



| <b>Semester-VII</b> |                                     |  |          |          |          |                |
|---------------------|-------------------------------------|--|----------|----------|----------|----------------|
| <b>S.No.</b>        | <b>Course Code</b>                  | <b>Course Name</b>   | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credits</b> |
| <b>1.</b>           | 20A04701a<br>20A04701b<br>20A04701c | <b>Professional Elective Course– III</b><br>DSP Processors & Architectures<br>Introduction to Internet of Things<br>Satellite Communications | 3        | 0        | 0        | 3              |
| <b>2.</b>           | 20A04702a<br>20A04702b<br>20A04702c | <b>Professional Elective Course– IV</b><br>Real Time Operating Systems<br>Digital Image Processing<br>Radar Engineering                      | 3        | 0        | 0        | 3              |
| <b>3.</b>           | 20A04703a<br>20A05703b<br>20A04703c | <b>Professional Elective Course– V</b><br>Smart Sensors<br>Nano Electronics<br>Cellular & Mobile Communications                              | 3        | 0        | 0        | 3              |
| <b>4.</b>           | 20A52701a<br>20A52701b2<br>0A52701c | <b>Humanities Elective – II</b><br>Entrepreneurship and Incubation<br>Management Science<br>Enterprise Resource Planning                     | 3        | 0        | 0        | 3              |
| <b>5.</b>           |                                     | <b>Open Elective Course – III</b>  | 3        | 0        | 0        | 3              |
| <b>6.</b>           |                                     | <b>Open Elective Course – IV</b>   | 3        | 0        | 0        | 3              |
| <b>7.</b>           | 20A04707                            | <b>Skill oriented course – V</b><br>Industrial IoT & Automation  | 1        | 0        | 2        | 2              |
| <b>8.</b>           | 20A04709                            | Evaluation of Industry Internship  |          |          |          | 3              |
| <b>Total</b>        |                                     |  |          |          |          | <b>23</b>      |

**Open Elective Course – III**

| <b>S.No</b> | <b>Course Code</b> | <b>Course Name</b>                                 | <b>Offered by the Dept.</b> |
|-------------|--------------------|--|-----------------------------|
| 1           | 20A01704           | Cost Effective Housing Techniques                  | CE                          |
| 2           | 20A02704           | IOT Applications in Electrical Engineering         | EEE                         |
| 3           | 20A03704           | Product Design & Development                       | ME                          |
| 4           | 20A05704a          | Web Technologies                                   | CSE & Allied/IT             |
| 5           | 20A05704b          | VR & AR for Engineers                              |                             |
| 6           | 20A05704c          | Software Engineering                               |                             |
| 7           | 20A27704           | Human Nutrition                                    | FT                          |
| 8           | 20A54702           | Numerical Methods for Engineers                    | Mathematics                 |
| 9           | 20A56702           | Sensors And Actuators for Engineering Applications | Physics                     |
| 10          | 20A51702           | Chemistry of Nanomaterials and Applications        | Chemistry                   |

**Open Elective Course – IV**

| <b>S.No</b> | <b>Course Code</b> | <b>Course Name</b>  | <b>Offered by the Dept.</b> |
|-------------|--------------------|---|-----------------------------|
| 1           | 20A01705           | Health, Safety & Environmental management                 | CE                          |
| 2           | 20A02705           | Renewable Energy Systems                                  | EEE                         |
| 3           | 20A03705           | Introduction to Composite Materials                       | ME                          |
| 4           | 20A05705a          | Cyber Security  | CSE & Allied/IT             |
| 5           | 20A05705b          | Introduction to Full Stack Development                    |                             |
| 6           | 20A27705           | Waste and Effluent Management                             | FT                          |
| 7           | 20A54703           | Number theory & its applications                          | Mathematics                 |
| 8           | 20A56703           | Smart Materials and Devices                               | Physics                     |
| 9           | 20A51703           | Green Chemistry and Catalysis for Sustainable Environment | Chemistry                   |



| Semester-VIII |             |                                |          |   |   |   |           |
|---------------|-------------|--------------------------------|----------|---|---|---|-----------|
| S.No.         | Course Code | Course Name                    | Category | L | T | P | Credits   |
| 1.            | 20A04801    | Full Internship & Project work | PR       |   |   |   | 12        |
| <b>Total</b>  |             |                                |          |   |   |   | <b>12</b> |

**COURSES OFFERED FOR HONOURS DEGREE IN ECE**

| S.No.                  | Course Code | Course Title                                | Contact Hours per Week |   | Credits |
|------------------------|-------------|---|------------------------|---|---------|
|                        |             |   | L                      | T |         |
| 1                      | 20A04H01    | Adaptive Signal Processing                  | 3                      | 1 | 4       |
| 2                      | 20A04H02    | Software Defined Radio                      | 3                      | 1 | 4       |
| 3                      | 20A04H03    | MEMS  | 3                      | 1 | 4       |
| 4                      | 20A04H04    | Low power VLSI Design                       | 3                      | 1 | 4       |
| 5                      | 20A04H05    | Wireless Communications                     | 3                      | 1 | 4       |
| 6                      | 20A04H06    | Speech Processing                           | 3                      | 1 | 4       |
| <b>Suggested MOOCs</b> |             |   |                        |   |         |
| 8.                     | 20A04107    | VLSI Testing                                |                        |   | 2       |
| 9.                     | 20A04108    | Embedded Software and Hardware Architecture |                        |   | 2       |

**LIST OF MINORS OFFERED TO ECE**

| S.No. | Minor Title                                | Department offering the Minor |
|-------|--|-------------------------------|
| 1.    | Construction Technology                    | Civil Engineering             |
| 2.    | Environmental Geotechnology                | Civil Engineering             |
| 3.    | Energy Systems                             | EEE                           |
| 4.    | 3D Printing                                | ME                            |
| 5.    | Industrial Engineering                     | ME                            |
| 6.    | Food Science                               | Food Technology               |
| 7.    | Artificial Intelligence & Data Science     | CSE& Allied/ IT               |
| 8.    | Virtual & Augmented Reality                |                               |
| 9.    | Cyber Security and Blockchain Technologies |                               |



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (ECE)– IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A04701a) DSP PROCESSORS & ARCHITECTURES**  
**(Professional Elective Course –III)**

**Course Objectives:**

- To describe unique features of Digital signal processing.
- To demonstrate various computational parameters of DSP devices.
- To introduce architectural improvements in programmable DSP devices.
- To expose to basic DSP algorithms.
- To outline DSP processors for developing various applications.

**Course Outcomes:**

- Summarize features of Digital Signal Processing
- Evaluate dynamic ranges and precision for the given DSP system
- Explain architectural features of DSP processors
- Analyze performance of DSP algorithms on programmable DSP platform for given application
- Select DSP processors for building real time applications

**UNIT I**

Introduction to Digital Signal Processing: A Digital signal processing system, the sampling process, Discrete time sequences, Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time invariant systems, Digital filters, Decimation and interpolation.

**UNIT II**

Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of Error in DSP Implementation, A/D Conversion Errors, D/A Conversion Errors

**UNIT III**

Architecture for Programmable DSP Devices: DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Programmability and Program Execution, Speed Issues, Commercial Digital Signal Processing Devices, Data Addressing Modes of TMS320C54xx Processors, Memory space of TMS320C54xx Processors, TMS320C54xx Instructions and Programs

**UNIT IV**

Implementation of Basic DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing, An FFT Algorithm for DFT Computation, A Butterfly Computation, Bit Reversed Index Generation, 4-point FFT Implementation on the TMS320C54xx, Computation of the Signal Spectrum .

**UNIT V**

Applications of Programmable DSP Devices: A DSP System, DSP Based Biotelemetry Receiver, A Speech Processing System, An Image Processing System.

**Textbooks:**

1. B. Venkataramani and M. Bhaskar, Digital Signal Processors, Architecture, Programming and Applications, TMH, 2002.
2. Avtar Singh and S. Srinivasan, Digital Signal Processing, Thomson Publications, 2004.

**References:**

1. J.G.Proakis, Algorithms for Statistical Signal Processing, Pearson, 2002.
2. Jonatham Stein, Digital Signal Processing, John Wiley, 2005.
3. K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, A Practical Approach to Digital Signal Processing. New Age International, 2006/2009
4. Lapsley et al., DSP Processor Fundamentals - Architectures & Features, S. Chand & Co., 2000



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**B.Tech (ECE)– IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A04701b) INTRODUCTION TO INTERNET OF THINGS**  
**(Professional Elective Course –III)**

**Course Objectives:**

Students will understand the concepts of Internet of Things and can able to build IoT applications.

**Course Outcomes:**

- Understand the concepts of Internet of Things
- Identify hardware and software components of Internet of Things
- Analyze basic communication protocols
- Design IoT applications in different domain and be able to analyze their performance

**UNIT 1**

Introduction to IoT: Architectural overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Role of cloud in IoT

**UNIT II**

Elements of IoT: Hardware components – computing (Arduino, Raspberry Pi), communication, Sensing, Actuation, I/O interfaces Software Components- Programming APIs (Using python/Arduino) for communication protocols-MQTT, Zigbee, Bluetooth, CoAP, UDP, TCP

**UNIT III**

Sensing and Actuation: Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors, Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT

**UNIT IV**

IoT Application Development: Solution frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices

**UNIT V**

IoT Case Studies: IoT Case studies and mini projects based on industrial Automation, Transportation, Agriculture, Healthcare, Home Automation.

**Textbooks:**

1. Vijay Madiseti, ArshdeepBahga, “Internet of Things a Hands-On- Approach”,2014.

**References:**

1. Dr SRN Reddy, RachitThukral and Manasi Mishra ,” Introduction to Internet of Things”: A practical Approach” ETI Labs
2. Raj Kamal , “ Internet of Things: Architecture and Design”, McGraw Hill
3. Adrian McEwen, “Designing the Internet of Things”, Wiley Publishers, 2013



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**B.Tech (ECE)– IV-I Sem**

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**(20A04701c) SATELLITE COMMUNICATIONS**  
**(Professional Elective Course –III)**

**Course Objectives:**

To introduce various aspects in the design of systems for satellite communication.

**Course Outcomes:**

- Learn the dynamics of the satellite.
- Understand the communication satellite design.
- Understand how analog and digital technologies are used for satellite communication networks.
- Learn the design of satellite links.
- Study the design of Earth station and tracking of the satellites.

**UNIT I**

Elements of orbital mechanics. Equations of motion. Tracking and orbit determination. Orbital correction/control. Satellite launch systems. Multistage rocket launchers and their performance

**UNIT II**

Elements of communication satellite design. Spacecraft subsystems. Reliability considerations. Spacecraft integration.

**UNIT III**

Multiple access techniques. FDMA,TDMA,CDMA. Random access techniques. Satellite onboard processing.

**UNIT IV**

Satellite link design: Performance requirements and standards. Design of satellite links – DOMSAT, INSAT, INTELSAT and INMARSAT. Satellite - based personal communication. links.

**UNIT V**

Earth station design. Configurations. Antenna and tracking systems. Satellite broadcasting.

**Textbooks:**

D. Roddy, Satellite Communication (4/e), McGraw- Hill, 2009.

T. Pratt & C.W. Bostain, Satellite Communication, Wiley 2000.

**References:**

B.N. Agrawal, Design of Geosynchrons Spacecraft, Prentice- Hall,1986



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**B.Tech (ECE)– IV-I Sem**

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**(20A04702a) REAL TIME OPERATING SYSTEMS**  
**(Professional Elective Course –IV)**

**Course Objectives:**

- To introduce general idea, structure and functions of general purpose operating systems.
- To describe process & memory management techniques
- To teach concepts of how process is created and controlled with RTOS.
- To provide knowledge about the common problems in developing an RTOS.
- To discuss application development using RTOS

**Course Outcomes:**

- Describe real-time operating system requirements and design issues
- Illustrate role of operating systems in memory and I/O devices management
- Apply concepts of inter-task communication and synchronization via shared memory, message queues, signals, semaphores
- Examine challenges arising in design problems when developing embedded applications in multitasking systems
- Develop programs using system proved timers, signals, mutual exclusion, semaphores, message queues and exception handlers

**UNIT I**

Introduction: Operating Systems Objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, Special - Purpose Systems, Operating System services, user OS Interface, System Calls, Types of System Calls, System Programs, Opening System Design and Implementation, OS Structure, Virtual machines

**UNIT II**

Process Concept, Process Scheduling, Operations on Processes, Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Semaphores, Classic problems of synchronization, Monitors, Memory Management and Virtual Memory and File System Interface.

**UNIT III**

RTOS: Differences between General Purpose OS & RTOS, Real-time concepts, Hard Real time and Soft Real-time systems, Basic architecture of an RTOS, components in RTOS, kernel, objects, scheduler, Multitasking, context switch, Scheduling types, Task states, Task management. Kernel Objects, Semaphores, Synchronization between two tasks and multiple tasks, Single shared-resource-access synchronization, Recursive shared- resource- access synchronization, message queue, Common pipe, pipe operation, Select operation on multiple pipes, Pipes for inter-task Synchronization, Event register, control block, Signals, Catch operation, Execution sequence of wait and signal operations.

**UNIT IV**

RTOS Services Overview- TCP/IP protocol- Stack- File system- Remote procedure calls- RTOS command shell Exceptions and Interrupts- Programmable interrupt controller-Priority scheme- Task and stack Interrupt nesting- Interrupt processing in two contexts. Timer and Timer Services - Real-time clock Soft-timer- Servicing the timer interrupt in the task context- Timeout event handlers. I/O Subsystem and Memory Management Port-mapped I/O- Memory-mapped I/O- Write operation for a block-mode device- I/O function mapping- Associating devices with drivers-Memory allocation map, fragmentation, free operation, Management unit.

**UNIT V**

Typical RTOS Introduction to RT Linux, Real-Time Linux Applications in Embedded system, Common Design Problems - Deadlock, priority inversion problem, Embedded RTOS for fault-Tolerant applications

**Textbooks:**



1. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne 8th Edition, Wiley Student Edition.
2. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011

**References:**

1. Operating systems - Internals and Design Principles, W. Stallings, 6th Edition, Pearson.
2. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.



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**B.Tech (ECE)– IV-I Sem**

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**(20A04702b) DIGITAL IMAGE PROCESSING**  
**(Professional Elective Course –IV)**

**Course Objectives:**

This course is designed to enable the students to familiarize themselves with basic concepts of digital image processing and different image transforms and learn various image processing techniques like image enhancement, restoration, segmentation and compression

**Course Outcomes:**

After completion of the course, students will be able to

- Perform image manipulations and different digital image processing techniques
- Illustrate basic operations like – Enhancement, segmentation, compression, Image transforms and restoration techniques on image.
- Analyze pseudo and full color image processing techniques.
- Apply various morphological operators on images

**UNIT I**

Lecture 8Hrs

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.

**UNIT II**

Lecture 9Hrs

Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

**UNIT III**

Lecture 9Hrs

Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter, image reconstruction from projections.

**UNIT IV**

Lecture 8Hrs

Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding Wavelets and Multiresolution Processing: Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

Lecture 9Hrs

**UNIT V**

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation. Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image





segmentation based on color, noise in color images, color image compression.

**Textbooks:**

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar, "Digital Image Processing", Tata McGraw-Hill Education, 2011.

**Reference Books:**

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009

**Online Learning Resources:**

<https://nptel.ac.in/courses/117105079>

<https://nptel.ac.in/courses/117105135>



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**B.Tech (ECE)– IV-I Sem**

**L T P C**  
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**(20A04702c) RADAR ENGINEERING**  
**(Professional Elective Course –IV)**

**Course Objectives:**

- To make student to acquire the knowledge on types of Radars, working principles, tracking a target, applications and understand on phased array antennas, navigational aids

**Course Outcomes:**

- Learn the basic working principle of Radar and target detection procedure
- Know the working and applications of CW and Frequency modulated Radar
- Gain the knowledge of about MTI and Pulse Doppler Radar
- Understand different methods of tracking a target and analyze the effect of noise at the receiver
- Learn about the phased array antennas and navigational aids

**UNIT I**

Basics of Radar: Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems. Radar Equation: SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Displays – types, Illustrative Problems.

**UNIT II**

**CW and Frequency Modulated Radar:** Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems. FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

**UNIT III**

**MTI and Pulse Doppler Radar:** Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.

**UNIT IV**

**Tracking Radar:** Tracking with Radar, Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two-coordinates), Phase Comparison Mono pulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

**Detection of Radar Signals in Noise:** Introduction, Noise Figure and Noise Temperature, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection, Detection criteria, Detector Characteristics, Automatic Detection, Constant False Alarm Rate Receiver.

**UNIT V**

**Phased Array Antennas and Navigational Aids:** Introduction to Phased Array Antennas- Basic Concepts, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency – scan Arrays, Radiation for Phased Array, Architecture for Phased Arrays. Radiation Pattern. Beam Steering and Beam Width changes. Navigational Aids: Direction Finder, VOR, ILS and Loran

**Textbooks:**

1. Merrill I. Skolnik, “Introduction to Radar Systems”, 2<sup>nd</sup> Edition, TMH Special Indian Edition, 2007.
2. Byron Edde, “Radar Principles, Technology, Applications”, Pearson Education, 1992.

**References:**

1. F.E. Terman, Radio Engineering, Mc Graw Hill Book Co. (for Chapter 7 only), Fourth Edition 1955
2. Simon Kingsley & Shaun Quegan, Understanding RADAR Systems, McGraw Hill Book Co., 1993.



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**(20A04703a) SMART SENSORS**  
**(Professional Elective Course –V)**

**Course Objective:**

To make student to acquire the knowledge on types of sensors/transducers, working principles, selection procedure, applications of sensing systems

**Course Outcomes:**

- Understand measuring parameters, measuring systems, effects of environment, characteristics and parameters to be considered for designing an instrument
- Understand different types of sensors/transducers, working principles, selection procedure, applications of sensing systems
- Select a sensor/sensing system for a requirement
- Derive sensor-based solution for different applications.

**UNIT I**

Introduction to Measurement: Measurement units, applications, elements, choosing appropriate measuring instruments. Instrument Types and Performance Characteristics: Review of instrument types, Static characteristics, dynamic characteristics Error during measurement process: Sources of systematic error, reduction and quantification of systematic errors, random errors, aggregation of measurement system errors. Calibration: Calibration of measuring instruments, Primary calibration, secondary calibration and field calibration. Calibration methods for different parameters (temperature, pressure, humidity, flow...etc.). Automatic Calibration mechanisms.

**UNIT II**

Temperature Sensors: Thermo-resistive, Resistance Temperature Detectors, Silicon Resistive, Thermistors, Semiconductor, Optical, Acoustic, Piezoelectric

Humidity and Moisture Sensors: Capacitive, Electrical Conductivity, Thermal Conductivity, Optical Hygrometer, Time Domain Reflect meter.

Pressure and Force Sensors: Mercury Pressure, Bellows, Membranes, and Thin Plates, Piezoresistive, Capacitive, Optoelectronic, Vacuum, Strain Gauges, Tactile, Piezoelectric Force

**UNIT III**

Occupancy and Motion Detectors: Ultrasonic, Microwave Motion, Capacitive Occupancy, Visible and Near-Infrared Light, Far-Infrared Motion, PIR Motion, Position, Displacement, and Level Sensors: Potentiometric, Gravitational, Capacitive, Inductive and Magnetic, Optical, Ultrasonic, Radar Velocity and Acceleration Sensors: Capacitive Accelerometers, Piezoresistive Accelerometers, Piezoelectric Accelerometers, Thermal Accelerometers, Heated-Plate Accelerometer, Heated Gas Accelerometer, Gyroscopes, Piezoelectric Cables

**UNIT IV**

Flow Sensors: Pressure Gradient Technique, Thermal Transport, Ultrasonic, Electromagnetic, and Micro flow, Coriolis Mass Flow, Acoustic Sensors: Resistive Microphones, Fiber-Optic, Piezoelectric, Solid-State microphone, Light & Radiation Sensors: Photodiodes, Phototransistor, Photo resistors, Thermal detectors

Chemical Sensors: Metal-Oxide Chemical, ChemFET, Electro-chemical, Potentiometric, Conduct metric, Amperometric, Optical Chemical, Mass Detector

**UNIT V**

Introduction to wireless sensor networks, Challenges for wireless sensor networks, Applications for wireless sensor networks, enabling technologies for wireless sensor networks.

Single node architecture – Hardware components, Energy consumption of Sensor nodes (only Operation states with different power consumption, Relationship between computation and communication, Power consumption of sensor and actuators is included), Deployment environments

Sensor Network Architecture - Sensor Network Scenarios, Optimization goals and figures of merit, Design principles of WSN, Service interfaces of WSNs, Gateway-concepts.



**Textbooks**

1. Measurement and Instrumentation Principles - Morris, AlanS
2. An Introduction to Error Analysis by John R.Taylor
3. Sensor Technology Handbook, John S.Wilson
4. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks" John-Wiley,First-Edition-2014.

**References:**

1. Mechanical Measurements – Beckwith, Marangoni,Lienhard
2. Measurement of Systems - Application and design - Earnest O.Doeblin
3. Electronic Instrumentation and Measurement Technique - Albert DHelfrick
4. Kazem Sohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks- Technology, Protocols, AndApplications”, John Wiley,2007.



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**(20A04703b) NANO ELECTRONICS**  
**(Professional Elective Course -V)**

**Course Objectives**

- To teach nano electronic systems and its building blocks
- To provide knowledge on spin electronic devices.
- To familiarize students with the present research trend in Nano electronics

**Course Outcomes:**

- Describe the fabrication process and limitations in the CMOS design
- Choose different models of MOS devices according to the requirement.
- Integrate and model the device with basic quantum structures.
- Compare MOSFET, CNFET and Spin FET devices

**UNIT I**

Challenges going to sub-100 nm MOSFETs Oxide layer thickness, tunneling, power density, non-uniform dopant concentration, threshold voltage scaling, lithography, hot electron effects, sub-threshold current, velocity saturation, interconnect issues, fundamental limits for MOS operation.

**UNITII**

Novel MOS-based devices Multiple gate MOSFETs, Silicon-on-insulator, Silicon-on-nothing, Fin FETs, vertical MOSFETs, strained Si devices.

**UNITIII**

Quantum structures quantum wells, quantum wires and quantum dots, Single electron devices charge quantization, energy quantization, Coulomb blockade, Coulomb staircase, Bloch oscillations.

**UNIT IV**

Hetero structure based devices Type I, II and III hetero junctions, Si-Ge hetero structure, hetero structures of III-V and II-VI compounds - resonant tunneling devices.

**UNIT V**

Carbon nanotubesbased devices CNFET, characteristics; Spin-based devices spin FET, characteristics, Applications of MOSFET, CNFET and Spin FET devcies.

**Textbooks:**

1. Mircea Dragoman and Daniela Dragoman, “ Nano electronics Principles & devices”, Artech House Publishers, 2005.
2. Karl Gosser, “Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices”, Springer 2005.

**References:**

1. Mark Lundstrom and Jing Guo, “Nanoscale Transistors: Device Physics Modelling and Simulation”, Springer, 2005.
2. Vladimir VMitin, Viatcheslav A Kochelap and Michael A Stroschio, “Quantum hetero structures”, Cambridge University Press, 1999.
3. S M Sze (Ed), “High speed semiconductor devices”, Wiley, 1990.



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**B.Tech (ECE)– IV-I Sem** **L T P C**  
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**(20A04703c) CELLUAR & MOBILE COMMUNICATIONS**  
**(Professional Elective Course –V)**

**Course Objectives:**

- To explain cell coverage for signal and traffic, diversity techniques and mobile antennas by the use of Engineering Mathematics.
- To present impairments due to multipath fading channel, fundamental techniques to overcome different fading effects, frequency management, Channel assignment and types of handoffs.
- To teach concepts and solve problems on mobile antennas and cellular systems.

**Course Outcomes:**

- Know about cell coverage for signal and traffic, diversity techniques and mobile antennas by the use of Engineering Mathematics
- Explain impairments due to multipath fading channel, fundamental techniques to overcome different fading effects, frequency management, Channel assignment and types of handoff
- Apply concepts to solve problems on mobile antennas and cellular systems
- Analyze Co-channel and Non Co-channel interferences, different Hand-offs and dropped call rates
- Evaluate performance of dropped call rate and false alarm rate
- Compare different handoffs

**UNIT I**

**Introduction to Cellular Mobile Radio Systems:** Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, Uniqueness of Mobile Radio Environment, Mobile Fading Characteristics, Operations of Cellular Systems, Evolution of Cellular Systems.

**Fundamentals of Cellular Radio System Design:** Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in an Omni Directional Antenna System, System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems- CellSplitting, Sectoring, Microcell Zone Concept.

**UNIT II**

**Cell Coverage for Signal and Traffic:** Signal Reflections in Flat and Hilly Terrain, Effect of Human Made Structures, Phase Difference between Direct and Reflected Paths, Constant Standard Deviation, Straight Line Path Loss Slope, General Formula for Mobile Propagation Over Water and Flat Open Area, Near and Long Distance Propagation, Path Loss from a Point to Point Prediction Model in Different Conditions, Merits of Lee Model.

**Cell Site and Mobile Antennas:** Space Diversity Antennas, Umbrella Pattern Antennas, Minimum Separation of Cell Site Antennas, Mobile Antennas.

**UNIT III**

**Co-Channel Interference Reduction:** Measurement of Real Time Co-Channel Interference, Design of Omnidirectional and directional Antenna System, Antenna Parameters and Their Effects, Diversity Techniques-Space Diversity, Polarization Diversity, Frequency Diversity, Time Diversity.

**Non-Co-Channel Interference:** Adjacent Channel Interference, Near End Far End Interference, Cross Talk, Effects on Coverage and Interference by Power Decrease, Antenna Height Decrease, Effects of Cell Site Components.

**UNIT IV**

**Frequency Management and Channel Assignment:** Numbering and Grouping, Setup Access and Paging Channels, Channel Assignments to Cell Site and Mobile Units, Channel Sharing and Borrowing, Sectorization, Overlaid Cells, Non Fixed Channel Assignment.

**UNIT V**

**Handoffs and Dropped Calls:** Handoff Initiation, Types of Handoff, Delaying Handoff, Advantages of Handoff, Power difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoffs, Intersystem Handoff, Introduction to Dropped Call Rates and their Evaluation.



**System Evaluation:** Performance Evaluation, Blockage, Dropped-call rate, Signaling Evaluation-False Alarm Rate, Word error rate consideration and calculations, Measurement of averaged received signal level and level crossings.

**Textbooks:**

1. W.C.Y. Lee, Mobile Cellular Telecommunications, McGraw Hill, 2nd Edn., 1989.
2. Theodore. S. Rapport, Wireless Communications, Pearson Education, 2nd Edn., 2002.

**References:**

1. W.C.Y Lee, Mobile Communications Engineering-Theory and Applications, McGraw Hill, Second Edition, ,2014.
2. Gordon L. Stuber, Principles of Mobile Communications, Springer International, 2nd Edn., 2001.
3. Simon Haykin, Michael Moher, Modern Wireless Communications, Pearson Education, 2005.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (ECE)– III-II Sem**

**L T P C**  
**3 0 0 3**

**(20A52701a) ENTREPRENEURSHIP & INCUBATION**  
**(HUMANITIES ELECTIVE II)**

**Course Objectives:**

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

**Course Outcomes:**

- Understand the concept of Entrepreneurship and challenges in the world of competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
- Evaluate the role of central government and state government in promoting Entrepreneurship.
- Create and design business plan structure through incubations.

**UNIT I**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

**UNIT II**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

**UNIT III**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

**UNIT IV**

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

**UNIT V**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

**Textbooks:**

1. D F Kuratko and T V Rao, “Entrepreneurship” - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : [login.cengage.com](http://login.cengage.com))
2. Nandan H, “ Fundamentals of Entrepreneurship”, PHI, 2013

**References:**

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, Himalaya Publishing 2012.
2. Rajeev Roy “Entrepreneurship”, 2<sup>nd</sup> Edition, Oxford, 2012.





3. B.JanakiramandM.Rizwanal “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013.

**E-Resources**

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. <http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship>
3. [http://nptel.ac.in/courses/122106032/Pdf/7\\_4.pdf](http://nptel.ac.in/courses/122106032/Pdf/7_4.pdf)
4. <http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (ECE)– III-II Sem** **L T P C**  
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**(20A52701b) MANAGEMENT SCIENCE**  
**(HUMANITIES ELECTIVE-II)**

**Course Objectives:**

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

**Course Outcomes:**

- Understand the concepts & principles of management and designs of organization in a practical world
- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

**UNIT I INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

**UNIT II OPERATIONS MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

**UNIT III HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

**UNIT IV STRATEGIC & PROJECT MANAGEMENT**

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management** - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).



### **UNIT V CONTEMPORARY ISSUES IN MANAGEMENT**

The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

#### **Textbooks:**

1. A.R Aryasri, "Management Science", TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

#### **References:**

1. Koontz & Wehrich, "Essentials of Management", 6<sup>th</sup> edition, TMH, 2005.
2. Thomas N.Duening & John M.Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.
4. Samuel C.Certo, "Modern Management", 9<sup>th</sup> edition, PHI, 2005



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech (ECE)– III-II Sem**

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**(20A52701c) ENTERPRISE RESOURCE PLANNING**  
**(HUMANITIES ELECTIVE-II)**

**Course Objectives:**

- To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning
- To enable the students in knowing the Advantages of ERP
- To train the students to develop the basic understanding of how ERP enriches the Business organizations in achieving a multidimensional growth.
- Impart knowledge about the historical background of BPR
- To aim at preparing the students, technologically competitive and make them ready to self-upgrade with the higher technical skills.

**Course Outcomes:**

- Understand the basic use of ERP Package and its role in integrating business functions.
- Explain the challenges of ERP system in the organization
- Apply the knowledge in implementing ERP system for business
- Evaluate the role of IT in taking decisions with MIS
- Create reengineered business processes with process redesign

**UNIT I**

Introduction to ERP: Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM),

**UNIT II**

Benefits of ERP: Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design-making Capability

**UNIT III**

ERP Implementation Lifecycle: Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)

**UNIT IV**

BPR: Historical background: Nature, significance and rationale of business process reengineering (BPR), Fundamentals of BPR. Major issues in process redesign: Business vision and process objectives, Processes to be redesigned, Measuring existing processes,

**UNIT V**

IT in ERP: Role of information technology (IT) and identifying IT levers. Designing and building a prototype of the new process: BPR phases, Relationship between BPR phases. MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System.

**Textbooks:**

1. Pankaj Sharma. “Enterprise Resource Planning”. Aph Publishing Corporation, New Delhi, 2004.
2. Alexis Leon, “Enterprise Resource Planning”, IV Edition, Mc.Graw Hill, 2019

**References:**

1. Marianne Bradford “Modern ERP”, 3rd edition.
2. ERP making it happen Thomas f. Wallace and Michael
3. Directing the ERP Implementation Michael w pelphrey



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech (ECE)– IV-I Sem**

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**(20A04707) INDUSTRIAL IOT AND AUTOMATION**  
**(Skill Oriented Course- V)**

**Course Objectives:**

To provide students with good depth of knowledge of Designing Industrial IOT Systems for various application.

**Learning Outcomes:**

- Discover key IIoT concepts including identification, sensors, localization, wireless protocols, data storage and security
- Explore IoT technologies, architectures, standards, and regulation
- Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices
- Examine technological developments that will likely shape the industrial landscape in the future
- Understand how to develop and implement own IoT technologies, solutions, and applications

**Course Syllabus**

**MODULE 1: Introduction & Architecture**

What is IIoT and connected world? the difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT.

Practice

1. Introduction to Arduino, Introduction to raspberry Pi.

<https://www.youtube.com/watch?v=AQdLQV6vhhk>

**MODULE 2: IIOT Components**

Fundamentals of Control System, introductions, components, closed loop & open loop system.

Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basicSensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, Electro Mechanical switches.

Practice

1. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.
2. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.
3. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.

**MODULE 3: Communication Technologies of IIoT**

Communication Protocols: IEEE 802.15.4, ZigBee, Bluetooth, BLE, NFC, RFIDIndustry standards communication technology (MQTT), wireless network communication.

Practice

1. Demonstration of MQTT communication.

**MODULE 4: Visualization and Data Types of IIoT**

Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

Practice

1. Visualization of diverse sensor data using dashboard (part of IoT's 'control panel')
2. Sending alert message to the user. ways to control and interact with your environment)

**MODULE 5: Retrieving Data**

Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M).

Practice

1. Device control using mobile Apps or through Web pages.
2. Machine to Machine communication.



### **MODULE 6: Control & Supervisory Level of Automation**

Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA).

Practice

1. Digital logic gates programming using ladder diagram.
2. Implementation of Boolean expression using ladder diagram.
3. Simulation of PLC to understand the process control concept.

#### **Projects:**

IIoT based smart energy meter

Smart Agriculture system

Automation using controller via Bluetooth

Temperature controlled Fan/cooler using controller

Automatic streetlight

Smart Baggage Tracker

#### **Textbooks**

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cybermanufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)



# OPEN ELECTIVES



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A01704) COST EFFECTIVE HOUSING TECHNIQUES**  
**(Open Elective Course - III)**

**Course Objectives:**

- To understand the requirements of structural safety for future construction.
- To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
- To know the traditional practices of rural housing
- To know the different innovative cost effective construction techniques
- To know the alternative building materials for low cost housing.

**Course Outcomes :**

- To know the repair and restore action of earthquake damaged non engineered buildings and ability to understand the requirements of structural safety for future construction
- To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
- Apply the traditional practices of rural housing
- Understand the different innovative cost effective construction techniques
- Suggest the alternative building materials for low cost housing

**UNIT I**

- Housing Scenario** :Introducing - Status of urban housing - Status of Rural Housing
- Housing Finance**: Introducing - Existing finance system in India - Government role as facilitator - Status at Rural Housing Finance - Impedimently in housing finance and related issues
- Land use and physical planning for housing** :Introduction - Planning of urban land - Urban land ceiling and regulation act - Efficiency of building bye lass - Residential Densities
- Housing the urban poor** :Introduction - Living conditions in slums - Approaches and strategies for housing urban poor

**UNIT II**

**Development and adoption of low cost housing technology**

Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements in partial prefabrication - Adopting of total prefabrication of mass housing in India- General remarks on pre cast roofing/flooring systems -Economical wall system - Single Brick thick load bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall – Fly-ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

**UNIT III**

**Alternative building materials for low cost housing**

Introduction - Substitute for scarce materials – Ferro-cement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - alternative building maintenance

**Low cost Infrastructure services:**

Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy

**UNIT IV**

**Rural Housing:** Introduction traditional practice of rural housing continuous - Mud Housing technology Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs

**UNIT V**





**Housing in Disaster prone areas:**

Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirement's of structural safety of thin precast roofing units against Earthquake forces Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

**Textbooks:**

1. Building materials for low – income houses – International council for building research studies and documentation.
2. Hand book of low cost housing by A.K.Lal – Newage international publishers.
3. Low cost Housing – G.C. Mathur by South Asia Books

**Reference Books:**

1. Properties of concrete – Neville A.m. Pitman Publishing Limited, London.
2. Light weight concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences 1963.
3. Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Rama chandra Murthy &G.Annamalai. E. & F. N. Spon Publishers

**Online Learning Resources:**

<https://nptel.ac.in/courses/124107001>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A02704) IoT APPLICATIONS IN ELECTRICAL ENGINEERING**  
**(Open Elective Course – III)**

**Course Objectives:**

- Understand basics of Internet of Things and Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
- Analyze motion less and motion detectors in IoT applications
- Understand about Analyze applications of IoT in smart grid
- Apply the concept of Internet of Energy for various applications

**Course Outcomes:**

- Understand the concept of IoT in Electrical Engineering
- Analyze various types of motionless sensors and various types of motion detectors
- Apply various applications of IoT in smart grid
- Design future working environment with Energy internet

**UNIT I                      SENSORS**

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

**UNIT II                      OCCUPANCY AND MOTION DETECTORS**

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

**UNIT III                      MEMS**

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

**UNIT IV                      IoT FOR SMART GRID**

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

**UNIT V                      INTERNET of ENERGY (IoE)**

Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid

**Textbooks:**

1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1<sup>st</sup> Edition, Mc Grawhill Education, 2017
3. Ersan Kabalci and Yasin Kabalci, From Smart grid to Internet of Energy, 1<sup>st</sup> Edition, Academic Press, 2019

**Reference Books:**

1. Raj Kumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1<sup>st</sup> Edition, CRC Press, 2019
3. RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019

**Online Learning Resources:**

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs96/preview](https://onlinecourses.nptel.ac.in/noc22_cs96/preview)
2. <https://nptel.ac.in/courses/108108123>
3. <https://nptel.ac.in/courses/108108179>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A03704) PRODUCT DESIGN AND DEVELOPMENT**  
**(Open Elective-III)**

**Course Objectives:**

- To Design products creatively while applying engineering design principles.
- To Apply principles of human factors, ethics and environmental factors in product design.
- To Work in groups or individually in their pursuit of innovative product design.
- To implement value design for optimum product cost.

**Course Outcomes:** After successful completion of the course, the student will be able to

- Apply knowledge of basic science and engineering fundamentals
- Undertake problem identification, formulation and solution
- Understanding of the principles of sustainable design and development
- Understanding of professional and ethical responsibilities and commitment to them

**UNIT I** Product Development Process

General problem-solving process - Flow of Work during the process of designing - Activity Planning Timing and scheduling, Planning Project and Product Costs - Effective Organization Structures - Interdisciplinary Cooperation, Leadership and Team behaviour.

**UNIT II** Task Clarification

Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the requirements, refining and extending the requirements, Compiling the requirements list, Examples. Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of requirements lists.

**UNIT III** Conceptual Design

Steps in Conceptual Design. Abstracting to identify the essential problems - Aim of Abstraction, Broadening the problem. Formulation, Identifying the essential problems from the requirements list, establishing functions structures, Overall function, Breaking a function down into sub-functions. Developing working structures - Searching for working principles, Combining Working Principles, Selecting Working Structures, Practical Application of working structures. Developing Concepts - Firming up into principle solution variants, Evaluating principle solution variants, Practical Applications of working structures. Examples of Conceptual Design - One Handed Household Water Mixing Tap, Impulse - Loading Test Rig.

**UNIT IV** Embodiment Design

Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design Principles of Embodiment Design - Principles of Force Transformations, Principles of Division of Tasks, Principles of Self-Help, Principles of Stability and Bi-Stability, Principles of Fault-Free Design Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to allow for creep and relaxation, Design against Corrosion, Design to minimize wear, Design to Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for Maintenance, Design for Recycling, Design for Minimum risk, Design to standards. Evaluation of Embodiment Designs.

**UNIT V** Mechanical Connections, Mechatronics And Adaptronics:

Mechanical Connections - General functions and General Behaviour, Material connections, From Connections, Force connections, Applications. Mechatronics - General Architecture and Terminology, Goals and Limitations, Development of Mechatronic Solution, Examples. Adaptronics - Fundamentals and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.



**Textbooks:**

1. G.Paul; W. Beitzetal, Engineering Design, Springer International Education, 2010.
2. Kevin Otto: K. Wood, Product Design And Development, Pearson Education, 2013.

**References:**

1. Kenith B. Kahu, Product Planning Essentials, Yes dee Publishing, 2011.
2. K.T. Ulrich, Product Design and Development, TMH Publishers, 2011.

**Online Learning Resources:**

- <https://nptel.ac.in/courses/112107217>
- <https://nptel.ac.in/courses/112104230>
- <https://www.youtube.com/watch?v=mvaqZAFdL6U>
- <https://nptel.ac.in/courses/107103082>
- <https://quizxp.com/nptel-product-design-and-manufacturing-assignment-5/>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

**B.Tech IV-I Sem**

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**3 0 0 3**

**(20A05704) WEB TECHNOLOGIES**  
**(Open Elective-III)**

**Course Objectives:**

The course is designed to Introduce the key technologies that have been developed as part of the birth and maturation of the World Wide Web.

**Course Outcomes:**

- Understand the Web essentials.
- Develop web pages using XHTML
- Apply style to web pages using CSS
- Write scripts for client side
- Develop and transform XML documents.

**UNIT I Web Essentials: Clients, Servers, and Communication**

The Internet, Basic Internet protocols, WWW, HTTP request message, HTTP response message, Web clients, Web Servers, Case study.

**UNIT II Markup Languages: XHTML 1.0**

An introduction to HTML, Basic XHTML syntax and semantics, fundamental HTML elements, Relative URLs, Lists, Tables, Frames, Forms, Defining XHTML's abstract syntax, Creating HTML documents.

**UNIT III Cascading Style Sheets**

Introduction, features, core syntax, style sheets and HTML, style rule cascading and inheritance, text properties, Box model, normal flow box layout, beyond the normal flow, lists, tables, cursor styles.

**UNIT IV Client-side programming: JavaScript**

Basic syntax, variables and data types, statements, operators, literals, functions, objects, Arrays, built-in objects, JavaScript debuggers.

**UNIT V Representing Web Data: XML**

Documents and vocabularies, Versions and declaration, Namespaces, Ajax, DOM and SAX parsers, transforming XML documents, XPath, XSLT, Displaying XML documents in Web browsers.

**Textbooks:**

1. J.C. Jackson, Web technologies: A computer science perspective, Pearson.

**Reference Books:**

1. Sebesta, Programming world wide web, Pearson.
2. Dietel and Nieto , Internet and World Wide Web – How to program, Pearson Education
3. Chris Bates , Web Programming, building internet applications, 2nd edition, WILEY, Dreamtech

**Online Learning Resources:**

<http://getbootstrap.com/>

<https://www.w3schools.com/whatis/>

<https://nptel.ac.in/courses/106105084>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**

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**3 0 0 3**

**(20A05704b) VR & AR FOR ENGINEERS**  
**(Open Elective Course – III)**

**Course Objectives:**

- Introduce to the design of visualization tools
- Demonstrate Virtual reality
- Learn Virtual reality animation and 3D Art optimization
- Understand the foundational principles describing how hardware, computer vision algorithms function
- Explore the history of spatial computing and design interactions

**Course Outcomes:**

- Apply VR/MR/AR in various fields in industry
- Design Data visualization tools
- Design audio and video interaction paradigms
- Apply technical and creative approaches to make successful applications and experiences.
- Explain how the humans interact with computers

**UNIT I**

**Computer generated worlds:** what is augmented reality? what is virtual reality?

**Understanding virtual space:** defining visual space and content, defining position and orientation in three dimensions, navigation

**The Mechanics of Sight:** the visual path way, spatial vision, and Depth Cues.

**Component Technologies of Head mounted Displays:** Display fundamentals, related terminology and concepts, optical Architectures.

**UNIT II**

**Augmented Displays:** Binocular augmenting displays, Monocular augmenting displays.

**Fully immersive Displays:** PC-Console driven displays, smartphone based displays, CAVES and Walls, Hemispheres and Domes.

**The Mechanics of hearing:** Defining sound, the auditory pathway, sound cues and localization, the vestibular system.

**Audio displays:** Conventional audio

**UNIT III**

**The Mechanics of Feeling:** The Science of feeling, Anatomy and Composition of the skin.

**Tactile and force feedback Devices:** Haptic illusions, tactile feedback devices, Force feedback devices.

**Sensors for tracking Position, and orientation and motion:** introduction to sensor technologies, optical trackers, beacon trackers, electromagnetic trackers, inertial sensors, acoustic sensors.

**Devices to enable navigation and interaction:** 2D vs 3D interaction and navigation, the importance of a manual interface, hand and gesture tracking, whole body tracking, gaming and entertainment interfaces, navigating with your mind.

**UNIT IV**

**Gaming and Entertainment:** Virtual reality and the arts, gaming, immersive video/ cinematic virtual reality.

**Architecture and Construction:** Artificial spaces, architectural design: Manage group architectures, Construction management, real estate sales applications, architectural acoustics.

**Science and engineering:** Simulate and innovate, naval architecture and marine engineering, automotive engineering, aerospace engineering, nuclear engineering and manufacturing.



**Health and medicine:** advancing the field of medicine, training applications, treatment applications.

#### UNIT V

**Aerospace and Defence:** Flight simulation and training, mission planning and rehearsal, dismounted soldier situational awareness, advanced cockpit avionics, space operations.

**Education:** Tangible skills education, theory, knowledge acquisition and concept formation.

**Information control and big data visualization:** What is big data?, big data analytics and human vision.

**Telerobotics and Telepresence:** Defining Telerobotics and Telepresence, space applications and robonaut, undersea applications, Terrestrial and airborne applications.

#### Textbooks:

1. Steve Aukstakalnis, “Practical Augmented Reality”, Pearson Education, 2017.

#### Reference Books:

1. Erin Pangilinan, Steve lukas, and Vasanth Mohan, “Creating Augmented& Virtual Realities”, O'REILLY

#### Online Learning Resources:

1. <https://www.coursera.org/learn/intro-augmented-virtual-mixed-extended-reality-technologies-applications-issues>
2. <https://www.coursera.org/learn/ar>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech IV-I Sem****L T P C**  
**3 0 0 3****(20A05704c) SOFTWARE ENGINEERING**  
**(Open Elective Course – III)****Course Objectives:**

- To learn the basic concepts of software engineering and life cycle models
- To explore the issues in software requirements specification and enable to write SRS documents for software development problems
- To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems
- To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
- To reveal the basic concepts in software project management

**Course Outcomes (CO):**

After completion of the course, students will be able to

- Obtain basic software life cycle activity skills.
- Design software requirements specifications for given problems.
- Implement structure, object oriented analysis and design for given problems.
- Design test cases for given problems.
- Apply quality management concepts at the application level.

**UNIT - I                      Basic concepts in software engineering and software project management                      Lecture 8Hrs**

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

**UNIT - II                      Requirements analysis and specification                      Lecture 8Hrs**

The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques, axiomatic specification, algebraic specification.

**UNIT - III                      Software Design                      Lecture 9Hrs**

Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based vs Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.

**UNIT - IV                      Coding and Testing                      Lecture 9Hrs**

Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.

**UNIT - V                      Software quality, reliability, and other issues                      Lecture 9Hrs**

Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.

**Textbooks:**

1. Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, PHI, 2018.
2. Pressman R, "Software Engineering- Practioner Approach", McGraw Hill.





Reference Books:

4. Somerville, “Software Engineering”, Pearson 2.
5. Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill.
6. JalotePankaj, “An integrated approach to Software Engineering”, Narosa

Online Learning Resources:

<https://nptel.ac.in/courses/106/105/106105182/>

<http://peterindia.net/SoftwareDevelopment.html>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A27704) HUMAN NUTRITION**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

- To get knowledge on Concepts and content of nutrition source and metabolic functions.
- To know about Balanced diets for various groups; Diets and disorders, recommended dietary allowances
- To learn about Epidemiology of under nutrition and over nutrition.
- To understand Nutrition and immunity.

**Course Outcomes:**

- To study the Salient features of Concepts and content of nutrition, Malnutrition, Nutrition education
- Assessment of nutritional status, disorders Food fad and faddism.

**UNIT I**

Concepts and content of nutrition: Nutrition agencies; Nutrition of community; Nutritional policies and their implementation; Metabolic function of nutrients. Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings;

**UNIT II**

Water and energy balance: Water intake and losses; Basal metabolism- BMR; Body surface area and factors affecting BMR Formulation of diets: Classification of balanced diet; Balanced diets for various groups; Diets and disorders. Recommended dietary allowances (RDA); For various age group; According physiological status; Athletic and sports man; Geriatric persons

**UNIT III**

Malnutrition: Type of Malnutrition; Multi-factorial causes; Epidemiology of under nutrition and over nutrition; Nutrition and immunity.

**UNIT IV**

Nutrition education Assessment of nutritional status: Diet surveys; Anthropometry; Clinical examination; Biochemical assessment; Additional medical information

**UNIT V**

Blood constituents; Hormone types; Miscellaneous disorders Food fad and faddism. Potentially toxic substances in human food.

**Textbooks:**

1. Swaminathan M, Advanced Text Book on Food & Nutrition (Volume I and II) , The Bangalore Printing and Publishing Co.Ltd, Bangalore. 2006
2. Stewart Truswell, ABC of Nutrition (4th edition) , BMJ Publishing Group 2003, ISBN 0727916645.
3. Martin Eastwood, Principles of Human Nutrition , Blackwell Publishing, Boca Rotan

**Reference:**

1. Mike Lean and E. Combet ,Barasi's Human Nutrition – A Health Perspective , Second Edition CRC Press, London
2. Introduction to Human Nutrition, Micheal J. G., Susan A.L. Aedin C. and Hester H.V, Wiley-Blackwell Publication, UK 2009 , ISBN 9781405168076
3. Bogert L.J., Goerge M.B, Doris H.C., Nutrition and Physical Fitness, W.B. Saunders Company, Toronto, Canada



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A54702) NUMERICAL METHODS FOR ENGINEERS**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

**Course Outcomes:**

- Apply numerical methods to solve algebraic and transcendental equations.
- Understand fitting of several kinds of curves.
- Derive interpolating polynomials using interpolation formulae.
- Solve differential and integral equations numerically.

**UNIT I                      Solution of Algebraic & Transcendental Equations**

Introduction-Bisection Method-Iterative method-Regula falsi method-Newton Raphson method.  
System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

**UNIT II                      Curve Fitting**

Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.

**UNIT III                      Interpolation**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae  
Gauss forward and backward formula, Stirling's formula, Bessel's formula

**UNIT IV                      Numerical Integration**

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

**UNIT V                      Solution of Initial value problems to Ordinary differential equations**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

**Textbooks:**

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, PNIE.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India

**Reference Books:**

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

**Online Learning Resources:**

<https://slideplayer.com/slide/8588078/>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A56702) SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

- To provide exposure to various kinds of sensors and actuators and their engineering applications.
- To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
- To enlighten the operating principles of various sensors and actuators
- To educate the fabrication of sensors
- To identify the required sensor and actuator for interdisciplinary application

**Course Outcomes:**

- To recognize the need of sensors and actuators
- To understand working principles of various sensors and actuators
- To identify different type of sensors and actuators used in real life applications
- To exploit basics in common methods for converting a physical parameter into an electrical quantity
- To make use of sensors and actuators for different applications

**UNIT I Introduction to Sensors and Actuators**

**Sensors:** Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

**Actuators:** Functional diagram of actuators, Types of actuators and their basic principle of working: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, piezo-electric and piezo-resistive actuators, Simple applications of Actuators.

**UNIT II Temperature and Mechanical Sensors**

**Temperature Sensors:** Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

**Mechanical Sensors:** Types of Mechanical sensors and their basic principle of working: Force sensors: strain gauges, tactile sensors, Pressure sensors: semiconductor, piezoresistive, capacitive, VRP.

**UNIT III Optical and Acoustic Sensors**

**Optical Sensors:** Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors: thermal, PIR, thermopiles

**Acoustic Sensors:** Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

**UNIT IV Magnetic, Electromagnetic Sensors and Actuators**

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors and actuators, Voice coil actuators (speakers and speaker-like actuators).

**UNIT V Chemical and Radiation Sensors**

**Chemical Sensors:** Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

**Radiation Sensors:** Principle and working of Ionization detectors, Scintillation detectors, Geiger-Mueller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)



**Textbooks:**

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2<sup>nd</sup> Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

**Reference Books:**

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
5. Principles of Industrial Instrumentation By D. Patranabhis

**NPTEL courses links**

[https://onlinecourses.nptel.ac.in/noc21\\_ee32/preview](https://onlinecourses.nptel.ac.in/noc21_ee32/preview)



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A51702) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**  
**(OPEN ELECTIVE-III)**

**Course Objectives:**

- To understand synthetic principles of Nanomaterials by various methods
- To characterize the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

**Course Outcomes:**

- Understand the state of art synthesis of nano materials
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry.
- Analyze nanoscale structure in metals, polymers and ceramics
- Analyze structure-property relationship in coarser scale structures
- Understand structures of carbon nano tubes

**UNIT I**

Introduction: Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Synthetic Methods: Bottom-Up approach: Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

**UNIT II**

Top-Down approach: Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling.

**UNIT III**

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

**UNIT IV**

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self-assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

**UNIT V**

Engineering Applications of Nanomaterials

**Textbooks:**

1. NANO: The Essentials: T Pradeep, McGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

**References:**

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
3. Nanomaterials Chemistry, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A01705) HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT PRACTICES**  
**(Open Elective Course-IV)**

**Course Objectives:**

- To understand safety, health and environmental management.
- To be familiar with hazard classification and assessment, hazard evaluation and hazard control, environmental issues and management
- To get exposed to accidents modeling, accident investigation and reporting, concepts of HAZOP and PHA
- To be familiar with safety measures in design and process operations.
- To get exposed to risk assessment and management, principles and methods

**Course Outcomes :**

- To understand safety, health and environmental management.
- To be familiar with hazard classification and assessment, hazard evaluation and hazard control, environmental issues and management
- To get concepts of HAZOP and PHA.
- To be familiar with safety measures in design and process operations.

**UNIT I**

Introduction to safety, health and environmental management - Basic terms and their definitions - Importance of safety - Safety assurance and assessment - Safety in design and operation - Organizing for safety.

**UNIT II**

Hazard classification and assessment - Hazard evaluation and hazard control. Environmental issues and Management - Atmospheric pollution - Flaring and fugitive release - Water pollution - Environmental monitoring - Environmental management.

**UNIT III**

Accidents modelling - Release modelling - Fire and explosion modelling - Toxic release and dispersion Modelling

**UNIT IV**

Accident investigation and reporting - concepts of HAZOP and PHA. Safety measures in design and process operations - Inserting, explosion, fire prevention, sprinkler systems.

**UNIT V**

Risk assessment and management - Risk picture - Definition and characteristics - Risk acceptance criteria - Quantified risk assessment - Hazard assessment - Fatality risk assessment - Risk management principles and methods.

**Textbooks:**

1. Process Safety Analysis, by Skelton. B, Gulf Publishing Company, Houston, 210pp., 1997.
2. Risk Management with Applications from Offshore Petroleum Industry, by TerjeAven and Jan Erik Vinnem, Springer, 200pp., 2007.

**Reference Books:**

1. Introduction to Safety and Reliability of Structures, by Jorg Schneider
2. Structural Engineering Documents Vol. 5, International Association for Bridge and Structural Engineering (IABSE), 138pp., 1997.
3. Safety and Health for Engineers, by Roger L. Brauer, John Wiley and Sons Inc. pp. 645-663, 2006.
4. Health, Safety and Environmental Management in Offshore and Petroleum Engineering, Srinivasan Chandrasekaran, John Wiley and Sons, 2016.

**Online Learning Resources:**

<https://nptel.ac.in/courses/114106017>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A02705) RENEWABLE ENERGY SYSTEMS**  
**(Open Elective Course – IV)**

**Course Objectives:**

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

**Course Outcomes:**

- Understand various alternate sources of energy for different suitable application requirements
- Understand the concepts of solar energy generation strategies and wind energy system
- Analyze Solar and Wind energy systems
- Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass and fuel cells

**UNIT I SOLAR ENERGY**

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

**UNIT II PV ENERGY SYSTEMS**

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

**UNIT III WIND ENERGY**

Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

**UNIT IV GEOTHERMAL ENERGY**

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

**UNIT V MISCELLANEOUS ENERGY TECHNOLOGIES**

**Ocean Energy:** Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.

**Bio mass Energy:** Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

**Fuel cell:** Principle of working of various types of fuel cells and their working, performance and limitations.

**Textbooks:**

1. Stephen Peake, “Renewable Energy Power for a Sustainable Future”, Oxford International Edition, 2018.
2. G. D. Rai, “Non-Conventional Energy Sources”, 4<sup>th</sup> Edition, Khanna Publishers, 2000.





**Reference Books:**

1. S. P. Sukhatme, “Solar Energy”, 3<sup>rd</sup> Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
2. B H Khan , “ Non-Conventional Energy Resources”, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma, “Non-Conventional Energy Resources”, 3<sup>rd</sup> Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, “Renewable Energy Resource: Basic Principles and Applications”, Narosa Publishing House, 2004.

**Online Learning Resources:**

1. <https://nptel.ac.in/courses/103103206>
2. <https://nptel.ac.in/courses/108108078>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**

**(20A03705) INTRODUCTION TO COMPOSITE MATERIALS**  
**(Open Elective-IV)**

**Course Objectives:**

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

**Course Outcomes:**

- Identify the practical applications of composites. (L3)
- Identify the polymer matrix composites. (L3)
- Classify of bio- degradable composites. (L2)
- Outline the various types of ceramic matrix materials. (L2)

**UNIT I Introduction to composites**

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

**UNIT II Polymer matrix composites**

Polymers - Polymer matrix materials – PMC processes - hand layup processes – spray up processes – resin transfer moulding – Pultrusion – Filament winding – Auto clave based methods - Injection moulding – sheet moulding compound – properties and applications of PMCs.

**UNIT III Metal matrix composites**

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMCs.

**UNIT IV Ceramic matrix composites**

Ceramic matrix materials – properties – processing of CMCs –Sintering - Hot pressing – Infiltration – Lanxide process – Insitu chemical reaction techniques – solgel polymer pyrolysis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

**UNIT V Advances & Applications of composites**

Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications. Bio degradability, introduction of bio composites, classification, processing of bio composites, applications of bio composites - Mechanical, Biomedical, automobile Engineering.

**Textbooks:**

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

**Reference Books:**

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME Publications, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bio plastics & Bio composites for Engineering applications, John Wiley publications, 2011.

**Online Learning Resources:**

- <https://nptel.ac.in/courses/112104229>
- <https://nptel.ac.in/courses/112104168>
- <https://nptel.ac.in/courses/101104010>
- <https://nptel.ac.in/courses/105108124>
- <https://nptel.ac.in/courses/112104221>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A05705a) CYBER SECURITY**  
**(Open Elective-IV)**

**Course Objectives:**

The course is designed to provide awareness on different cyber crimes, cyber offenses, tools and methods used in cybercrime.

**Course Outcomes:**

- Classify the cybercrimes and understand the Indian ITA 2000
- Analyse the vulnerabilities in any computing system and find the solutions
- Predict the security threats of the future
- Investigate the protection mechanisms
- Design security solutions for organizations

**UNIT I Introduction to Cybercrime**

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

**UNIT II Cyber Offenses: How Criminals Plan Them**

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

**UNIT III Cybercrime: Mobile and Wireless Devices**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

**UNIT IV Tools and Methods Used in Cybercrime**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

**UNIT V Cyber Security: Organizational Implications**

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

**Textbooks:**

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

**Reference Books:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin. CRC Press T&F Group

**Online Learning Resources:**

<http://nptel.ac.in/courses/106105031/40>  
<http://nptel.ac.in/courses/106105031/39>  
<http://nptel.ac.in/courses/106105031/38>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A05705b)INTRODUCTION TO FULL STACK DEVELOPMENT**  
**(Open Elective Course – IV)**

**Course Objectives:**

- To build foundation on HTML this will help developer to use HTML concepts for building responsive web application.
- To Develop HTML based Single application for Browsers.
- To Understand OOPs concepts and its applications by building competency in object –oriented Programming.
- To implement frontend and backend scenarios using Web Sockets.
- To become proficient in Bootstrap concepts.

**Course Outcomes:**

- Able to how to program a browser like using JavaScript, jQuery, Angular, or Vue.
- Distinguishing trends in multi-device implementation.
- Create webpages that function using external data.
- Disambiguate the different structures that a no SQL database may represent.
- Derive information from data and implement data into applications.

**UNIT I**

**e The Modern Web:** Rise of the Web, Mobile Web, The State of HTML, Applications vs Web Sites, Keeping Up.

**Planning Your Work: Identifying** Requirements, Defining the Work, Tracking the Work Continuous Improvement, Prioritization & Estimation, Managing Bugs, Continuous Delivery

**User Experience:** Information Architecture, Getting the User Experience Right, Polishing the User Experience, Implementing the User Experience.

**UNIT II**

**Designing Systems:** System Architectures, Identifying Concepts, Identifying User Interactions, Handling Commonalities, Working with Legacy and External Dependencies, Component Interactions, Applications vs. Modules, Cross-Functional Requirements, Caching, Designing for Failure, Designing Modules, Refactoring, Tools, Changing Your Architecture.

**Ethics:** Privacy, Cognitive Load, Energy Usage, Trust.

**Front End:** HTML, From Server to Browser, Styling, Components, Responsive Design, Progressive Enhancement to Progressively Enhance, or Not? Mobile First, Feature Detection, Progressive Enhancement of Style, When Not Using Progressive Enhancement, Search Engine Optimization, Build Tools.

**UNIT III**

**Testing:** Test-Driven Development, Test Pyramid, Behaviour-Driven Development, Three Amigos, Manual Testing, Visual Testing, Cross-Functional Testing,

**JavaScript:** Asynchronicity, JavaScript in the Browser, Offline-First Development, Document Object Model, Server-Side JavaScript, Table of Contents viii JavaScript Modules, Structuring Your JavaScript, JavaScript Types, Object-Oriented Programming, Functional Programming, Communicating Between Components, Connecting Components Together, Testing, Build Tools.

**Accessibility:** Accessible from the Start, Working with Assistive Technologies, Dealing with Interactive UI, Testing for Accessibility, Avoiding Common Mistakes.

**UNIT IV**

**APIs:** API Responsibilities, designing a REST API, Securing Your API, Event-Based APIs, Discovering APIs, Using APIs

**Storing Data:** Types of Databases, To SQL, or NoSQL?, Where to Store Your Data, Accessing Data from Your App, Managing Your Data, Protecting Your Data.

**Security:** Trust, Responding to Incidents, The Golden Rule, Threats, Security Checklists, Passwords, Indirect Attacks.



## UNIT V

**Deployment:** Twelve Factor Apps, Developer Machines, Production Environments, Moving Code into Production, Configuring Your Box, Infrastructure, Immutable Infrastructure, Continuous Delivery & Continuous Deployment.

**In Production:** Fire Drills, Run Books, Monitoring, Responding to Incidents

**Constant Learning:** Collecting, Experiments, Analysing Results, Hypothesis-Driven.

### Textbook:

1. Chris Northwood, The full Stack Developer, Apress, 2018.

### Reference Books:

1. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, Frank Zammetti.
2. Full Stack Web Development for Beginners, Riaz Ahmed.

### Online Learning Resources:

1. Learn Full Stack Web Development with 40+ Projects and Exercises | Udemy



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A27705) WASTE AND EFFLUENT MANAGEMENT**  
**(OPEN ELECTIVE-IV)**

**Course Objectives:**

- To understand the wastewater treatment process.
- To gain knowledge on waste disposal in various ways.
- To know about advances in wastewater treatment.

**Course Outcomes:**

- Acquires knowledge on technologies used for chemical and biological methods of waste water and effluent treatment

**UNIT I**

Wastewater Treatment an Overview: Terminology – Regulations – Health and Environment Concerns in waste water management – Constituents in waste water inorganic – Organic and metallic constituents. Process Analysis and Selection: Components of waste water flows – Analysis of Data – Reactors used in waste water treatment – Mass Balance Analysis – Modeling of ideal and non ideal flow in Reactors – Process Selection

**UNIT II**

Waste disposal methods – Physical, Chemical & Biological; Economical aspects of waste treatment and disposal. Treatment methods of solid wastes: Biological composting, drying and incineration; Design of Solid Waste Management System: Landfill Digester, Vermicomposting Pit.

**UNIT III**

Introduction: Classification and characterization of food industrial wastes from Fruit and Vegetable processing industry, Beverage industry; Fish, Meat & Poultry industry, Sugar industry and Dairy industry.

Chemical Unit Processes: Role of unit processes in waste water treatment chemical coagulation – Chemical precipitation for improved plant performance chemical oxidation – Neutralization – Chemical Storage

**UNIT IV**

Biological Treatment: Overview of biological Treatment – Microbial metabolism – Bacterial growth and energetics – Aerobic biological oxidation – Anaerobic fermentation and oxidation – Trickling filters – Rotating biological contractors – Combined aerobic processes – Activated sludge film packing.

**UNIT V**

Advanced Wastewater Treatment: Technologies used in advanced treatment – Classification of technologies. Removal of Colloids and suspended particles – Depth Filtration – Surface Filtration – Membrane Filtration- Absorption – Ion Exchange – Advanced oxidation process.

**Textbooks:**

1. Herzka A & Booth RG; “Food Industry Wastes: Disposal and Recovery”; Applied Science Pub Ltd. 1981,
2. Fair GM, Geyer JC & Okun DA; “Water & Wastewater Engineering”; John Wiley & Sons, Inc. 1986,

**References:**

1. GE; “Symposium: Processing Agricultural & Municipal Wastes”; AVI. 1973,
2. Inglett Green JH & Kramer A; “Food Processing Waste Management”; AVI. 1979,
3. Rittmann BE & McCarty PL; “Environmental Biotechnology: Principles and Applications”; Mc-Graw-Hill International editions 2001,.
4. Bhattacharyya B C & Banerjee R; “Environmental Biotechnology”; Oxford University Press.
5. Bartlett RE; “Wastewater Treatment; Applied Science” Pub Ltd.
6. G. Tchobanoglous, FI Biston, “Waste water Engineering Treatment and Reuse”: Mc Graw Hill, 2002.
7. “Industrial Waste Water Management Treatment and Disposal by Waste Water” 3<sup>rd</sup> Edition Mc Graw Hill 2008



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A54703) NUMBER THEORY AND ITS APPLICATIONS**  
**(OPEN ELECTIVE-IV)**

**Course Objectives:**

This course enables the students to learn the concepts of number theory and its applications to information security.

**Course Outcomes:**

- Understand number theory and its properties.
- Understand principles on congruences
- Develop the knowledge to apply various applications
- Develop various encryption methods and its applications.

**UNIT I Integers, Greatest common divisors and prime Factorization**

The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations

**UNIT II Congruences**

Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruences

**UNIT III Applications of Congruences**

Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem- Pseudo primes- Euler's theorem- Euler's  $\phi$ -function- The sum and number of divisors- Perfect numbers and Mersenne primes.

**UNIT IV Finite fields & Primality, factoring**

Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-fermat factorization and factor bases.

**UNIT V Cryptology**

Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers-Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science.

**Textbooks:**

1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories.
2. A course in Number theory & Cryptography, Neal Koblitz, Springer.

**Reference Books:**

1. An Introduction To The Theory Of Numbers, Herbert S. Zuckerman, Hugh L. Montgomery, Ivan Niven, wiley publishers
2. Introduction to Analytic number theory-Tom M Apostol, springer
3. Elementary number theory, VK Krishnan, Universities press

**Online Learning Resources:**

<https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications>



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem** **L T P C**  
**3 0 0 3**  
**(20A56703) SMART MATERIALS AND DEVICES**  
**(OPEN ELECTIVE-IV)**

**Course Objectives:**

- To provide exposure to smart materials and their engineering applications.
- To impart knowledge on the basics and phenomenon behind the working of smart materials
- To enlighten the properties exhibited by smart materials
- To educate various techniques used to synthesize and characterize smart materials
- To identify the required smart material for distinct applications/devices

**Course Outcomes:**

- to recognize the need of smart materials
- to understand the working principles of smart materials
- to know different techniques used to synthesize and characterize smart materials
- to exploit the properties of smart materials
- to make use of smart materials for different applications

**UNIT I**

**Introduction:** Historical account of the discovery and development of smart materials, Two phases: Austenite and Martensite, Temperature induced phase changes, Shape memory effect, Pseudoelasticity, One-way shape memory effect, Two-way shape memory effect.

**UNIT II: Properties of Smart Materials:** Physical principles of optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials

**UNIT III: Synthesis of smart materials:** Solid state reaction technique, Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Co-precipitation. Green synthesis, Mechanical alloying and Thin film deposition techniques: Chemical etching, Sol-gel, spray pyrolysis.

**UNIT IV: Characterization techniques:** X-ray diffraction, Raman spectroscopy (RS), Fourier-transform infrared reflection (FTIR), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy, Atomic force microscopy (AFM) and Differential Scanning Calorimetry (DSC).

**UNIT V: Materials and Devices:** Characteristics of shape memory alloys, Magnetostrictive, Optoelectronic, Piezoelectric, Metamaterials, Electro-rheological and Magneto-rheological materials and Composite materials.

Devices based on smart materials: Sensors & Actuators, MEMS and intelligent devices, Future scope of the smart materials.

**Textbooks:**

1. Encyclopaedia of Smart Materials- Mel Schwartz, John Wiley & Sons, Inc.2002
2. Smart Materials and Structures - M. V. Gandhi and B.S. Thompson, Chapman and Hall, 1992

**References:**

1. Smart Materials and Technologies- M. Addington and D. L. Schodek, , Elsevier, 2005.
2. Characterization and Application of smart Materials -R. Rai, Synthesis, , Nova Science, 2011.
3. Electroceramics: Materials, Properties, Applications -A.J. Moulson and J.M. Herbert, 2<sup>nd</sup>Edn., John Wiley & Sons, 2003.
4. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic 1. Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, 2002.
5. Optical Metamaterials: Fundamentals and Applications -W. Cai and V. Shalaev, springer,2010.
6. Smart Materials and Structures - P. L Reece, New Research, Nova Science, 2007

**NPTEL courses links**

<https://nptel.ac.in/courses/112/104/112104173/>

<https://nptel.ac.in/courses/112/104/112104251/>

[https://nptel.ac.in/content/storage2/courses/112104173/Mod\\_1\\_smart\\_mat Lec](https://nptel.ac.in/content/storage2/courses/112104173/Mod_1_smart_mat Lec)





**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR**  
**B.Tech IV-I Sem**

**L T P C**  
**3 0 0 3**

**(20A51703) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (OPEN ELECTIVE-IV)**

**Course Objectives:**

- Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
- Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

**Course Outcomes:**

- Recognize and acquire green chemistry concepts and apply these ideas to develop respect for the interconnectedness of our world and an ethic of environmental care and sustainability.

**UNIT I: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY**

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

**UNIT II: CATALYSIS AND GREEN CHEMISTRY**

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C-C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

**UNIT III: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS**

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbon dioxide, super critical water and water as a reaction solvent: water-based coatings, Ionic liquids as catalyst and solvent

**UNIT IV: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES**

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Renewable Feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

**UNIT V: GREEN PROCESSES FOR GREEN NANOSCIENCE**

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

**Textbooks:**

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4<sup>th</sup> Edition, Oxford University Press, USA

**References:**

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8:Green Nanoscience, wiley-VCH, 2013.