Syllabus for B. Tech in Electronics & Communication Engineering
(Applicable from the academic session 2018-2019)

**Semester-VIII**

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<tr>
<th>PE-EC801A</th>
<th>Antennas and Propagation</th>
<th>3L:0T</th>
<th>3 credits</th>
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</table>

Fundamental Concepts- Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.

Radiation from Wires and Loops- Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.

Aperture and Reflector Antennas-Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

Broadband Antennas- Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.

Micro strip Antennas- Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.

Antenna Arrays-Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method.

Basic Concepts of Smart Antennas-Concept and benefits of smart antennas, fixed weight beam forming basics, Adaptive beam forming.

Different modes of Radio Wave propagation used in current practice.

**Text/Reference Books:**

**Course Outcomes:**
At the end of the course, students will demonstrate the ability to:
1. Understand the properties and various types of antennas.
2. Analyze the properties of different types of antennas and their design.
3. Operate antenna design software tools and come up with the design of the antenna of required specifications.
Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.


WDM and DWDM systems. Principles of WDM networks.

Nonlinear effects in fiber optic links. Concept of self-phase modulation, group velocity dispersion and soliton based communication.

Text/Reference Books

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors.
4. Analyze system performance of optical communication systems.
5. Design optical networks and understand non-linear effects in optical fibers.
Maulana Abul Kalam Azad University of Technology, West Bengal  
(Formerly West Bengal University of Technology) 
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<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PE-EC801C</td>
<td>Error Correcting Codes</td>
<td>3L:0T</td>
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### Course Details:
Linear block codes: Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels; Hamming codes; Weight enumerators and the McWilliams identities; Perfect codes, Introduction to finite fields and finite rings; factorization of \((X^n-1)\) over a finite field; Cyclic Codes.

BCH codes; Idempotents and Mattson-Solomon polynomials; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes. Decoding of BCH codes: Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm. Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.

### Text/Reference Books:

### Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand the error sources
2. Understand error control coding applied in digital communication
PE-EC802A | Mixed Signal Design | 3L:0T | 3 credits

Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.

Switched-capacitor filters- Nonidealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission.

Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.

Text/Reference Books:

Course Outcomes:
At the end of the course, students will demonstrate the ability to:
1. Understand the practical situations where mixed signal analysis is required.
2. Analyze and handle the inter-conversions between signals.
3. Design systems involving mixed signals.
Sensors: Displacement sensors, Force sensors, Ultrasonic sensors, Temperature sensors, Pressure sensors etc
Actuators: Dc motors, Servo motors, Stepper motors, Piezo electric actuators, Pneumatic actuators etc.

Controller tuning:

Automation:
PLC (Programmable logic controllers): Overview, operation and architecture, PLC programming, Application examples.
DCS (Distributed control systems): Overview, Advantages, Functional requirements of Distributed control systems, Communication for distributed control, Application examples.
SCADA (supervisory control and data acquisition): Introduction to SCADA, SCADA system components, architecture and communication, SCADA applications.
Advanced control techniques: Feed forward control, Ratio control, Cascade control, Adaptive control, Duplex or split range control, Override control, internal mode control.

Text book

Course Outcome: At the end of the course, the students will be able to:
1. select suitable sensor to measure industrial parameters and the different types of actuators and its working. They will be able to design proper signal conditioning circuit to the transducer.
2. determine the effect of proportional gain, integral time, derivative gain constant on the system performance and will be able to tune the controller using tuning methods, implement PID using electronic, digital, pneumatic and hydraulic methods.
3. design the ladder logic to implement any process with given problem statement.
4. analyze DCS hardware and its merits/demerits in an industrial automation
5. analyze SCADA hardware and software and its merits/demerits in industrial automation.
6. design the complex control scheme to a particular process.
Unit-I: Introduction to VLSI Design methodologies
Review of Data structures and algorithms - Review of VLSI Design automation tools -
Algorithmic Graph Theory and Computational Complexity - Tractable and Intractable problems
- general purpose methods for combinatorial optimization.

Unit-II: Layout Compaction, Placement & Partitioning
Layout Compaction: Design rules - problem formulation - algorithms for constraint graph
compaction – Placement & Partitioning: Circuit representation - Placement algorithms -
partitioning

Unit-III: Floorplanning & Routing
Floor planning concepts: Terminologies, floorplan representation, shape functions and floorplan
sizing Routing: Types of local routing problems - Area routing - channel routing - global routing
- algorithms for global routing.

Unit-IV: VLSI Simulation
Gate-level modeling and simulation - Switch-level modeling and simulation - Combinational
Logic Synthesis - Binary Decision Diagrams - Two Level Logic Synthesis- High level Synthesis.

Unit-V: High Level Synthesis
Hardware models - Internal representation - Allocation assignment and scheduling - Simple
scheduling algorithm - Assignment problem – High level transformations.

REFERENCE BOOKS
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwar Academic
Publishers, 2002
OE-EC803A  Internet of Things (IoT)  3L:0T:0P  3 credits

Introduction:
The Internet of Things: an Overview:
The flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things?

Design Principles for Connected Devices:
Calm and Ambient Technology, Magic as Metaphor, Privacy, Web Thinking for Connected Devices, Affordances.

Internet Principles:

Prototyping:
Thinking About Prototyping: Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Open Source versus Closed Source, Tapping into the Community.

Prototyping Embedded Devices:

Prototyping the Physical Design:
Preparation, Sketch, Iterate, and Explore, Non-digital Methods, Laser Cutting, 3D Printing, CNC Milling, Repurposing/Recycling.

Prototyping Online Components:
Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols.

Techniques for Writing Embedded Code:
Memory Management, Performance and Battery Life, Libraries, Debugging.

Prototype to Reality:

Moving to Manufacture:
What Are You Producing?, Designing Kits, Designing Printed Circuit Boards, Manufacturing Printed Circuit Boards, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software,

Ethics:
Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.
Text Book


Course Outcome: At the end of the course, the students will be able to:

1. understand the application areas of IOT.
2. realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
3. understand building blocks of Internet of Things and characteristics.
OE-EC803B | Big Data Analysis | 3L:0T:0P | 3 credits

COURSE OBJECTIVES:

• Understand the Big Data Platform and its Use cases
• Provide an overview of Apache Hadoop
• Provide HDFS Concepts and Interfacing with HDFS
• Understand Map Reduce Jobs
• Provide hands on Hadoop Eco System
• Apply analytics on Structured, Unstructured Data.
• Exposure to Data Analytics with R.

COURSE OUTCOMES: The students will be able to:

• Identify Big Data and its Business Implications.
• List the components of Hadoop and Hadoop Eco-System
• Access and Process Data on Distributed File System
• Manage Job Execution in Hadoop Environment
• Develop Big Data Solutions using Hadoop Eco System
• Analyze Infosphere BigInsights Big Data Recommendations.
• Apply Machine Learning Techniques using R.

Pre- requisites: Should have knowledge of one Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

UNIT I: INTRODUCTION TO BIG DATA AND HADOOP

Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.

UNIT II: HDFS (Hadoop Distributed File System) The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

UNIT III: Map Reduce Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.
Unit IV: Hadoop Eco System Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase: HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL: Introduction

UNIT V: Data Analytics with R Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.

Text Books


References

Introduction:

Cyber security objectives and guidance

Cyber governance issues

Cyber infrastructure issues
Cyber Infrastructure Issue – economics ,finance and banking – Health care – Industrial Control systems. Cyber insurance, cyber security in international relations.

Text Book

Reference Book

Course Outcome : At the end of the course, the students will be able to :
1. understand the concept of cyber security
OE-EC804A  Artificial Intelligence  3 credits

Introduction:
Overview; Foundation; History; The State of Art.

Intelligent Agents:
Agents and environment; Rationality; The nature of environment; The structure of agents.

Solving Problems by Searching:
Problem-solving agents; Well defined problems & solutions; Formulating problems; Searching for solution; Uninformed search strategies: (BFS, DFS, DLS, IDDFS, Bidirectional Search)

Informed Search and Exploration:
Informed search strategies; Heuristic functions; On-line search agents and unknown environment.

Constraint Satisfaction Problems:
Constraint satisfaction problems; Backtracking search for CSPs; Local search for CSPs.

Adversial search:
Games; Optimal decisions in games; Alpha-Beta pruning.

Logical Agents:
Knowledge-based agents; The wumpus world as an example world; Logic: Propositional logic Reasoning patterns in propositional logic.

First-order Logic:
Syntax and semantics of first-order logic; Use of first-order logic.

Text Book

Reference Book

Course Outcome: At the end of the course, the students will be able to:
1. understand the modern view of AI as the study of agents that receive percepts from the environment and perform actions.
2. demonstrate awareness of the major challenges facing AI and the complex of typical problems within the field.
3. exhibit strong familiarity with a number of important AI techniques, including in particular search, knowledge representation, planning and constraint management.
4. asses critically the techniques presented and to apply them to real world problems.
Introduction: Introduction to Microwave Integrated Circuits (MIC) and Monolithic Microwave Integrated Circuits (MMICs), their advantages over discrete circuits, MMIC fabrication techniques, Thick and Thin film technologies and materials, encapsulation and mounting of active devices in MIC and MMIC.

Planar Transmission Lines-I: Strip line & microstrip line, field configurations, quasi-TEM mode in microstrip line, analysis of microstrip transmission line, concept of effective dielectric constant, impedance of Strip line & microstrip line, dispersion and losses in microstrip line, discontinuities in microstrip.

Planar Transmission Lines-II: Slot Line, approximate analysis and field distribution of slot line, transverse resonance method and evaluation of slot line impedance, comparison with microstrip line. Fin lines & Coplanar Lines, analysis of Fin lines by transverse resonance method, conductor loss in Fin lines, coplanar wave guide (CPW).

Parallel-coupled Microstrip Lines and Power Dividers: Coupled microstrip lines, even mode and odd mode characteristic impedances, semi-empirical formulae for coupled line parameters, coupled-region length, coupler directivity, crosstalk between microstrip lines, design of microstrip branch-line power divider and rat-race ring power divider.

MIC Measurement, Testing and Applications: MIC measurement system, microwave test fixtures and probes, measurement techniques of S-parameters, noise measurement.

Text Book

Reference Book
Course Outcome: At the end of the course, the students will be able to:
1. analyze the fabrication techniques of MIC and MMIC, use of active devices with MIC and MMIC, differentiate between MIC and MMIC.
2. analyze and design strip lines and micro strip lines, and model the discontinuities in those lines.
3. analyze and design slot lines, fin lines, coplanar lines and coplanar wave-guides.
4. design parallel coupled lines for couplers and power divider circuits.
5. differentiate between various measurement techniques associated with planar transmission lines.
OE-EC804C Organizational Behavior 3L:0T:0P 3 credits

UNIT-1-Introduction to Organization and Organizational Behaviour:
Meaning and definition of organization, features and principles of organization, Organizational structures and nature of organizational behavior.

UNIT-2-Personality:
Meaning of Personality, Personality Development, Determinants of personality, Application of personality in the organizational level. Motivation-concept of motivation, motivation and behavior, Theories of motivation, Need theory, Hygiene theory, Theory X and Theory Y, Elements of sound motivational system, Motivation in Indian organization.

UNIT-3-Leadership:

UNIT-4-Organizational Change:
Meaning and Nature of organizational change, Factors of organizational change, Resistance to change, Factors in resistance, Overcoming resistance to change, Organizational Development-Concept, Objectives and process of organization development.

Text Book

Reference Book
1. Organizational Behaviour Dr S.S.Khanka, S.Chand, 2014.

Course Outcome: At the end of the course the students will be able to:
1. know about organisational structure, organisational behaviour and personality development.
2. learn about motivational techniques and skill required to work in a group and the process of group decision making.
3. know various leadership styles and the role of leader in achievement of organisational objective.
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4. learn about the reasons organizational change and its development.

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<tr>
<th>EC881</th>
<th>Project Stage II</th>
<th>L:0T:15P</th>
<th>7.5 credits</th>
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The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.