module I

Environmental implications of buildings energy, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transporation Energy for Building Materials; Maintenance Energy for Buildings.

Module II

Implications of Building Technologies Embodied Energy of Buildings: Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

Module III

Comforts in Building: Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

Module IV

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Unit V Green Composites for buildings: Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

TEXT BOOKS

[1] K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.

[2] Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.

[3] Green My Home!: 10 Steps to Lowering Energy Costs and Reducing Your Carbon Footprint, by Dennis C. Brewer, ISBN:9781427798411, Publisher: Kaplan Publishing, Publication Date: October 2008.

[4] B. Givoni, Man, Climate and Architecture Elsevier, 1969.

[5] T. A. Markus and E. N. Morris Buildings Climate and Energy. Pitman, London, 1980. Arvind Kishan et al (Ed)

[6] Climate Responsive Architecture. TataMcGraw Hill, 2001.

[7] Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

[8] O. H. Koenigs Berger, T. G. Ingersoll, Alan Mayhew and S. V. Szokolay. Manual of Tropical Housing and Building. Orient Long man, 1975.

REFERENCE BOOKS

[1] Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.

[2] Michael F. Ashby Materials and the Environment, Elsevier, 2009.

[3] Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.

[4] Mili M. Ajumdar (Ed) Energy Efficient Building in India. Teri and Mnes, 2001/2002.

[5] T. N. Seshadri et al Climatological and Solar Data for India. CBRI and Sarita Prakashan, 1968. 34

[6] Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

[7] The New Solar Electric Home: The Photovoltaics How-To Handbook, by Joel Davidson, ISBN: 9780937948095, Publisher: Aatec Publications, Publication Date: July 1987.

BRANCH-CIVIL ENGINEERING

***Specialization:** Water Resource Engineering & Management/ Water Resource Engineering*

Second Semester							
	Theory				Practical		
Course Name	**Hours/ Week L/T**	**Credit Theory**	**University Marks**	**Internal Evaluation**	**Hours/ Week L/T**	**Credit Practical**	**Marks**
Specialization Core-1 Ground Water Hydrology	4-0	4	100	50	-	-	-
Specialization Core-2 Free Surface Flow	4-0	4	100	50	-	-	-
Elective I(Specialization related) 1.Advanced Fluid Mechanics 2. Applied Hydrology 3.Fluvial Hydraulics 4. Ground Improvement Engineering	4-0	4	100	50	-	-	-
Elective II (Departmental related) 1. Design of Irrigation Structure 2. GIS & Remote Sensing 3. Irrigation & Drainage 4.Water Resources System & Management	4-0	4	100	50	-	-	-
Elective III(from any department) 1. Composite Structure 2. Hydropower Engineering 3.Non-conventional Energy 4. Advanced Numerical Method 5.Green Building Concepts	4-0	4	100	50	-	-	-
Lab-2 (Specialization lab to be decided by the department)					4	4	150
Seminar/Project					4	4	150
Total							
Total Marks: 1050							
Total Credits: 28							

GROUND WATER HYDROLOGY

Module I

Well Hydraulics: Aquifers and Aquifer Parameters, Darcy's law, Hydraulic Conductivity and its Characteristics, Dupuit Equation, Groundwater Flow Direction Steady Groundwater Flow, Groundwater Flow Equation, Estimation of Aquifer Parameters from Pumping Test Data, Graphical Techniques and their Limitations, Groundwater Well Losses, Interference among Wells, Potential Flow, Image well theory and its Application in Groundwater Flow.

Module II

Water Well Design and Well Drilling: Well Screen, Development and Completion of Well, Rotary Drilling and Rotary Percussion Drilling, maintenance of Wells.

Module III

Hydrogeology: Porosity and Permeability of Rocks, Groundwater in Igneous, Metamorphic, Sedimentary Rocks and Non Industrated Sediments, Hydrogeological Regions of India. Surface and Subsurface Geophysical methods for Groundwater Explorations.

Module IV

Groundwater Management: Conjunctive Use, Alternative Basin Yields, Artificial Recharge of Groundwater, Groundwater Quality. Groundwater Modelling: Groundwater Flow, mathematical, Analog and Digital modelling, Regional Groundwater Modelling.

References:

1. Walton, W.C. "Groundwater Resources Evaluation", McGraw Hill Inc, n York
2. Todd, D.K. "Groundwater Hydrology", John Wiley & Sons, Singapore
3. Johnson, E.E."Groundwater", E. Johnson Inc. Washington.
4. Raghunath, H.M. "Groundwater", Wiley Eastern Ltd, N Delhi
5. Sharma, H.D. and Chawla, A.S. "Manual on Groundwater and Tube Wells", Technical Report No.18, CBIP, New Delhi,
6. Davis, S.N. and De Weist, R.J.M. "Hydrogeology", John Wiley & Sons, N York.
7. Domenico "Concepts and models in Groundwater Hydrology", McGraw Hill Inc. N York
8. Garg, S.P. "Groundwater and Tube Wells", Oxford and IBH Publishing C. N Delhi.

FREE SURFACE FLOW

Module I

Basic Concepts of Free Surface Flow, classification of flow, velocity & pressure distribution. Conservation laws: continuity equation, momentum equation, Velocity and Pressure distribution in channel, Uniform flow, efficient section, Section of constant velocity, Specific energy, Critical depth, Section factor.

Module II

First hydraulic exponent M, Second hydraulic exponent Compound section Non-uniform flow, Gradually varied flow, Characteristic of surface profiles, Integration of varied flow equation, Estimation of N and M for trapezoidal channel Rapid varied flow,

Module III

Hydraulic jump, classification, location and length of hydraulic jump, jumps in Non rectangular channel, Jumps as energy dissipater.

Module IV

Surges in open channel, Positive surges, Negative surges Sharp crested weir, submergence, Ogee spillway: Uncontrolled, Gated, Contraction; Broad crested weir, Sluice gate flow.

References:

1. Chow .V.T. “Open Channel Hydraulics”, McGraw Hill . N York
2. Henderson. “Open Channel Flow”, McMillan Pub. London..
3. Subramanya, K “Flow in Open Channels”, Tata McGraw Hill Pub., 1995
4. Grade and Ranga Raju, K.G. “Mechanics of Sediment Transportation and Alluvial Stream Problems”, Wiley Eastem, N Delhi
5. Chaudhry M.H. “Open – Channel Flow”, Prentice Hall of India, N Delhi
6. French, R.H. “Open Channel Hydraulics”, McGraw Hill Pub Co., N York

ADVANCED FLUID MECHANICS

Module I

Description of fluid flow: with reference to translation, rotation and deformation concept of continuum, control mass & control volume approach, Reynolds transport theorem. Steady flow and uniform flow.

Module II

Velocity field, one & two-dimensional flow analysis, circulation and vorticity, stream function and velocity potential function, potential flow, standard flow patterns, combination of flow patterns, flow net.

Dimensional Analysis as a tool in design of experiments, identification of non-dimensional numbers and their significance, dimensional analysis methods.Equations of motion for laminar flow of a Newtonian fluid - Viscous flow – Navier-Stoke's equations, simple exact solutions.

Module III

Boundary Layer Theory-Formation, growth and separation of boundary layer-Integral momentum principles to compute drag and lift forces Mathematical models for boundary layer flows.

Module IV

Turbulence, Origen of turbulence universal velocity distribution laws of turbulence, smooth rough and transitional turbulent flow in pipes, pipe resistance equation for pipes design of pipe networks. Diffusion and dispersion of pollutants in natural streams.

References:

1. Som S. K and Biswas G "Introduction to Fluid Mechanics and Fluid Machines",TMH
2. Schlichting: "Boundary Layer theory", International Text – Butterworth
3. Fox R.W., Pitchard P.J, and Mcdonald A "Fluid Mechanics" Wiley India.
4. Rouse, H. "Advanced Fluid Mechanics", John Wiley & Sons, N York
5. White, F.M. "Viscous Fluid Flow", McGraw Hill Pub. Co, N York
6. Yalin, M.S. "Theory of Hydraulic Models", McMillan Co.
7. Mohanty A.K. "Fluid Mechanics", Prentice Hall of India, N Delhi.

APPLIED HYDROLOGY

Module I

Introduction: Hydrologic Cycle, Systems Concept, Hydrologic model classification. Hydrologic Processes: Reynolds Transport Theorem. Atmospheric circulation: Water Vapour, perceptible water, Thunderstorm cell model. Evaporation: Energy balance method and Aerodynamic method. Evapotranspiration. Subsurface water: unsaturated flow, Richard's equation. Infiltration: Horton's and Phillip's equations. Green-Ampt Method, Ponding time. Surface Water: Hydrograph Analysis, SCS method, Effective Rainfall, Runoff, Runoff Components, Direct Runoff Hydrograph.

Module II

Unit Hydrograph Theory: Linear Time Invariant System, Response Functions of Linear Systems, Derivation of Non Parametric Unit Hydrograph From Single Storm and Multi Storm Events, S - Curve Hydrograph, Instantaneous Unit Hydrotherapy.

Module III

Rainfall – Runoff Analysis: Review of Rational Methods, Conceptual Models, Parametric Unit Hydrograph, Clarke, Nash and Dooge Models, Hydrologic Simulation Models, Stanford Watershed Model, Derivation of Unit Hydrograph for Ungagged Catchments, Synthetic Unit Hydrograph.

Module IV

Hydrologic Time Series Analysis: Independent and Auto correlated Data, Structure of a Hydrologic Time Series, Trend, Jump and Seasonality, Stationarity and Ergodicity, Auto covariance and Auto Correlation Function, Correlogaram Analysis, Spectral Analysis, Analysis of Multivariate Hydrologic Series. Modelling of Hydrologic Time Series: Data Generation Techniques, Linear Stochastic Models, Autoregressive, Moving Average, ARMA Models, Modelling of Nonstationary and seasonal Series, Thomas – Feiring Model, ARIMA Models.

Hydrologic Flood Routing: Reservoir Routing, Channel Routing, Estimation of Parameters of Flood Routing Models, Flood estimation and flood frequency studies, Real Time Flood Forecasting.

References:

1. Chow, V.T., Maidment, D.R. and Mays, L.W. "applied Hydrology", McGraw Hill Inc. N York
2. Singh, V.P. "Hydrologic Systems,", Prentice Hall Inc., N York
3. Haan C.T., "Statistical Methods in Hydrology", East West Press, New Delhi
4. Viessman, W., Lewis, G.L. and Knapp, J.W. "Introduction to Hydrology", Harper & Row Publications Inc., Singapore.
5. Ponce, W.F. "Engineering Hydrology", Prentice Hall Inc. N York.
6. Kottegoda "Stochastic Processes in Hydrology", Prentice Hall, Inc., N Jersey
7. Patra K.C "Hydrology and Water resources Engineering", Narosa publishing house, New Delhi.

FLUVIAL HYDRAULICS

Module I

Introduction, nature of sediment problems, origin of sediments, properties of sediment. Incipient motion, tractive force, critical tractive force of different types of sediments, regimes of flow.

Module II

Bed load transport, derivation of bed load transport equation based on dimensional analysis, semi-theoretical equations. Suspended load transport, general equation of diffusion, sediment distribution equation, total load transport.

Module III

Design of stable channels, factors influencing stable channel design, regime flow theories for design of stable channels, tractive force theory method for design of stable channels.

Module IV

Sediment control, methods of sediment control in canal, river training works for control of sediment in rivers and streams, reservoir sedimentation, best management practices for control of reservoir sedimentation.

Reference Books:

1. Garde, R.J., “River Morphology”, New International Publishers.
2. Julien, P.Y., “Erosion and Sedimentation”, Cambridge University Press.
3. Jansen, P.P.H., “Principals of River Engineering”, VSSD Publications.
4. Garde, R.J. and Ranga Raju, K.G., "Mechanics of Sediment Transportation and Alluvial Stream Problems", Wiley Eastern Limited.

Ground Improvement Engineering

Module I

Introduction, typical situations where ground improvement becomes necessary, historical review of methods adopted in practice, current status and the scope in the Indian context.

Module II

Methods of ground improvement, mechanical compaction, dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, dynamic consolidation, design aspects of stone columns, use of admixtures, injection of grouts, design guidelines and quality control, design examples on preloading with sand drains, road designs with geo-synthetics.

Module III

Reinforced earth, basic mechanism, constituent materials and their selection; engineering applications – shallow foundations on reinforced earth, design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth.

Module IV

Geotextiles, selection and engineering applications, design examples, stabilisation/improvement of ground using geomembranes, geocells, geonets, geosynthetic walls.
Soil nailing, construction of underground structures, landslide controls, deep vertical cuts, contiguous piles.
Problematic soils, use of ply soils, improvement of saline soils, improvement of black cotton soils.

References:

1) Moseley, M. P. and Kirsch K.,"Ground Improvement", Spon press.
2) Mittal, Satyendra, "Ground Improvement Engineering", Vikas publishing house
3) Koerner, R.M., "Designing with Geosynthetics"' Prentice hall.
4) Saran, S., "Reinforced Soil and Its Engineering Applications", I.K. international.
5) Rao, G.V., Geosynthetics – An Introduction, Sai Master geoenvironmental services.
6) Jones, CJFP, "Earth Reinforcement and soil structure", Thomas Telford.
7) Shukla, S.K., Yin, Jian-Hua, "Fundamentals of Geosynthetic Engineering", Taylor & Francis.

IRRIGATION AND DRAINAGE

Module I

Introduction, objectives of irrigation, type of irrigation and suitability; selection of irrigation method.
Irrigation requirement, water balance, soil water relationships, water storage zone, infiltration. Flow of moisture through root zone, soil physical and chemical properties, crop evaporative and drainage requirements, irrigation efficiency and uniformity.

Module II

Surface irrigation systems, types of surface systems, basin irrigation, border irrigation, furrow irrigation, field measurement techniques, flow measurement, flumes, weirs, irrigation events, advance, wetting, depletion and recession phases.

Module III

Infiltration, infiltrometer, ponding methods, soil water, tensiometers, neutron probe, time domain reflectometer, evapotranspiration, crop coefficient, leaf area index, FAO guide lines on evapotranspiration estimation.

Module IV

Fundamentals of surface irrigation hydraulics, continuity equation, momentum equation Hydrodynamic model, zero inertia model, kinematic wave model. Drainage principles, need for drainage, steady state equations, Hooghoudt, Kirkham, Dagan and Ernst equations.

Salt balance, water and salt balance of the root zone, salt equilibrium equation and leaching requirement, leaching efficiency.

Reference Books:

1. Walker, W.R., and Skogerboe, G.V., "Surface Irrigation Theory and Practice", Prentice Hall, INC.
2. Drainage Principles and Applications, "International Institute for Land Reclamation and Improvement", Wageningen.
3. Michael, A.M., "Irrigation: Theory and Practice", Vikas Publishing House.
4. Asawa, G.L., "Irrigation Engineering", New Age International Publishers.
5. Majumdar, D.K., “Irrigation Water Management”, PHI Learning.
6. Luthin, J.N., "Drainage Engineering", John Wiley.

DESIGN OF IRRIGATION STRUCTURE

Module I

Concrete Dams: Investigation and Planning. Forces on Concrete dams, Types of loads, Stability analysis. Safety criteria, Gravity analysis, Internal stress calculation and Galleries. Joints and keys and cooling arrangement. Water stops at joint, closing gaps. Buttress and Arch Dam. Mass concrete for dams: Properties and quality control. Pressure grouting.

Module II

Spillway: Types, Design principles of Ogee spillway, side channel spillway, Chute spillway, Syphon Spillway, shaft Spillway, Gates & Valves. Energy dissipators and stilling basin design. Outlet works.

Module III

Earth and rock fill Dams : subsurface explorations methods, cut off trenches, sheet piling cutoffs, upstream blankets, horizontal drainage blankets and filters, toe drains and drainage trenches, pressure relief well. Seepage through embankments, Stability analysis of slopes of homogeneous and zoned embankment type under different reservoir conditions, Upstream and downstream slope protection measures.

Module IV

Diversion Head works: Components, Weir, Design of impervious floor, Khosla's theory Canal Regulations works: Canal Fall, its type and design methods, Canal outlets.

References:

1. Varshney R.S. "Concrete Dams", Oxford & IBH Publication Co..
2. Stewart L., Flayd E. Dominy " Design of Small Dams", Oxford & IBH Publication Co..
3. Punmia B.C. Lal B.B. Pande, Jain A. K. Jain A. K. "Irrigation and Water Power Engineering", Laxmi Publications (P) Ltd.

GIS AND REMOTE SENSING

Module I

Remote sensing- Introduction, physics of remote sensing- electromagnetic radiations and their characteristics, thermal emissions, multi-concept in remote sensing, remote sensing satellites and their data products, sensors and orbital characteristics, spectral reflectance curves for earth surface features, methods of remotely sensed data interpretation- visual interpretation, concept of fcc, digital image processing- digital image and its characteristics, satellite data formats, image rectification and restoration, image enhancement- contrast manipulation, spatial feature manipulation, multi-image manipulation

Module II

Fundamentals of GIS: introduction, definition of GIS, evolution of GIS, roots of GIS, definition, GIS architecture, models of GIS, framework for GIS, GIS categories, map as a model, spatial referencing system, map projections, commonly used map projections, grid systems, cartographic symbolization, types of maps, typography, map design, map productions, map applications, data management,Models and quality issues: conceptual models, geographical data models, data primitives, data types - raster and vector approach, digital terrain modelling , approaches to digital terrain data modelling , acquisition of digital terrain data, data modelling and spatial analysis, sources of geographical data, data collectors and providers, creating digital data sets, data presentation, data updating, data storage

Module III

GIS data processing, analysis and visualization: raster based GIS data processing, vector based GIS data processing, human computer interaction and GIS, visualization of geographic information, principles of cartographic design in GIS, generation of information product, image classification and GIS, visual image interpretation, types of pictorial data products, image interpretation strategy, image interpretation process, Rainfall runoff modelling using remote sensing inputs,

Module IV

Flood and Drought Studies – Flood plain zoning –inundated areas – evaluation models – Drought assessment and Monitoring. Command Area Studies –Cropping patterns, conditions of crops, irrigation system performance – crop yield estimation.

References:

1. Meijerink A.M.J., H.A.M. de Brouwer, C.M. Mannaerts and C.R. Valenzuela, “Introduction to the use of Geographic Information Systems for Practical Hydrology”, ITC Publication, Paris.
2. Lillesand T.M. and Kiefer R.W., “Remote Sensing and Image Interpretation”, John Wiley and Sons,N York.
3. Swain P.H., and S.M. Davis, “Remote Sensing – The Quantitative Approach”, McGraw Hill Publishing Company, N York.
4. Reddy M.A “Remote Sensing And GIS”, , B.S. Publication, Hyderabad
5. Kang-Tsung Chang “Introduction Of GIS” , Tata Mcgraw-Hill, New Delhi
6. Lyon, J.G. and Mc Larthy, J. “Wetland and Environmental Application of GIS”, Lewis Publishers,Washington.

WATER SUPPLY SYSTEMS

Module I

Instructions: Water Requirements, Sources of Water, Water Supply Considerations, Water Quality, Drinking Water Standards Secondary Standards – Toxic Water Pollutants, Quality Criteria for Surface Water, Purpose of Water Treatment – Selection of Water Processes , Water – Processing Sludges.

Module II

Conventional treatment Processes: Sedimentation, Type of Sedimentation, Zone Setting, Filtration, Gravity Granular-Media Filtration, Head Losses, Back Washing and Media Fluidization – Pressure Filters – Slow Sand Filters, Coagulation and Flocculation Coagulants, Coagulants, Coagulant Aids, Rapid Mixing Devices, Disinfection, Disinfection Methods, CI2 handling and Dosage, Control of Thms, Fluoridation, Defluoridation.

Module III

Water Softening: Lime soda Process, Variations-Ion Exchange Softening and Nitrate Removal. Iron and Manganese Removal: Iron Corrosion, Water Stabilization-Cathodic Protection.

Module IV

Taste and Odour: Methods for Control, Aeration, Adsorption, Control of Algae Growth.
Reduction of Dissolved Salts: Distillation, Reverse Osmosis, Electro dialysis.
Transportation and Distribution of Water: Aqueducts, Hydraulic Consideration, Design of Transportation System, Distribution Reservoirs and Service Storage.

References

1. Viessman Jr., Mark J. Hammer “Water Supply and Pollution Control”. Mc Graw Hill International Edition.
2. Peavy, H.S., H.S., Row, D.R. and Tchobanaglous, G. “Environmental Engineering”. Mc Graw Hill International Edition.
3. Fair, Geyer, Okun “Water Supply Engineering”. John Wiley.
4. Turbuit T H Y “Principles of Water Quality Control”, Pergamon Press.

WATER RESOURCES SYSTEM AND MANAGEMENT

Module I

Introduction: General Principles of Systems Analysis to Problems in Water Resources Engineering, Objectives of Water Resources Planning and Development, Nature of Water Resources Systems, Socio Economic Characteristics.

Module II

Economic Analysis of Water Resources System: Principles of Engineering Economy, Capital, Interest and Interest Rates. Time Value of Money, Depreciation, Benefit Cost Evaluation, Discounting Techniques, Economic and Financial Evaluation, Socio-Economic Analysis.

Module III

Methods of Systems Analysis: Linear Programming Models, Simplex Method, Sensitivity Analysis, Dual Programming, Dynamic Programming Models, Classical Optimisation Techniques, Gradient Techniques, Stochastic Programming, Simulation, Search Techniques, Multi Objective Optimisation.

Module IV

Water Quantity Management: Surface Water Storage Requirements, Storage Capacity and Yield, Reservoir Design, Water Allocations for Water Supply, Irrigation, Hydropower and Flood Control, Reservoir Operations, Planning of an Irrigation System, Irrigation Scheduling, Groundwater management, Conjunctive Use of Surface and Subsurface Water Resources, Design of Water Conveyance and Distribution Systems.

References:

1. Loucks, D.P., Stedinger, J.R. and Haith, D.A. “Water Resources Systems Planning and Analysis”,Prentice Hall Inc. N York
2. Chaturvedi, M.C. “Water Resources Systems Planning and Management”, Tata McGraw Hill Pub.Co., N Delhi.
3. Hall. W.A. and Dracup, J.A. “Water Resources Systems”, Tata McGraw Hill Pub. N Delhi
4. James, L.D. and Lee “Economics of Water Resources Planning”, McGraw Hill Inc. n York
5. Kuiper, E. “Water Resources Development, Planning, Engineering and Economics”, Buttersworth, London
6. Biswas, A.K. “Systems Approach to Water Management”, McGraw Hill Inc. N York
7. Major, D.C. and Lenton, R.L., “Applied Water Resources System Planning”, Prentice-Hall Inc,N.Jersey
8. Taha h A, “Operations Research”, Prentice Hall of India, N Delhi.

COMPOSITE STRUCTURES

Module I:

Introduction: definition and characteristics, fibres, matrices, fibre reinforced composites, advantages and limitations, basic concepts and characteristics: isotropy, orthotropic, classification, lamina and laminate, micromechanics and micromechanics, constituent materials and properties.

Module II:

Elastic behaviour of unidirectional lamina: specially orthotropic and transversely isotropic material, relation between mathematical and engineering constants, stress strain relations for thin lamina, transformation of stress and strain, transformation of elastic parameters, transformation of stress-strain relations in terms of engineering constants.

Module III:

Elastic behaviour of multidirectional laminates, symmetric and balanced laminates, design considerations, computational procedure for finding engineering elastic properties, stress and failure analysis of multidirectional laminates.

Module IV:

Bending of laminated composite plates, thin laminated plate theory, deflection of all edges simply supported rectangular symmetric cross-ply laminate, two opposite edges simply supported.

Books:

1. I.M. Daniel & O. Ishai, “Engineering Mechanics of Composite Materials", Oxford Press
2. S.W.Tsai & H.T.Hahn, "Introduction to Composite Materials: Techonomic Pub. Co.INC, USA.
3. P.K.Sinha,"A short term course on Composite Materials and Structures"-1996

HYDRO POWER ENGINEERING

Module I:

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Module II:

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Module III:

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels. Turbines: Introduction, types of turbines, hydraulic features, turbine size, constructional features of turbines, layout arrangements, hydraulic of turbines, basic flow equations, draft tubes, cavitations in turbines, governing of turbines, characteristics of turbines, illustrative examples.

Module IV:

Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house. Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house. Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

References:

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books
2. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
3. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal (Laxmi Publications Private Limited)

NON-CONVENTIONAL ENERGY

Module I

Introduction various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. 3 Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

Module II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations.

Module III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo-thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. 4 Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. 2 Fuel Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

Module IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. 2 Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.
Bio-mass: Availability of bio-mass and its conversion theory. 2 Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

References Books:

1. Raja etal, “Introduction to Non-Conventional Energy Resources” Scitech Publications.
2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3. M.V.R. Koteswara Rao, “ Energy Resources: Conventional & Non-Conventional “ BSP Publications,2006.
4. D.S. Chauhan,”Non-conventional Energy Resources” New Age International. 5.
C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI Learning.

ADVANCED NUMERICAL METHODS

Module I:

Introduction to digital computers & Programming - an overview; Errors - polynomial approximations and interpolations - Numerical differentiation & Integration;

Module II:

Evaluation of single and multiple integrals, Newton's method, variational and weightened residual methods. Matrices – Linear equations, Eigenvalues and Eigenvectors - nonlinear equations,

Module III:

Harmonic and biharmonic equations - solutions, convergence, completeness & stability.

Module IV:

Initial and boundary value problems of finite difference method, Implicit & Explicit scheme.

Referrences

1. Jain M.K, SRK Iyenge and RK Jain."Numerical Methods for Scientific & Engg.Computation".
2. Mathews J. H "Numerical Methods for Mathematics, Science and Engineering".
3. Gerld C.F and PO Wheatley "Applied Numerical Analysis".
4. Gupta S.C and V. K. Kapoor "Fundamentals of Applied Statistic", Sultan Chand & Sons.
5. Johnson R.A " Probability and Statistics for Mngineers.
6. Rajeshwaran S, "Numerical Methods in Science & Engineering (A Practical Approach)",Willey Publication.

Green Building Concepts

Module I

Environmental implications of buildings energy, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transporation Energy for Building Materials; Maintenance Energy for Buildings.

Module II

Implications of Building Technologies Embodied Energy of Buildings: Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.

Module III

Comforts in Building: Thermal Comfort in Buildings- Issues; Heat Transfer Characteristic of Building Materials and Building Techniques. Incidence of Solar Heat on Buildings-Implications of Geographical Locations.

Module IV

Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. Unit V Green Composites for buildings: Concepts of Green Composites. Water Utilization in Buildings, Low Energy Approaches to Water Management. Management of Solid Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.

TEXT BOOKS

[1] K.S.Jagadish, B. U. Venkataramareddy and K. S. Nanjundarao. Alternative Building Materials and Technologies. New Age International, 2007.
[2] Low Energy Cooling For Sustainable Buildings. John Wiley and Sons Ltd, 2009.
[3] Green My Home!: 10 Steps to Lowering Energy Costs and Reducing Your Carbon Footprint, by Dennis C. Brewer, ISBN:9781427798411, Publisher: Kaplan Publishing, Publication Date: October 2008.
[4] B. Givoni, Man, Climate and Architecture Elsevier, 1969.
[5] T. A. Markus and E. N. Morris Buildings Climate and Energy. Pitman, London, 1980. Arvind Kishan et al (Ed)
[6] Climate Responsive Architecture. TataMcGraw Hill, 2001.
[7] Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.
[8] O. H. Koenigs Berger, T. G. Ingersoll, Alan Mayhew and S. V. Szokolay. Manual of Tropical Housing and Building. Orient Long man, 1975.

REFERENCE BOOKS

[1] Osman Attmann Green Architecture Advanced Technologies and Materials. McGraw Hill, 2010.
[2] Michael F. Ashby Materials and the Environment, Elsevier, 2009.
[3] Jerry Yudelson Green building Through Integrated Design. McGraw Hill, 2009.
[4] Mili M. Ajumdar (Ed) Energy Efficient Building in India. Teri and Mnes, 2001/2002.
[5] T. N. Seshadri et al Climatological and Solar Data for India. CBRI and Sarita Prakashan, 1968. 34
[6] Fundamentals of Integrated Design for Sustainable Building By Marian Keeler, Bill Burke

[7] The New Solar Electric Home: The Photovoltaics How-To Handbook, by Joel Davidson, ISBN: 9780937948095, Publisher: Aatec Publications, Publication Date: July 1987.

CREDIT DISTRIBUTION STRUCTURE FOR M.TECH ADMISSION BATCH 2016-17

1ST SEMESTER				2ND SEMESTER			
CODE	**SUBJECT**	**L-T-P**	**CREDIT**	**CODE**	**SUBJECT**	**L-T-P**	**CREDIT**
	COMPUTATIONAL METHODS AND TECHNIQUES	3-1-0	4		SPECILIZATION CORE I	3-1-0	4
	INTERNET OF THINGS	3-1-0	4		SPECILIZATION CORE II	3-1-0	4
	BRANCH SPECILIZATION CORE -I	3-1-0	4		ELECTIVE -I (SPECILIZATION RELATED)	3-1-0	4
	BRANCH SPECILIZATION CORE- II	3-1-0	4		ELECTIVE -II (DEPATMENTAL REALTED)	3-1-0	4
	BRANCH SPECILIZATION CORE- III	3-1-0	4		ELECTIVE- III (FROM ANY DEPATMENT)	3-1-0	4
CREDITS (THEORY)			**20**	**CREDITS (THEORY)**			**20**
PRACTICALS/SESSIONALS				**PRACTICALS/SESSIONALS**			
	LAB I	0-0-4	4		LAB II	0-0-4	4
					DESIGN PROJECTS	0-0-4	4
CREDITS (PRACTICALS/SESSIONALS)			**4**	**CREDITS (PRACTICALS/SESSIONALS)**			**8**
TOTAL SEMESTER CREDITS			**24**	**TOTAL SEMESTER CREDITS**			**28**
TOTAL CUMULATIVE CREDITS			**24**	**TOTAL CUMULATIVE CREDITS**			**52**

3RD SEMESTER				4TH SEMESTER			
CODE	**SUBJECT**	**L-T-P**	**CREDIT**	**CODE**	**SUBJECT**	**L-T-P**	**CREDIT**
	RESEARCH METHODOLOGY	3-1-0	4				
	IPR (INTELLECTUAL PROPERTY RIGHTS)	3-1-0	4				
CREDITS (THEORY)			**8**				
PRACTICALS/SESSIONALS				**PRACTICALS/SESSIONALS**			
	PRE DESSERATION WORK EVALUATION		9		DESSERATION EVALUATION AND OPEN DEFENCE		17
CREDITS (PRACTICALS/SESSIONALS)			**9**	**CREDITS (PRACTICALS/SESSIONALS)**			**17**
TOTAL SEMESTER CREDITS			**17**	**TOTAL SEMESTER CREDITS**			**17**
TOTAL CUMULATIVE CREDITS			**69**	**TOTAL CUMULATIVE CREDITS**			**86**

INTELLECTUAL PROPERTY RIGHTS

Unit 1 - Introduction

Intellectual property: meaning, nature and significance, need for intellectual property Right (IPR), IPR in India – Genesis and development, IPR in abroad, Examples:-Biotechnology Research and Intellectual Property Rights Management.

What is a patent, What can be protected by a patent, Why should I apply for a patent? Patent Law, Patentability requirements, Non-Patentable subject matters, Layout of the Patents. Procedure for domestic and international filing of applications, Restoration, Surrender and Revocations of Patents, Rights of Patentee and Working of Patent, Licensing and Enforcing Intellectual Property.

Unit 2 – Copyrights

Copyright: meaning, scope; What is covered by copyright? How long does copyright last? Why protect copyright? Related rights, Rights covered by copyright. Ownership: Duration, Division, Transfer and Termination of Transfers.

Unit 3 – Infringement and Remedies

Literal and non-literal infringement, Role of claims, Doctrines on infringement: Equivalent doctrine, Pith and Marrow doctrine, Comparative test. Defenses: Gillette Defense, General grounds, Patents granted with conditions, Parallel import. Remedies: Civil, Administrative.

Unit 4 – State Law: Trade Secret, Contract, Misappropriation, Right of Publicity

Trademarks, Trade Secret - Overview, Requirements, Misappropriation of Trade Secret, Departing Employees, Remedies, Criminal Liability, Misappropriation, Clickwrap Agreements, Idea Submissions; Right of Publicity, Federal Preemption, Review.

Books:-

1. W. R. Cornish and D. Llewellyn, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Rights, Sweet & Maxwell.
2. Lionel Bently and Brad Sherman, Intellectual Property Law, Oxford University Press.
3. P. Narayanan, Intellectual Property Law, Eastern Law House
4. B. L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing Co.
5. V. K. Ahuja, Law Relating to Intellectual Property Rights, LexisNexis.
6. Ajit Parulekar and Sarita D'Souza, Indian Patents Law – Legal & Business Implications;Macmillan India ltd, 2006
7. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.

Reference

1. The Copyright Act, 1957
2. The Patent Act, 1970
3. The Trade Marks Act, 1999
4. The Designs Act, 2000
5. The Geographical Indication of Goods Act, 1999
6. The Protection of Plant Varieties and Farmers' Rights Act, 2001
7. The Semiconductor Integrated Circuits Layout Design Act, 2000

RESEARCH METHODOLOGY

Module I:
Introduction to RM: Meaning and significance of research. Importance of scientific research in decision making. Types of research and research process. Identification of research problem and formulation of hypothesis. Research Designs.

Module II:
Measurement and Data Collection. Primary data, Secondary data, Design of questionnaire ; Sampling fundamentals and sample designs. Measurement and Scaling Techniques, Data Processing.

Module III:
Data Analysis – I: Hypothesis testing; Z-test, t-test, F-test, Chi-square test. Analysis of variance. Non-parametric Test – Sign Test, Run test, Krushall – Wallis test

Module IV:
Data Analysis – II: Factor analysis, Multiple Regressions Analysis. Discriminant Analysis, Use of SPS Package.

Reference Books

1. Research Methodology, Chawla and Sondhi, Vikas
2. Research Methodology, Paneersevam, PHI