# Detailed Syllabus
## Lab-wise Breakup

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|---|---|---|---|
| **Course Code** | 16B1NEC832 | **Semester Odd (specify Odd/Even)** | **Semester** 7th **Session** 2021 -2022 **Month from** July - Dec |
| **Course Name** | MIMO-OFDM APPLICATION TO WIRELESS COMMUNICATION | | |
| **Credits** | 3 | **Contact Hours** | 3 |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Pankaj Yadav |
| | **Teacher(s) (Alphabetically)** | Pankaj Yadav |

| COURSE OUTCOMES: At the completion of the course, students will be able to: | | **COGNITIVE LEVELS** |
|---|---|---|
| **C310. 1** | Understand concepts of MIMO diversity, OFDM and various generation wireless communication | Understanding Level (C2) |
| **C310.2** | Analyze effect of frequency offset, channels and its importance in real life communication systems. | Applying Level (C4) |
| **C310.3** | Identify theoretical and practical requirements for implementing MIMO OFDM | Applying Level (C4) |
| **C310.4** | Analyze the different Systems of future communication | Analyzing Level (C4) |

| Module No. | Subtitle of the Module | Topics in Module | No. of Lectures |
|---|---|---|---|
| 1. | Introduction | Introduction to wireless networks, basic principles of orthogonality, Single vs multi carrier systems, orthogonal frequency-division multiplexing (OFDM) block diagram, modulation, demodulation, synchronization, peak-to-average power ratio (PAPR) reduction. | 8 |
| 2. | ICI cancellation | Inter carrier interference (ICI) cancellation , ICI self cancellation, correlative coding based ICI cancellation, conjugate cancellation etc. | 6 |
| 3. | PAPR reduction | Various PAPR reduction techniques, clipping and filtering/Windowing, selective mapping (SLM), partial transmit sequence (PTS),tone reservation (TR), tone injection, peak insertion (PI) techniques etc | 4 |
| 4. | MIMO systems | MIMO channel model, antenna diversity, space-time coding, MIMO detection algorithms, channel capacity | 4 |
| 5 | MIMO OFDM in 4G/LTE Networks | LTE, LTE advance, beam forming for LTEA, | 10 |
| 6 | MIMO OFDM in 5G Networks | Introduction to 5G-NR, Massive MIMO, beam forming in 5G-NR | 10 |
| | | **Total number of Lectures** | **42** |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |

| | |
|---|---|
| End Semester | 35 |
| TA | 25 |
| **Total** | **100** |

**Project Based Learning**: Student will be able to develop code for computing PAPR, MIMO detection Algorithm

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. (Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

| | |
|---|---|
| **1.** | MIMO-OFDM Wireless Communications with MATLAB , by Yong Soo Cho, Jaekwon Kim, Won Young Yang, Chung-Gu Kang , Wiley, 2018. |
| **2.** | OFDM for Wireless Communication Systems, Ramjee Prasad, ARTECH house |

**Detailed Syllabus**

**Lecture-wise Breakup**

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|---|---|---|---|
| **Subject Code** | **20B12EC413** | **Semester (Odd)** | **Semester VII Session – 2021- 2022 Month Jul. – Dec. 2021** |
| **Subject Name** | **Basics of Antenna and Wave Propagation** | | |
| **Credits** | 4 | **Contact Hours** | 4 (3 - 1 – 0) |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Vishal Narain Saxena, Mr. Abhay Kumar |
| | **Teacher(s) (Alphabetically)** | Mr. Abhay Kumar, Prof. Shweta Srivastava<br>Vishal Narain Saxena |

**Course Objectives:**

- To introduce the fundamental principles of different types of antennas and their applications.
- Emphasis will be on dipole antennas, loop antennas, antenna arrays, aperture antennas and microstrip patch antennas, their design considerations for use in wireless communication systems.
- Learn how to characterize antennas and use antenna design for communications, radar, remote sensing systems.
- Emphasis on modern antennas like Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and propagation of radio waves

| S. No. | Course Outcomes | Cognitive Levels/ Blooms Taxonomy |
|---|---|---|
| **C433-8.1** | Recall the concepts of Electromagnetic field theory, classify different types of antennas, illustrate antenna parameters and demonstrate the effect on antenna parameters due to changes in the physical dimensions. | Understanding Level (C2) |
| **C433-8.2** | Compare Broadband Antennas, Frequency Independent antennas and Aperture antennas. Explain Dipole antenna and their characteristic, loop antenna | Applying Level (C3) |
| **C433-8.3** | Design Array Antennas and identify the E and H fields for the antennas. Design Reconfigurable antenna, Active antenna, Dielectric antennas and measure radiation pattern, polarization and VSWR. | Creating Level (C6) |
| **C433-8.4** | Define terminology relevant to mode of propagation and examine the propagation of radio waves in different atmospheres. | Analyzing Level (C4) |

| Module No. | Subtitle of the Module | Topics | No. of Lectures |
|---|---|---|---|
| **1.** | Radiation Fundamentals & | Antenna types, radiation, use of potential functions, radiated fields, far fields, Radiation from current | 8 |

| | | | |
|---|---|---|---|
| | Antenna Parameters | element, Infinitesimal dipole, antenna parameters, radiation pattern, Directivity, numerical evaluation of directivity, Gain, efficiency, impedance, Loss resistance, Polarization, equivalent area, effective area and its relation to gain | |
| **2.** | Linear Antennas Loop Antennas | Linear antennas, current distribution Total power, radiation resistance, Short-dipole, center-fed dipole, Half-wave dipole, dipole characteristics, folded dipole, Small loop antenna, Loop characteristics | 7 |
| **3.** | Antenna Arrays | Antenna arrays, Broadside and End-fire arrays, Hansen-Woodyard array, Binomial arrays, Array theory Scan blindness in array theory ,Aperiodic arrays | 7 |
| **4.** | Broadband Antennas, Frequency Independent antennas & Aperture antennas | Yagi-Uda arrays, helical antennas Log-periodic antenna Fields as sources of radiation; Horn antennas, Reflector antennas | 7 |
| **5.** | Modern antennas- | Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements - Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR | 6 |
| **6.** | Propagation of Radio Waves | Modes of propagation , Structure of atmosphere, Ground wave propagation , Free Space Wave Propagation, Ground Reflection, Surface Waves, Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept, Ionospheric propagation, Sky wave propagation – Virtual height, critical frequency , Maximum usable frequency – Skip distance, Fading , Multi hop propagation, Electrical Properties of Ionosphere | 8 |
| | | **Total number of Lectures** | 43 |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 |
| **Total** | **100** |

**Project based learning:** Each student in a group of 4-5 will do project based on antenna designing and measurement. Each group will assign designing problems on different types of antenna with its real time applications. Apart from course different research paper will provide to the students then based on the research data students will solve different design problem and do discussion in class.

| **Recommended Reading** (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format) | |
|---|---|
| **1.** | John D. Kraus & RJ Marhefka, Antennas for all applications, The McGraw-Hill Companies, 5th edition, 2017 |
| **2.** | C.A. Balanis, Antenna Theory, Analysis and Design. NY: John Wiley and Sons, 4th edition, 2016. |
| **3.** | WL Stutzman& GA Thiele, Antenna Theory and Design , John Wiley and Sons, 2nd edition,1997 |
| **4.** | Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2015 |

**Detailed Syllabus**
**Lecture-wise Breakup**

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|---|---|---|---|
| **Course Code** | 15B1NEC733 | **Semester** ODD **(specify Odd/Even)** | **Semester** 7th **Session** 2021-2022 **Month from** July to Dec |
| **Course Name** | Fundamentals of Embedded Systems | | |
| **Credits** | 4 | **Contact Hours** | 3L+ 1T |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Dr. Rachna Singh |
| | **Teacher(s) (Alphabetically)** | |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| C431-4.1 | Understanding of the fundamental concepts for embedded systems designandcomplete architecture of the ATMEGA16/32 microcontroller. | Understanding Level (C2) |
| C431-4.2 | Identify various on chip peripherals of the ATMEGA16/32 microcontroller and make use of them for designing embedded applications. | Applying Level (C3) |
| C431-4.3 | Experiment the basic concepts of embedded 'C' programming and make use of them in designing embedded system applications around various sensors and actuators. | Analyzing Level (C4) |
| C431-4.4 | Understanding of the basic concept of RTOS, detailed study of ARM7 architecture (32 bit) and study of wireless protocols. | Understanding Level (C2) |

| **Module No.** | **Title of the Module** | **Topics in the Module** | **No. of Lectures for the module** |
|---|---|---|---|
| **1.** | Fundamental for Embedded Developers. | Embedded System and its applications, Future Trends of Embedded System, Design Parameters of Embedded System and its significance, Microprocessor Versus Microcontrollers, Microcontrollers for Embedded Systems, Embedded Versus External Memory Devices, CISC Versus RISC Processors, and Harvard Versus Von-Neumann architecture. | 4 |
| **2.** | Detailed Study of AVR Microcontroller | ATmega16/32 Microcontroller (Basic architecture, Pin configuration, Memory organization (registers and i/o ports), Embedded C programming, Timers, on chip PWM, on chip ADC, Interrupts and Serial Communication. | 10 |
| **3.** | Concept of Embedded 'C' programming | Introduction to C, Difference between C and Embedded C, Data Types used in Embedded C, Arithmetic & Logical Operators, Control Flow, If & If – else, While & Do – while, For, Switch & Case, Continue & Break, Array & String, Functions and Header files, Pointers. | 6 |
| **4.** | Real World Interfacing with Microcontroller | Interfacing of single LED, Blinking of LED with timer and without timer, Interfacing of push-button and LED, Interfacing of 7-segment display, Interfacing of 8 push-buttons to control 7-segment display, Intelligent LCD Display, Interfacing of intelligent LCD display, Interfacing of Matrix Keyboard to control 7-segment display, ADC and | 12 |

| | | | |
|---|---|---|---|
| | | DAC Modules, Interfacing of ADC0804, Interfacing with DAC0808, Different wave generation through DAC0808, Stepper Motor & DC Motor, Interfacing with stepper & DC motor, Different Sensor Interfacing, (IR Sensor, DTMF, Temperature Sensor) | |
| **5.** | Concept of RTOS and Advanced Microprocessor | Real Time Operating System (RTOS), Types of real time tasks, Task Periodicity, Process state diagram, Kernel and Scheduler, Scheduling algorithms, Shared data (Resource) and Mutual Exclusion, Semaphore, Introduction to ARM, Features, ARM Pipeline, Instruction Set Architecture (ISA), Thumb Instructions, Exceptions in ARM, Embedded Wireless Protocols (Infrared Data Association (IrDA), Bluetooth, IEEE 802.11). | 10 |
| | | **Total number of Lectures** | **42** |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Assignments&Quiz) |
| **Total** | **100** |

**Project Based Learning Component:** This course teaches embedded system design using a building block approach, which allows one to visualize the requirement of an embedded system and then to design it efficiently. Learning out Embedded Systems will give the skills to design and manufacture embedded system products of the future which will help participants towards better employability. The course will teach embedded system design using a microcontroller, namely ATMEL Corporation ATmega16/32 microcontroller and also introduced the concept of advanced microprocessor of ARM family. The course will introduce various interfacing techniques for popular input devices including sensors, output devices and communication protocols. It will also teach effective embedded programming techniques in C and RTOS. It will have a significant practical component, which will be achieved by distributing different minor projects to group of students.

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)


| | |
|---|---|
| **1.** | Muhammad Ali Mazidi, "The AVR microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Pearson Education, 2008. |
| **2.** | Frank Vahid / Tony Givargis, "Embedded System Design", Willey India, 2002. |
| **3.** | Santanu Chattopadhyay, "Embedded System Design", 1st Edition,PHI Learning, 2010. |

# Detailed Syllabus

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|---|---|---|---|
| **Course Code** | 15B19EC793 | **Semester -:** Odd (specify Odd/Even) | **Semester-: 7th Session** 2021-22 **Month- :** July - December |
| **Course Name** | Summer Training Viva | | |
| **Credits** | Qualifying | **Contact Hours** | - |

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|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Dr. Bajrang Bansal, Mrs. Smriti Bhatnagar |
| | **Teacher(s)** | Dr. Bajrang Bansal, Dr. Ashish Gupta, Mrs. Smriti Bhatnagar, Mr. Mandeep Narula |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| C455.1 | Extend theoretical knowledge to real time Industry | Understanding Level (C2) |
| C455.2 | Demonstrate the capacity for critical reasoning and independent learning | Understanding Level (C2) |
| C455.3 | Make use of Industrial Training experience to prepare a scientific report | Applying Level (C3) |
| C455.4 | Develop greater clarity about career goals in present condition | Applying Level (C3) |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| Viva | 25 |
| Real world idea and knowledge of Industry | 25 |
| Report | 25 |
| Diary | 25 |
| **Total** | **100** |

**Detailed Syllabus**
**Lecture-wise Breakup**

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|---|---|---|---|
| **Subject Code** | 17B11EC733 | **Semester:** Odd **(specify Odd/Even)** | **Semester:** 7th **Session:** 2021-22 **Month :** from July to December |
| **Subject Name** | Optical Communication | | |
| **Credits** | 4 | **Contact Hours** | 3(L)+1(T) |

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|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Dr. Kaushal Nigam (JIIT-128) and Dr. Neetu Joshi (JIIT-62) |
| | **Teacher(s) (Alphabetically)** | |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| **C412.1** | Develop an understanding of optical fiber, its structure, types, and propagation and transmission properties. | Remembering (C1) |
| **C412.2** | Identify and examine the different kinds of losses and signal distortion in optical Fibers. | Analyzing (C4) |
| **C412.3** | Classify the Optical sources and detectors and their principle of operation . | Understanding (C2) |
| **C412.4** | Design a fiber optic link based on budget analysis. | Evaluating (C5) |

| **Module No.** | **Subtitle of the Module** | **Topics** | **No. of lectures for the module** |
|---|---|---|---|
| **1.** | Overview of Optical fiber Communications | Electromagnetic Spectrum, Historical development and advantages of optical fiber communication, Elements of optical fiber transmission link, Optical laws and definitions, optical fiber modes and configurations. | 3 |
| **2.** | Optical fibers Structures | Optical fiber wave guides, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays. Cylindrical fibers Modes, V Number, Mode Coupling, Step Index fibers, Graded Index fibers. Single mode | 4 |

| | | | |
|---|---|---|---|
| | | fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. | |
| **3.** | Signal Degradation in Optical fibers | Signal distortion in optical fibers- Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses. Information capacity, Group delay, Types of Dispersion - Material dispersion, Wave-guide dispersion, Polarization mode dispersion, Intermodal dispersion, Pulse broadening. Optical fiber Connectors- Connector types, Single mode fiber connectors, Connector return loss. | 7 |
| **4.** | Optical Sources | Light emitting diode (LEDs)-structures, materials, Figure of merits, Quantum efficiency, Power, Modulation, Power bandwidth product. Laser Diodes - Modes & threshold conditions, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, temperature effects, external quantum efficiency, and laser diode rate equations. Reliability of LED & ILD. | 6 |
| **5.** | Power Launching and Coupling | Source to fiber power launching: - Output patterns, Power coupling, Power launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling, LED coupling to single mode fiber. Fiber Splicing- Splicing techniques, splicing single mode fibers. Multimode fiber joints and single mode fiber joints. Fibre alignment and joint loss. | 6 |
| **6.** | Photo detectors& Receivers | Optical detectors- Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation:- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Probability of error, Quantum limit, Analog receivers. | 7 |

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|---|---|---|---|
| **7.** | Optical System Design | Considerations, component choice, multiplexing.Point-to- point links, System considerations, Link considerations. Overall fiber dispersion in multi mode and single mode fibers. Rise time considerations. Distance consideration in optical transmission system. Line coding in Optical links, WDM Principles & Types of WDM, Measurement of Attenuation and Dispersion, Eye pattern. | 7 |
| | | **Total number of lectures** | 40 |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (Assignment, quiz, attendance) |
| **Total** | **100** |

**Project Based Learning:** Students will learn about fundamental concepts, working and applications of an optical communication system. Understanding of various losses in an optical link provide requisite skills in design, analysis and evaluation of the performance of analog and digital optical fiber link. Students will be able to design an optical link with the given specifications. Designing based questions given in the assignments built-up the thought process of the students in the field applications.

**Recommended Reading**(Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)


| | |
|---|---|
| **1.** | Govind P. Agarwal, Fiber Optic Communication Systems, 5th Edition, John Wiley, 2021. |
| **2.** | Gerd Keiser, Optical Fiber Communications, 5th Edition, Mc Graw-Hill International Edition, 2017. |
| **3.** | John M. Senior, Optical Fiber Communications, 5th Edition, PHI, 2014. |
| **4.** | D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Fiber Optic Communications, Pearson Education, 2005. |
| **5.** | Joseph C. Palais, Fiber Optic Communications, 5th Edition, Pearson Education, 2005 |

**Detailed Syllabus**
**Lecture-wise Breakup**

| | | | |
|---|---|---|---|
| **Course Code** | 18B12EC413 | **Semester** ODD Sem | **Semester -VII Session** 2021 -2022<br>**Month from** Aug-Dec |
| **Course Name** | Digital Control Systems | | |
| **Credits** | 3 | **Contact Hours** | 3L+1T |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Ritesh Kumar Sharma |
| | **Teacher(s) (Alphabetically)** | Ritesh Kumar Sharma |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| **C434-8.1** | To represent the systems in the Z domain and in state space representation. | Remembering Level(C1) |
| **C434-8.2** | To analyze transient and steady state behaviors of linear discrete time control systems with modified transfer function. | Analyzing Level (C4) |
| **C434-8.3** | To understand and gain knowledge in stability analysis of digital control systems. | Understanding Level (C2) |
| **C434-8.4** | To Design Digital Control Systems | Designing Level (C6) |

| **Module No.** | **Subtitle of the Module** | **Topics** | **No. of Lectures** |
|---|---|---|---|
| **1.** | Review of Z transform | z transform and inverse z transform .<br>Relationship between s- plane and z- plane- Difference equation . Solution by recursion and z-transform. | 3 |
| **2.** | Review of state space techniques | Review of state space techniques to continuous data systems, state space representation of discrete time systems- Transfer function from state space model-various canonical forms- conversion of transfer function model to state space model-characteristics equation- solution to discrete state equations. | 5 |
| **3.** | Introduction to Digital Control System | Basic Elements of discrete data control systems, advantages of discrete data control systems, examples. Signal conversion & processing: Digital signals & coding, data conversion & quantization, sample and hold devices, Mathematical modeling of the sampling process; Data reconstruction and filtering of sampled signals: Zero order hold, first order Hold. | 8 |
| **4.** | Analysis of Digital Control Systems | Digital control systems- Pulse transfer function .<br>analysis of closed loop and open loop systems in z domain, Modified z- transfer function- Stability of linear digital control systems and Jury's stability test | 8 |
| **5.** | Stability tests | Stability tests- Steady state error analysis, Root loci ,Frequency domain analysis- Bode plots, Gain margin and phase margin. | 8 |
| **6.** | State feedback concept | Controllability and Observability - Response between sampling instants using state variable approach, Pole placement using state feedback . | 5 |
| **7.** | Digital System Design | Observer Design for digital control, Pole placement design based on input-output models. | 5 |

| | |
|---|---|
| **Total number of Lectures** | **42** |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 |
| **Total** | **100** |

Project Based Learning: Students will learn about the analysis and Design of Digital controllers with the help of assignments/simulations based projects. Some designing and simulation based problems will be assigned to students.

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)


| | |
|---|---|
| **1.** | B. C. Kuo , "Digital control systems" (Second Edition) , Oxford University Press,2007. |
| **2.** | K. Ogatta, "Discrete Time control systems ", 2nd ed. PHI),1995 |
| **3.** | M. Gopal, "Digital Control and State Variable Methods", 3rd Edition, TMH, Sep-2008. |
| **4.** | G. F. Franklin, J. D. Powell, M. Workman, Digital Control of Dynamic Systems, 3rd Edition, Longman, 1998. |

**Detailed Syllabus**

Lecture-wise Breakup

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|---|---|---|---|
| **Course Code** | 19B12EC416 | **Semester** odd | **Semester** 7th **Session** 2021 -2022<br>**Month from** August 21 to December 21 |
| **Course Name** | Deep Learning for Multimedia | | |
| **Credits** | 4 | **Contact Hours** | 3-1-0 |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Mr.B.Suresh |
| | **Teacher(s) (Alphabetically)** | Mr.B.Suresh |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| **C431-7.1** | Compare various loss functions and optimization methods for deep learning approaches | Understanding Level (C2) |
| **C431-7.2** | Experiment with various CNN architectures for related applications | Applying Level (C3) |
| **C431-7.3** | Apply and analyze sequence models for natural language processing | Analyzing Level (C4) |
| **C431-7.4** | Utilize and compare various deep learning techniques in real life problems | Evaluating Level (C5) |

| **Module No.** | **Title of the Module** | **Topics in the Module** | **No. of Lectures for the module** |
|---|---|---|---|
| **1.** | Introduction to Neural Networks, Loss Functions and Optimization | Neuron Model and Network Architectures: Perceptron and Hamming networks. Perceptron learning rule and proof of convergence. Performance surfaces and optimum points: Performance Optimization, Steepest Descent, Stable Learning Rates and Widrow-Hoff Learning. | 13 |
| **2.** | Backpropagation and Generalization | Backpropagation: Multilayer Perceptrons, Function Approximation, Performance Index, Chain Rule, Backpropagating the Sensitivities, Convergence, Generalization., Methods for Improving Generalization: Early Stopping, Regularization, Relationship Between Early Stopping and Regularization | 8 |
| **3.** | Convolutional Neural Network (CNN) Architectures | Review: Feed forward neural net, Layers for Conv Nets, Feature Maps and Pooling, FC layer to Conv layer conversion, CNN to Classify Text and Images: LeNet5, AlexNet, VGG, ResNet. | 10 |
| **4.** | Sequential Networks | Recurrent Neural Networks, Adding Feedback Loops and Unfolding a Neural Network, Long Short-Term Memory, Recurrent Neural Network for word predictions, Autoencoders, Different Autoencoder Architectures, Neural Language Models: Word Embeddings and Word Analogies, Word2vec. | 10 |

| | | | |
|---|---|---|---|
| | | | |
| | | **Total number of Lectures** | 41 |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 [Assignments and Quiz] |
| **Total** | **100** |

Project based learning: Each student in a group of 3-4 select a topic related to latest development in the technology and write done Algorithms and their corresponding code, This method of learning will help students to understand latest development in the industry once they land in to entry it will be a simple task to design and implement any given task. Knowledge acquired during this course will boost their confidence and clarity while attending any Interview related to placement activities and establishment of their own application based startup company related with latest and cutting edge technologies

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)


| | |
|---|---|
| **1.** | Introduction to Deep Learning, S. Kansi, Springer 2018 |
| **2.** | Pattern Recognition and Machine Learning, C.M. Bishop, 2nd Edition, Springer, 2011. |
| **3.** | Deep Learning, I. Goodfellow, Y, Bengio, A. Courville, MIT Press, 2016. |
| **4.** | The Elements of Statistical Learning , T. Hastie, R. Tibshirani, J. Friedman., 2nd Edition, 2008 |
| **5.** | Machine Learning Yearning , A. Ng, 2018 |

**Detailed Syllabus**

**Lecture-wise Breakup**

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|---|---|---|---|
| **Subject Code** | **21B12EC412** | **Semester (specify Odd/Even)** | **Semester** odd **Session** 2021-22 **Month from** July **to** Dec |
| **Subject Name** | Modeling and Simulation of Semiconductor Devices | | |
| **Credits** | 3 | **Contact Hours** | 3 |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Dr. Akansha Bansal |
| | **Teacher(s) (Alphabetically)** | |

| S. No. | Course Outcomes | Cognitive Levels/ Blooms Taxonomy |
|---|---|---|
| **CO1** | Develop an understanding of semiconductor physics, different modeling techniques and models. | Understanding Level (C2) |
| **CO2** | Perform mathematical modeling for different transport equations and given boundary conditions. | Applying Level (C3) |
| **CO3** | Analyze the electrical performances of Semiconductor devices. | Analyzing Level (C4) |
| **CO4** | Analyze the electrical performances of Optical and Photonic devices. | Analyzing Level (C4) |

| Module No. | Subtitle of the Module | Topics | No. of Lectures |
|---|---|---|---|
| **1.** | Introduction | Review of semiconductor electronics, band model for solids, Distinguish among activities of analysis, modeling, simulation and design, Transform the equivalent circuit form of a device model into a mathematical form, and vice-versa, Semi-classical Bulk Transport – Qualitative Model | 8 |
| **2.** | Fundamentals of Models | Fundamental equations for semiconductor devices: current equations, Poisson equation, study cases, continuity equations, Semi-classical Bulk Transport – EM field and Transport Equations. Drift-Diffusion Transport Model – Equations, Boundary Conditions, Mobility and Generation / Recombination | 12 |

| | | | |
|---|---|---|---|
| **3.** | Modeling and design strategy of MOSFET | MOSFET: basic theories and models, MOSFET parameters, Body effects, transconductance, speed of response, channel-length modulation, MOSFET design, control of the threshold voltage.<br><br>MOSFET Model: Structure and Characteristics, Qualitative Model, Equations, Boundary Conditions and Approximations, Surface Potential based and Threshold based solutions, Parameter Extraction | 10 |
| **4.** | Modeling and design strategy of Photonic Devices | Introduction to optical and photonic devices, Electromagnetic waves in homogeneous material, Waves scattering on interfaces and thin slabs, light cone, dispersion relation, Modeling of one-dimensional photonic crystal: physical origin of gaps, lattice defects, bound states. Photonic crystal slabs and Bloch surface wave based design. | 10 |
| **5.** | Recent Trends | Introduction to recent trends in semiconductor devices | 2 |
| | | **Total number of Lectures** | 42 |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 |
| **Total** | **100** |

Project Based Learning: Students will learn about the modeling & analysis of semiconductor devices with the help of assignments/simulations based projects. Some modeling and simulation based problems will be assigned to students.

| **Recommended Reading** (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format) | |
|---|---|
| **1.** | Sophocles J. Orfanidis, Electromagnetic Waves and Antennas, Rutgers University, 2016 |
| **2.** | Sarkar C. K., Technology Computer Aided Design: Simulation for VLSI MOSFET, 2018. |
| **3.** | Sahay S., Mamidala M. J., Junctionless Field-Effect Transistors: Design, Modeling, and Simulation, 2018. |
| **4.** | IEEE, Elsevier, and IOPscience Journals |

# Detailed Syllabus
## Lab-wise Breakup

| | | | |
|---|---|---|---|
| **Course Code** | 15B19EC791 | **Semester** Odd **(specify Odd/Even)** | **Semester** 7th **Session** 2021-22 **Month from** August to December |
| **Course Name** | Major Project Part-1 | | |
| **Credits** | 4 | **Contact Hours** | |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Mr. Shivaji Tyagi, Dr. Megha Aggarwal |
| | **Teacher(s) (Alphabetically)** | Dr. Rahul Kaushik, Dr. Sajaivir Singh |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| **CO1** | Summarize the contemporary scholarly literature, activities, and explored tools/ techniques/software/hardware for hands-on in the respective project area in various domain of Electronics Engineering. | Understanding (C2) |
| **CO2** | Analyze/ Design the skill for obtaining the optimum solution to the formulated problem with in stipulated time | Analyzing (C4) |
| **CO3** | Evaluate /Validate sound conclusions based on evidence and analysis | Evaluating (C5) |
| **CO4** | Develop the skill in student so that they can communicate effectively in both verbal and written form. | Create Level (C6) |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| Mid Sem Viva | 20 |
| Final Viva | 30 |
| Day to Day | 30 |
| Project Report | 20 |
| **Total** | **100** |

**Detailed Syllabus**
**Lecture-wise Breakup**

| | | | |
|---|---|---|---|
| **Course Code** | **16B1NHS831** | **Semester: Odd (specify Odd/Even)** | **Semester: VII Session** 2021 -2022 **Month: Aug2021 -Dec2021** |
| **Course Name** | Gender Studies | | |
| **Credits** | 3 | **Contact Hours** | 3-0-0 |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Ms. Shikha Kumari |
| | **Teacher(s) (Alphabetically)** | Ms. Shikha Kumari |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| **C401-19.1** | Demonstrate knowledge of the construct of gender and the way itintersects with other social and cultural identities ofrace, class, ethnicity andsexuality | Understanding Level (C2) |
| **C401 - 19.2** | Apply feminist and gender theory in an analysis of gender including an examination of the social construct of femininity andmasculinity | Applying Level (C3) |
| **C401- 19.3** | Analyze the ways in which societal institutions and power structures such as the family, workplace impact the material and social reality of women's lives | Analyzing Level (C4) |
| **C401-19.4** | Assess the need for Gender Sensitization and Gender Inclusivity and its practice in contemporarysettings | Evaluating Level (C5) |
| **C401- 19.5** | Evaluate and interpret information from a variety of sources including print and electronic media, film, video and other information technologies | Evaluating Level (C5) |

| **Module No.** | **Title of the Module** | **Topics in the Module** | **No. of Lectures for the module** |
|---|---|---|---|
| **1.** | **Introducing Gender Issues** | • Sex andGender<br>• Types ofGender<br>• Gender Roles<br>• Gender Division ofLabor<br>• Gender Stereotyping and GenderDiscrimination | 9 |
| **2.** | **Gender Perspectives of Body & Language** | • Socio-Cultural Perspectives ofbody<br>• Body as a Site and Articulation of PowerRelations<br>• Cultural Meaning of Female Body andWomen's Lived Experiences<br>• The Other andObjectification | 6 |
| **3.** | **Social Construction of Femininity &Feminism** | • Bio-Social Perspective ofGender<br>• Gender as AttributionalFact<br>• Feminine &Feminist<br>• Major Theorists of Feminism Challenging Cultural Notions of Femininity<br>• Feminism Today: Radical, Liberal, Socialist, Cultural, Eco feminism & Cyberfeminism<br>• Images of Women in Sports, Arts, Entertainment, Media and Fashion Industry ;Cultural Feminism& | 9 |

| | | | |
|---|---|---|---|
| | | Celebrating Womanhood<br>• Analysis of role women have played acrosscultures | |
| **4.** | **Social Construction of Masculinity** | • Definition and Understanding ofMasculinities<br>• Sociology of Masculinity& itsTypes<br>• Social Organization of Masculinity and Privileged Position ofMasculinity<br>• Politics of Masculinity andPower<br>• Major Theorists ofMasculinity<br>• Masculine Identities in Literature, Cinema & Media. | 9 |
| **5.** | **Gender Sensitization Empowerment &Gender Inclusivity** | • Women & Women Rights InIndia<br>• From Women's Studies to Gender Studies:A ParadigmShift<br>• Gender Sensitization & Gender Inclusivity<br>• Gender Studies & Media: Creating NewParadigms in Gender &Culture | 9 |
| | | **Total number of Lectures** | **42** |

**Evaluation Criteria**

| **Components** | **MaximumMarks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| EndSemesterExamination | 35 |
| TA | 25 (Project/ Assignment) |
| **Total** | **100** |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)


| | |
|---|---|
| **1** | Davis K., et al, *"Handbook of Gender and Women's Studies*. London: Sage. (2006) |
| **2** | Helgeson, Vicki S., *"The Psychology of Gender"*, Pearson(2012) |
| **3** | Friedan B., "*The Feminine Mystique"*, Penguin. (1971/1992) |
| **4** | DebeauvoirS. , "*The Second Sex"*, Vintage (1953/1997) |
| **5** | Wharton Amy S., "*The Sociology of Gender: An Introduction to Theory & Research*", Wiley-Blackwell (2005) |
| **6** | Pachauri G.," *Gender, School & Society*", R.Lall Publishers( 2013) |
| **7** | Connell R.W, "*Masculinities*", Cambridge: Polity. (1985) |
| **8** | MacInnes J., "The *End of Masculinity"*. Buckingham: Open University Press. (1998) |
| **9** | Kaul A.& Singh M., *"New Paradigms for Gender Inclusivity*", PHI Pvt Ltd (2012) |

**Detailed Syllabus**
**Lecture-wise Breakup**

| | | | |
|---|---|---|---|
| **Course Code** | 17B1NBT732 | **Semester** Odd **(specify Odd/Even)** | **Semester** VII **Session** 2021-2022 **Month from** July to Dec |
| **Course Name** | Healthcare Marketplace | | |
| **Credits** | 3 | **Contact Hours** | 3 |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Dr. Shweta Dang |
| | **Teacher(s) (Alphabetically)** | Dr. Indira P. Sarethy, Dr. Shweta Dang |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| **CO1** | Explain healthcare market, drugs and devices, role of various stakeholders | Understand Level (C2) |
| **CO2** | Apply related intellectual property laws and regulatory approvals for healthcare sector | Apply Level (C3) |
| **CO3** | Analyze the various business models/ innovations in the healthcare industry | Analyze Level (C4) |
| **CO4** | Compare economic aspects pertaining to the sector | Analyze Level (C4) |

| **Module No.** | **Title of the Module** | **Topics in the Module** | **No. of Lectures for the module** |
|---|---|---|---|
| **1.** | **Introduction to Healthcare markets** | About the various Regulatory bodies for approval of new medical innovations 2 | **02** |
| **2.** | **Clinical Pharmacokinetics and Clinical trials for new Drugs** | Biologic sampling techniques, analytical methods for the measurement of drugs and metabolites, and procedures that facilitate data collection and manipulation.<br>Clinical Trials: PhI, II, III and IV | **05** |
| **3.** | **Regulatory approval pathways** | Preclinical studies<br>US and EU filings<br>IND submissions, NDA and BLA Submissions, Non-patent exclusivities, data and market exclusivities cost analysis | **06** |
| **4.** | **Patents of drugs and devices, Entry for generics in health care markets** | Role of patents on new drugs and devices, Ever-greening of patents, Product and Process patents.<br>Hatch Waxman act and Introduction of generics and resulting cost reduction, Orange book (FDA) and related case studies. | **08** |
| **5.** | **Economics of healthcare** | Stakeholders in healthcare- doctors, hospitals and insurers and their roles, technology and human capital | **7** |
| **6.** | **Medical technology and insurance** | For medical devices, pharmaceuticals, genetic diagnostic tests and their regulations | **4** |
| **7.** | **Indian hospital sector** | Various players – government, private, PPP models, strategic perspectives, case studies | **4** |

| | | | |
|---|---|---|---|
| **8** | **Innovations in the marketplace** | Health to market innovations | **4** |
| **9** | **Healthcare informatics** | e-health, collection of health data, data processing, evaluation, health information systems, case studies | **2** |
| | | **Total number of Lectures** | **42** |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 (PBL, Assignments 1, 2, 3, Attendance) |
| **Total** | **100** |

**Project Based Learning:** Students analyze the site https://pmjay.gov.in/about/pmjay, understand the following sections:

- Coverage under PM-JAY
- Implementation Model
- Financing of the Scheme

And represent them in one comprehensive diagram, integrating all the above components. This helps them in understanding recent innovations in healthcare market and integration of healthcare informatics.

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)


| | |
|---|---|
| **1.** | https://www.who.int/nationalpolicies/processes/stakeholders/en/ |
| **2.** | Conflict of interests. I. Lo, Bernard. II. Field, Marilyn J. (Marilyn Jane) III. Institute of Medicine (U.S.). Committee on Conflict of Interest in Medical Research, Education, and Practice. IV. National Academies Press (U.S.), 2009 |
| **3.** | Research papers and online resources |

**Detailed Syllabus**
**Lecture-wise Breakup**

| | | | |
|---|---|---|---|
| **Course Code** | 18B12CS424 | **Semester Odd** | **Semester** VII **Session** 2021-22<br>**Month from July to December** |
| **Course Name** | Algorithm Analysis and Artificial Intelligence | | |
| **Credits** | **3** | **Contact Hours** | **3-0-0** |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Alka Singhal |
| | **Teacher(s) (Alphabetically)** | Alka Singhal |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| C401-12.1 | Analyze algorithm's time complexities (Master's method, Recursion tree and substitution method- Sorting and Searching algorithms) | Analyzing Level (C4) |
| C401-12.2 | Propose solutions for real life computing problems using greedy, divide & conquer, and dynamic programming techniques. | Creating Level (C6) |
| C401-12.3 | Apply informed and uninformed searching algorithms(A*, Hill Climbing and Simulated Annealing) in AI related problems. | Applying Level (C3) |
| C401-12.4 | Solve constraint satisfaction problems and adversarial search algorithms | Creating Level (C6) |
| C401-12.5 | Apply inference mechanisms( propositional logic , first order predicate logic, and probabilistic reasoning) | Applying Level (C3) |
| C401-12.6 | Design and simulate Genetic Algorithms for Optimization. | Creating Level (C6) |

| **Sr.** | **Module** | **Chapters** | **Lectures** |
|---|---|---|---|
| 1. | Introduction | Time Complexity analysis: Master's Method.<br>Divide and Conquer methods: Insertion Sort, Merge Sort, Quick Sort | 06 |
| 2. | Divide and Conquer and Greedy Algorithms | Strassen's Matrix multiplication , Knapsack Problem; Coin change Problem; Huffman Coding; Activity Selection; Minimum Spanning tree, shortest path. | 09 |
| 3. | Dynamic Programming Algorithms | Knapsack Problem; Coin change Problem; Matrix chain Multiplication, Longest common subsequence etc. | 05 |
| 4. | Artificial Intelligence : Problem Spaces and Problem Solving by search | State Spaces, Uninformed search strategies (BFS, DFS, DLS, IDS, Bidirectional search),Informed Search & exploration (A*,Heuristic, Local search algorithms, online search agents) | 07 |
| 5. | Constraint satisfaction problems | Constraint satisfaction problems (backtracking, variable and value ordering, local search), Adversarial Search (games, alpha beta pruning, elements of chance, state of art games) | 06 |
| 6. | Propositional Logic | Knowledge based agents, PL, FOPL, Syntax and semantics, use, knowledge engineering) , Inference in FOPL(Propositional vs First order inference | 06 |
| 7. | Uncertainty | Probabilistic reasoning, Bayesian rule, Bayesian network, Inference, Reasoning over time | 03 |

| | | | |
|---|---|---|---|
| 8. | Genetic Algorithms | Travelling Salesman Problem,Knapsack Problem | 01 |
| | | **Total number of Lectures** | **43** |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25(Attendance-10Quiz/Assignments/Presentations/Mini-Project- 15) |
| **Total** | **100** |

**Project based learning:** Each student understood on the application of Artificial Intelligence for algorithmic optimization. They presented the application by a power-point presentation. It can help improve the efficiency of the real life projects in the real world IT organizations.

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc.

**TEXT BOOKS**


| | |
|---|---|
| ***1.*** | Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein , Introduction to Algorithms, MIT Press, 3rd Edition, 2009 |
| ***2.*** | Artificial Intelligence – A modern approach by Stuart Russel and Peter Norvig, PHI, 2008. |
| **REFERENCE BOOKS Journals, Reports, Websites etc. in the IEEE format** | |
| ***3.*** | Artificial Intelligence Review: An International Science and Engineering Journal, Springer |
| ***4.*** | Nunes de Castro, Leandro, " Nature-Inspired Computing Design, Development, and Applications" IGI Global, 31-May-2012 - 435 pages |
| ***5.*** | Steven Skiena ,The Algorithm Design Manual, Springer; 2nd edition , 2008 |
| ***6.*** | Knuth, The art of Computer Programming Volume 1, Fundamental Algorithms, Addison-Wesley Professional; 3 edition,1997 |
| ***7.*** | Horowitz and Sahni, Fundamentals of Computer Algorithms, Computer Science Press, 1978 |

**Detailed Syllabus**
**Lecture-wise Breakup**

| | | | |
|---|---|---|---|
| **Course Code** | 17B1NPH732 | **Semester: ODD** | **Semester: 7th Session:** 2021 -2022 **Month from July to December** |
| **Course Name** | Nanoscience and Technology | | |
| **Credits** | 3 | **Contact Hours** | 3+1 |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Navendu Goswami |
| | **Teacher(s) (Alphabetically)** | Navendu Goswami |

| **COURSE OUTCOMES** | | **COGNITIVE LEVELS** |
|---|---|---|
| **C401-4.1** | Define the Nanoscience and Technology and to know about various other terminologies and developments involved with Nanoscience and Technology | Remembering (C1) |
| **C401-4.2** | Classify the nanomaterials depending on the nature of dimensionalities, type of materials classes and explain the basic concepts of nanomaterials | Understanding (C2) |
| **C401-4.3** | Apply the concepts of Nanoscience for solving the theoretical and numerical problems | Applying (C3) |
| **C401-4.4** | Determine the properties of nanomaterials through suitable characterization tools | Analyzing (C4) |

| **Module No.** | **Title of the Module** | **Topics in the Module** | **No. of Lectures for the module** |
|---|---|---|---|
| **1.** | Introduction | Development of nanoscience and nanotechnology, naturally occurring nanomaterials, Crystallinity of nanomaterials, Metallic nanostructures, Semiconductor nanostructures Magnetic nanomaterials, Chemically assisted nanostructures, Growth in 2-D nanostructures, Carbon nanomaterials | 10 |
| **2.** | Properties of Nanomaterials | Surface to volume ratio, Surface states and energy, Nanoscale oscillators, Confinement in nanostructures, Density of States and number of states of 0-, 1-, 2-, 3-dimensional systems, Change in Band structure and gap, Energy levels, confinement energy and emission in nano, Fluorescence by QDs, Concept of Single electron transistor | 5 |
| **3.** | Nanomaterials Synthesis | Introduction to synthesis techniques, Top down and bottom up approach, Biological methods, Sol-gel method, Nucleation and growth, Ball Milling technique, Chemical vapor deposition, Physical Vapor deposition: Concept of Epitaxy and sputtering, Basics of Photolithography and its limitations, Soft Lithography and Nanolithography | 10 |
| **4.** | Characterization of Nanomaterials | Resolving power (Rayleigh and other criteria) of microscopes and their limitations for nanostructure measurements, Concept of Far and Near field and modification by NSOM, Basic principle, Design of setup, Theory and working, Characterization procedure, result analysis, Merits/demerits of SEM, TEM, STM, AFM | 5 |
| **5.** | Application of | Nanoelectronics, Nanobiotechnology, Catalysis by | 10 |

| | | | |
|---|---|---|---|
| | Nanomaterials | nanoparticles, Quantum dot devices, Quantum well devices, High $T_c$ nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS | |
| | | **Total number of Lectures** | **40** |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 [2 Quiz (10 M), Attendance (10 M) and Cass performance (5 M)] |
| **Total** | **100** |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)


| | |
|---|---|
| **1.** | *Nanostructures and nanomaterials: synthesis properties and application*, Guozhong Cao, Imperial college press, London. |
| **2.** | *Introduction to nanotechnology,* Charles Poole *et al* J John Wiley & Sons, Singapore. |
| **3.** | *The Handbook of Nanotechnology: Nanometer Structures, Theory, Modeling, and Simulation,* A. Lakhtakia, Spie Press USA. |
| **4.** | *Springer Handbook of Nanotechnology,* Edited by B. Bhushan, Springer Verlag. |


**Project based learning:** Students would work on a project of their choice in the field of Nanoelectronics, Nanobiotechnology, Catalysis by nanoparticles, Quantum dot devices, Quantum well devices, High Tc nano-Superconductors, Nanomaterials for memory application, CNT based devices, MEMS and NEMS. In such projects students can apply the basic concepts of Nanoscience for solving theoretical and numerical problems. They can also work on analysis of a nanomaterial to determine its properties through suitable characterization tools such as SEM, TEM, AFM etc. The learning gained through this project would consolidate the understanding and provide skills of analysis and application in Nanoscience and Technology and thereby providing the employability prospects in the organizations and industries involved in the research and development of nanomaterials synthesis and characterizations, nanoelectronics, nanobiotechnology/nanomedicine etc.

**Detailed Syllabus**
**Lecture-wise Breakup**

| | | | |
|---|---|---|---|
| **Course Code** | 17M11EC118 | **Semester Odd (specify Odd/Even** | **Semester** 7th **Session** 2021-2022 **Month from July to December** |
| **Course Name** | ADVANCED DIGITAL SIGNAL PROCESSING(CO code : C110) | | |
| **Credits** | 3 | **Contact Hours** | 3 |

| | | |
|---|---|---|
| **Faculty (Names)** | **Coordinator(s)** | Dr. Vineet Khandelwal |
| | **Teacher(s) (Alphabetically)** | NIL |

| **COURSE OUTCOMES** At the end of the semester, students will be able to | | **COGNITIVE LEVELS** |
|---|---|---|
| CO1 | Recall the principles of various transform techniques like Z, Chirp Z, Hilbert, Discrete Fourier transform and Fast Fourier Transform. | Applying Level (C3) |
| CO2 | Demonstrate the ability to apply different methods to design and analyze digital FIR (Finite Impulse Response) and IIR (Infinite Impulse Response) filters with its structural realization. | Analyzing Level(C4) |
| CO3 | Analyze Multirate signal processing and examine its application. | Analyzing Level(C4) |
| CO4 | Comprehend different methods for designing adaptive filters and examine its application | Analyzing Level(C4) |

| **Module No.** | **Title of the Module** | **Topics in the Module** | **No. of Lectures for the module** |
|---|---|---|---|
| **1.** | **Review of Digital Signal Processing** | Review of discrete–time sequences and systems, Linear Shift Invariant (LSI) systems. Causality and Stability Criterion, FIR & IIR representations, Z-Transform, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT) algorithms using decimation in time and decimation in frequency techniques, Chirp Z- Transform, Hilbert Transform and applications | 6 |
| **2.** | **Design of IIR and FIR Filters** | Digital filter specifications, selection of filter type, and filter order, FIR filter design; using windowing Techniques, Fourier Series and frequency sampling method, Design of IIR Filters Using Butterworth, Chebyshev and Elliptic Approximations, Frequency Transformation Techniques; approximation of derivatives, Impulse invariant method, Bilinear transformation, Structures for IIR Systems – Direct Form I & II, Cascade, Parallel, Lattice & Lattice-Ladder Structures, Structures For FIR Systems – Direct , Cascade, | 12 |

| | | | |
|---|---|---|---|
| | | Parallel, Lattice & Lattice ladder Structures. | |
| **3.** | **Multirate Digital Signal Processing** | Decimation & Interpolation, Sampling rate conversion, Identities, polyphase decomposition, General polyphase framework for Decimator and Interpolator, Multistage decimator and Interpolator, Efficient transversal structure for Decimator and Interpolator, FIR and IIR structure for Decimator, Filter design for FIR decimator and Interpolator, Application of Multirate Signal processing. | 14 |
| **4.** | **Adaptive Filters** | Introduction, Application of adaptive filters, correlation structure, FIR Weiner Filter, Adaptive Direct-form FIR filters Adaptive Lattice-Ladder filters, Introduction to linear prediction, linear prediction and autoregressive modeling. | 10 |
| | | **Total number of Lectures** | 42 |

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25 |
| **Total** | **100** |

**Project based learning:** Students will learn different techniques used for the design of the adaptive DSP systems that are used to condition, extract and interpret information bearing signal which is essential for smart phones, home appliances, biomedical devices and multimedia systems. These systems have dynamic transfer function whose frequency response are changed or controlled by varying certain variable parameters by means of an optimization algorithm. Student shall be given various practical situation based design exercises to be implemented in MATLAB. This would enable them to recall and apply various techniques and algorithms taught in course to design and analyse the required system that meets the given technical specification.

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)


| | |
|---|---|
| **1.** | J.G. Proakis & D.G. Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", 4th Edition, PHI, 2012 |
| **2.** | Aurelio Uncini, "Fundamentals of Adaptive Signal Processing", Springer Nature, Jan 2015. |
| **3.** | Tulay Adah and Simon Haykins, "Adaptive Signal Processing: Next Generation Solutions", Wiley India, 2012. |
| | |

# Detailed Syllabus
## Lecture-wise Breakup

| | | | |
|---|---|---|---|
| **Course Code** | **20M41EC117** | **Semester:** ODD **(specify Odd/Even)** | **Semester: 7th Session: 2021-22 Month from Aug to Dec** |
| **Course Name** | **ADVANCED DIGITAL COMMUNICATION SYSTEMS** | | |
| **Credits** | 3 | **Contact Hours** | 3 |
| **Faculty (Names)** | **Coordinator(s)** | Dr. Ashish Goel | |
| | **Teacher(s) (Alphabetically)** | Dr. Ashish Goel | |

| **COURSE OUTCOMES-** At the completion of the course, students will be able to | | **COGNITIVE LEVELS** |
|---|---|---|
| **C112.1** | Understanding of line coding schemes and study of various issues related to ISI | Understanding Level (C2) |
| **C112.2** | Understand and analyse the Optimum filter realization for digital signals | Analyzing Level (C4) |
| **C112.3** | Understand the concepts of digital modulation techniques and evaluate their probability of error and bandwidth efficiency. | Evaluating Level (C5) |
| **C112.4** | Understanding of symbol and carrier synchronization and various equalization schemes. | Understanding Level (C2) |
| **C112.5** | Analyse different types of spread spectrum techniques. | Analyzing Level (C4) |

| **Module No.** | **Title of the Module** | **Topics in the module** | **No. of Lectures for the module** |
|---|---|---|---|
| **1.** | **Waveform Coding and Baseband Shaping for Data Transmission** | Overview of wave form coding scheme, Companding scheme for PCM system, Signal to Quantization Noise Ratio of Companded PCM system. Line codes and Power Spectral Density of line coding schemes, Intersymbol Interference: Ideal solution, Practical Solution and Correlative Coding. Eye pattern. | 10 |
| **2.** | **Optimal Reception of Digital Signals** | Baseband Signal Receiver, Peak signal to RMS Noise output Voltage Ratio, Probability of error, Optimum Threshold: Maximum Likelihood Detector and Bayes' Receiver, Optimal receiver design: calculation of the optimum filter transfer function, Optimum filter realization using Match filter, Probability of error of Matched filter, Optimum filter realization using Correlator | 8 |
| **3.** | **Digital Modulation Techniques** | Digital modulation formats, M-ray modulation techniques: Modulation, Demodulation, Power spectra, Bandwidth efficiency, symbol error probabilities. Channel capacity theorem for M-ary modulation formats. Minimum Shift keying: Effect of side lobes, MSK as FSK, Signal Space representation of MSK, Phase continuity in MSK, generation and reception of MSK, GMSK. | 10 |
| **4.** | **Synchronization and Equalization** | Synchronization: Phase Jitter in Symbol Synchronization, Carrier synchronization. | 7 |

| | | | |
|---|---|---|---|
| | | Equalization: Maximum–Likelihood Sequence Estimation (MLSE), Linear equalization, Decision -feedback equalization, Reduced complexity ML detectors | |
| **5.** | **Spread Spectrum Signals for Digital Communication** | Model of spread spectrum digital communication system, Spreading code sequences; generation and properties: PN Sequence, Gold Code, Walsh Hadamard Code. Direct sequence spread spectrum signals; Frequency hopped spread spectrum signals, FDMA, TDMA, CDMA, Time hopping SS, Synchronization of SS systems. | 7 |
| | | **Total number of Lectures** | **42** |

**Project based learning**: Here, students will learn the advanced concept digital communication starting from the basics process of modulation, demodulation and its impairment. These schemes are of utmost importance to understand the concepts of any current or future generations of communication system and to design the same . Student will be able to design the physical layer of digital communication and to analyze the effect of ISI, effect of noise and fading issues. Students can perform the some simulation on Matlab to analyze the same. Understating of these techniques will further help to work in any core communication industry.

**Evaluation Criteria**

| **Components** | **Maximum Marks** |
|---|---|
| T1 | 20 |
| T2 | 20 |
| End Semester Examination | 35 |
| TA | 25(Attendance, Performance. Assignment/Quiz) |
| **Total** | **100** |

**Recommended Reading material:** Author(s), Title, Edition, Publisher, Year of Publication etc. ( Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

| | |
|---|---|
| 1. | John G. Proakis, "Digital Communication", McGraw Hill, 5th edition, 2013. |
| **2.** | H. Taub, D. L. Schilling and Gautam Saha, Principles of Communication Systems, 4th/ed, TMH, 2017 |
| **3.** | S.Haykin, Digital Communication Systems ,John Wiley & Sons, 2013 |
| **4.** | Don Torrieri, " Principles of Spread-Spectrum Communication Systems ", Springer, 2015. |