OPEN ELECTIVE - I

U20OEC51	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

Pre-requisite: Digital Logic Circuits

COURSE OBJECTIVES:

- Building Blocks of Embedded System Various Embedded Development Strategies
- Bus Communication in processors, Input/output interfacing.
- Various processor scheduling algorithms.
- Basics of Real time operating system and example tutorials to discuss on one real time operating system tool.

UNIT I: INTRODUCTION TO EMBEDDED SYSTEMS (9)

Introduction to Embedded Systems –Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging.

UNIT II: EMBEDDED NETWORKING (9)

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols RS232 standard – RS422 – RS 485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers.

UNIT III: EMBEDDED FIRMWARE DEVELOPMENT ENVIRONMENT (9)

Embedded Product Development Life Cycle- objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model.

UNIT IV: RTOS BASED EMBEDDED SYSTEM DESIGN (9)

Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non-preemptive scheduling, Task communication shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance.

UNIT V: EMBEDDED SYSTEM APPLICATION AND DEVELOPMENT (9)

Case Study of Washing Machine- Automotive Application- Smart card System Application-ATM machine –Digital camera.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand an embedded system for a given application.
2. Operate various Embedded Development Strategies
3. Study about the bus Communication in processors.
4. Acquire knowledge on various processor scheduling algorithms.
5. Understand basics of Real time operating system.

TEXT BOOKS:

1. Peckol, “Embedded system Design”, John Wiley & Sons,2010
2. Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson, 2013
3. Shibu. K.V, “Introduction to Embedded Systems”, 2e, Mc graw Hill, 2017.

REFERENCE BOOKS:

1. Raj Kamal, ‘Embedded System-Architecture, Programming, Design’, Mc Graw Hill, 2013.
2. C.R.Sarma, “Embedded Systems Engineering”, University Press (India) Pvt. Ltd, 2013.
3. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier, 2006.
4. Han-Way Huang, “Embedded system Design Using C8051”, Cengage Learning, 2009.
5. Rajib Mall “Real-Time systems Theory and Practice” Pearson Education, 2007.

U20OEC52 **IOT FOR SMART GRIDS**

L	T	P	C
3	0	0	3

Pre-requisite: Communication networks

COURSE OBJECTIVES:

- Get acquainted with different smart devices and smart meters
- Describe how modern power distribution system functions
- Identify suitable communication networks for Smart Grid applications

UNIT I: INTRODUCTION TO SMART GRID (9)

Introduction - Evolution of Electric Grid, Smart Grid Concept - Definitions and Need for Smart Grid – Functions – Opportunities – Benefits and challenges, Difference between conventional & Smart Grid, Technology Drivers.

UNIT II: ENERGY MANAGEMENT SYSTEM (9)

Energy Management System (EMS) - Smart substations - Substation Automation - Feeder Automation, SCADA – Remote Terminal Unit – Intelligent Electronic Devices – Protocols, Phasor Measurement Unit – Wide area monitoring protection and control, Smart integration of energy resources – Renewable, intermittent power sources – Energy Storage.

UNIT III: DISTRIBUTION MANAGEMENT SYSTEM (9)

Distribution Management System (DMS) – Volt / VAR control – Fault Detection, Isolation and Service Restoration, Network Reconfiguration, Outage management System, Customer Information System, Geographical Information System, Effect of Plug in Hybrid Electric Vehicles

UNIT IV: SMART METERS (9)

Introduction to Smart Meters – Advanced Metering infrastructure (AMI), AMI protocols – Standards and initiatives, Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

UNIT V: COMMUNICATION NETWORKS & IOT (9)

Elements of communication and networking – architectures, standards, PLC, Zigbee, GSM, BPL, Local Area Network (LAN) - House Area Network (HAN) - Wide Area Network (WAN) - Broadband over Power line (BPL) - IP based Protocols - Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand the features of Smart Grid.
2. Analyze various protocols for IoT
3. Assess the role of automation in Transmission and Distribution.
4. Apply data analytics and offerings related to IoT.
5. Analyze applications of IoT in real time scenario

TEXT BOOKS:

1. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.
2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012

REFERENCE BOOKS:

1. Mini S. Thomas, John D McDonald, 'Power System SCADA and Smart Grids', CRC Press, 2015.
2. Kenneth C.Budka, Jayant G. Deshpande, Marina Thottan, 'Communication Networks for Smart Grids', Springer, 2014.

U20OEC53 PRINCIPLES OF COMMUNICATION

L	T	P	C
3	0	0	3

Pre-requisite: Probability and Calculus

COURSE OBJECTIVES:

- Get basic discipline of telecommunication theory and relevant techniques.
- In addition to an information theory introduction, it includes the study of signal and architecture of communication systems, amplitude and angle modulation, modulation and demodulation techniques and so forth.
- The important concepts like noise, interference, channel distortion, intersymbol interference and entropy are also elucidated.
- To acquire the basic engineering understanding to the modern communication systems and; the relevant theory and technique.

UNIT I: SWITCHED COMMUNICATION SYSTEMS (8)

Communication systems – Basic block representation – Communication channel types – Classification – Switched communication system – Telegraphy – Telephony –Transmitter – Receiver – DTMF – Telephone exchanges (qualitative treatment only)

UNIT II: ANALOG COMMUNICATION (12)

Amplitude modulation – Modulation index – Power calculation – Non-linear modulation – Linear modulation – AM types – DSB-SC – Modulation and coherent detection – Costa's receiver – SSB – Modulation – Phase discrimination method – coherent SSB demodulation – VSB – Modulation and Envelope detection of VSB – Frequency modulation – Narrow band FM – Wide band FM – Transmission bandwidth of FM – Generation of FM – Indirect FM – Direct FM – Demodulation of FM signals – Non-linear effects in FM – Phase modulation – Modulation and demodulation – Comparison – AM – FM – PM.

UNIT III: TRANSMITTERS AND RECEIVERS (9)

AM transmitter – Broadcast transmitters – SSB transmitter – Radio telegraphy Transmitter – FM transmitter – Tuned radio frequency and super heterodyne receivers – AM broadcast receiver – SSB receivers – Diversity reception – FM receivers.

UNIT IV: DIGITAL COMMUNICATION (8)

Sampling – Pulse amplitude modulation – Pulse duration modulation – Pulse position modulation – Pulse code modulation – DPCM – Delta modulation – Adaptive delta modulation – Generation and detection – Amplitude shift keying – Frequency shift keying – Phase shift keying.

UNIT V: BROAD BAND COMMUNICATION (8)

Multiplexing – Time division multiplexing – Frequency division multiplexing – Multiple access techniques – CDMA – Optical communication – ISDN – Satellite Communication system.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Design simple systems for generating and demodulating AM, DSB, SSB and VSB signals.
2. Design simple systems for generating and demodulating frequency modulated signals.
3. Learn the concepts of random process and various types of noise.
4. Evaluate the performance of the communication system in presence of noise.
5. Analyze pulse modulation and sampling techniques.

TEXT BOOKS:

1. Simon Haykin, “Communication Systems”, 4th Edition, John Wiley and Sons.
2. Anokh Singh, “Principles of communication”,S.Chand and company Ltd.

REFERENCE BOOKS:

1. Proakis, J.G., Masoud Salehi, “Communication Systems”, 1st Edition Pearson Education, 2006.
2. H.Taub, D.L.Schilling and G.Saha, “Principles of communication”, 3rd Edition, Tata McGraw Hill Publishers, 2007.
3. B.Sklar, “Digital Communication Fundamentals and Applications”, 2nd Edition, Pearson Education, 2007.

U20OEC54 INTRODUCTION TO NANO TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Mathematics and physics

COURSE OBJECTIVES:

- To learn about basis of nanomaterial science, preparation method, types and application

UNIT I: INTRODUCTION (9)

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowiresultra-thin films-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II: GENERAL METHODS OF PREPARATION (9)

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III: NANOMATERIALS (9)

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, Nano alumina, CaO, AgTiO2, Ferrites, Nano clays-functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.

UNIT IV: CHARACTERIZATION TECHNIQUES (9)

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.

UNIT V: APPLICATIONS (9)

Nano InfoTech: Information storage- Nano computer, molecular switch, super chip, nanocrystal, Nano biotechnology: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targeted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nano sensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sun barrier products - In Photostat, printing, solar cell, battery.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand about the science of nano materials
2. Demonstrate the preparation of nano materials
3. Explain various nano materials with its specifications
4. Develop knowledge in characteristic nano material
5. Explain the applications of nano technology

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., ―Nanomaterials: Synthesis, Properties and Applications‖, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, ―Nanoscale Characterization of surfaces & Interfaces‖, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCE BOOKS:

1. G Timp, ―Nanotechnology‖, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,―The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations‖. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

U20OEC55 NANO TECHNOLOGY APPLICATIONS

L	T	P	C
3	0	0	3

Pre-requisite: Mathematics and physics

COURSE OBJECTIVES:

- To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates

- To explore the basics of nanomaterial synthesis and characterization.
- To introduce the applications of nanotechnology

UNIT I: INTRODUCTION TO NANOTECHNOLOGY (9)

Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures- clusters of metals and semiconductors, bio nano-particles.

UNIT II: FABRICATION AND CHARACTERIZATION OF NANOMATERIALS (9)

Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes); Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.

UNIT III: PROPERTIES AND MEASUREMENT OF NANOMATERIALS (9)

Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

UNIT IV: NANO STRUCTURES (9)

Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc. Cells response to Nanostructures.

UNIT V: APPLICATIONS OF NANOTECHNOLOGY (9)

Nano electronics, Nano sensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Describe the basic science behind the properties of materials.
2. Interpret the creation, characterization, and manipulation of nanoscale materials.
3. Understand the concepts of nano structures
4. Comprehend the exciting applications of nanotechnology at the leading edge of scientific research
5. Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.

TEXT BOOKS:

1. Springer Handbook of Nanotechnology by Bharat Bhushan 2004.(Unit I – V)
2. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004. (Unit I – V)

REFERENCE BOOKS:

1. Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects, D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009.
2. Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y. Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003.
3. Handbook of Nanoceramics and their Based Nanodevices (Vol. 2) Edited by Tseung-Yuen Tseng and Hari Singh Nalwa, American Scientific Publishers.

OPEN ELECTIVE - II

		L	T	P	C
U20OEC71	**FIBRE OPTICS AND LASER INSTRUMENTATION**	3	0	0	3

Pre-requisite: Optical Communication

COURSE OBJECTIVES:

- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about holography and Medical applications of Lasers.

UNIT I: OPTICAL FIBRES AND THEIR PROPERTIES (9)

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle (θa) Numerical aperture and Skew mode, –Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers,– fibrecharacteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses – Dispersion – Connectors and splicers –Fibre termination – Optical sources: Light Emitting Diode.

UNIT II: INDUSTRIAL APPLICATION OF OPTICAL FIBRES (9)

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacementsensor (extrinsic sensor) - Fibre optic instrumentation system: Measurement of attenuation (by cut back method) - Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) - –Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III: LASER FUNDAMENTALS (9)

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers; – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

UNIT IV: INDUSTRIAL APPLICATION OF LASERS (9)

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting – Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

UNIT V: HOLOGRAM AND MEDICAL APPLICATIONS (9)

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording, Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions

Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand the principle, transmission, dispersion and attenuation characteristics of optical fibers
2. Apply the gained knowledge on optical fibers for its use as communication medium and as sensor
3. Understand the applications of optical fibres in production, manufacturing industrial and biomedical
4. Understand laser theory and laser generation system.
5. Apply laser theory for the selection of lasers for a specific Industrial and medical application.

TEXT BOOKS:

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India,1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.
3. Eric Udd, William B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.

REFERENCE BOOKS:

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008.
4. Monte Ross, 'Laser Applications', McGraw Hill, 1968.
5. John and Harry, "Industrial lasers and their application", McGraw-Hill, 2002.
6. Keiser, G., "Optical Fiber Communication", McGraw-Hill, 3rd Edition, 2000. http://nptel.ac.in/courses/117101002/

U20OEC72 FUNDAMENTALS OF SIGNALS & SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: Analog signal and digital signals

COURSE OBJECTIVES:

- To study the properties and representation of discrete and continuous signals.
- To study the sampling process and analysis of discrete systems using z-transforms.
- To study the analysis and synthesis of discrete time systems.

UNIT I: CLASSIFICATION OF SIGNALS AND SYSTEMS (9)

Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and periodic, random signals, CT systems and DT systems, Basic properties of systems - Linear Time invariant Systems and properties.

UNIT II: ANALYSIS OF CONTINUOUS TIME SIGNALS (9)

Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in Signal Analysis.

UNIT III: LINEAR TIME INVARIANT –CONTINUOUS TIME SYSTEMS (9)

Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency

response , Fourier and Laplace transforms in analysis, State variable equations and matrix representation of systems

UNIT IV: ANALYSIS OF DISCRETE TIME SIGNALS (9)

Sampling of CT signals and aliasing, DTFT and properties, Z-transform and properties of Z-transform.

UNIT V: LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS (9)

Difference equations, Block diagram representation, Impulse response, Convolution sum,LTI systems analysis using DTFT and Z-transforms , State variable equations and matrix representation of systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Analyze the properties of signals & systems.
2. Apply Fourier transform, Laplace transform in CT signal
3. Analyze continuous time LTI systems using Fourier and Laplace Transforms.
4. Analyze discrete time signals using Discrete Time Fourier Transform
5. Analyze discrete time LTI systems using Z transform.

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson Education, 2007.
2. Edward W Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007.

REFERENCE BOOKS:

1. H P Hsu, Rakesh Ranjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007
2. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, McGraw Hill International/TMH, 2007.
3. Simon Haykins and Barry Van Veen, Signals and Systems John Wiley & sons , Inc, 2004.
4. Robert A. Gabel and Richard A.Roberts, Signals & Linear Systems, John Wiley, III edition, 1987.
5. Rodger E. Ziemer, William H. Tranter, D. Ronald Fannin. Signals & systems, Fourth Edition, Pearson Education, 2002.

U20OEC73 FUZZY SYSTEMS

L	T	P	C
3	0	0	3

Pre-requisite: Digital logic and set of theory

COURSE OBJECTIVES:

- To master the various fundamental concepts of fuzzy logic and artificial neural networks.
- To get sufficient knowledge to analyze and design the various intelligent control systems

UNIT I: FUNDAMENTALS OF FUZZY LOGIC (9)

Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets- complements- union intersection- combination of operation- general aggregation operations- fuzzy relations-compatibility relations-orderings- morphisms- fuzzy relational equations-fuzzy set and systems

UNIT II: ARCHITECTURE OF NEURAL NETWORKS (9)

Architectures: motivation for the development of natural networks-artificial neural networks-biological neural networks-area of applications-typical Architecture-setting weights-common activations functions Basic learning rules- Mcculloch-Pitts neuron- Architecture, algorithm, applications-single layer net for pattern classification- Biases and thresholds, linear separability - Hebb'srule- algorithm -perceptron - Convergence theorem-Delta rule

UNIT III: BASIC NEURAL NETWORK TECHNIQUES (9)

Back propagation neural net:standard back propagation-architecture algorithm- derivation of learning rules number of hidden layers--associative and other neural networks- hetro associative memory neural net, auto associative net- Bidirectional associative memory-applications-Hopfield nets-Boltzman machine

UNIT IV: COMPETITIVE NEURAL NETWORKS (9)

Neural network based on competition: fixed weight competitive nets- Kohonenself organizing maps and applications-learning vector quantization-counter propagation nets and applications adaptive resonance theory: basic architecture and operation-architecture, algorithm, application and analysis of ART1 & ART2

UNIT V: SPECIAL NEURAL NETWORKS (9)

Cognitron and Neocognitron - Architecture, training algorithm and application-fuzzy associate memories, fuzzy system architecture- comparison of fuzzy and neural systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand the basic concept of fuzzy sets, fuzzy logic & defuzzification
2. Learn basics of Artificial Neural of theory and programming of Microprocessors
3. Analyze various techniques in feedback and feed forward Neural networks.
4. Understand the principle of competitive neural networks and Adaptive resonance theory.
5. Learn the architecture and algorithm of Cognitron, Neo cognitron The concepts of fuzzy associative memory and fuzzy systems.

TEXT BOOKS:

1. Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India, First Edition.
2. Lawrence Fussett- fundamental of Neural network Prentice Hall , First Edition.

REFERENCE BOOKS:

1. Bart Kosko, —Neural network and Fuzzy System - Prentice Hall-1994.
2. J.Klin and T.A.Folger, —Fuzzy sets University and information- Prentice Hall -1996.
3. J.M.Zurada, —Introduction to artificial neural systems-Jaico Publication house, Delhi 1994.
4. VallusuRao and Hayagvna Rao, C++ Neural network and fuzzy logic-BPB and Publication, New Delhi, 1996.

U20OEC74 INDUSTRIAL NANO TECHNOLOGY

L	T	P	C
3	0	0	3

Pre-requisite: Nanomaterials and nanoparticles

COURSE OBJECTIVES:

- To elucidate on advantages of nanotechnology based applications in each industry
- To provide instances of contemporary industrial applications of nanotechnology

- To provide an overview of future technological advancements and increasing role of nanotechnology in each industry

UNIT I: NANO ELECTRONICS (9)

Advantages of nano electrical and electronic devices –Electronic circuit chips – Lasers - Micro and Nano Electromechanical systems – Sensors, Actuators, Optical switches,- Data memory –Lighting and Displays – Batteries - Fuel cells and Photo-voltaic cells – Electric double layer capacitors – Lead-free solder – Nanoparticle coatings for electrical products

UNIT II: BIONANOTECHNOLOGY (9)

Nanoparticles in bone substitutes and dentistry – Implants and Prosthesis – Nanorobotics in Surgery – Nanosensors in Diagnosis– Neuro-electronic Interfaces– Therapeutic applications.

UNIT III: NANOTECHNOLOGY IN CHEMICAL INDUSTRY (9)

Nanocatalyts – Smart materials – Heterogenous nanostructures and composites – Nanostructures for Molecular recognition (Quantum dots, Nanorods, Nanotubes) – Molecular Encapsulation and its applications – Nanoporous zeolites – Self-assembled Nanoreactors.

UNIT IV: NANOTECHNOLOGY IN AGRICULTURE AND FOOD TECHNOLOGY (9)

Nanotechnology in Agriculture -Precision farming, Smart delivery system – Insecticides using nanotechnology – Potential of nano-fertilizers - Nanotechnology in Food industry

UNIT V: NANOTECHNOLOGY IN TEXTILES AND COSMETICS (9)

Nanofibre production - Electrospinning – Controlling morphologies of nanofibers – Tissue engineering application– Polymer nanofibers - Nylon-6 nanocomposites from polymerization - Nano-filled polypropylene fibers - Nano finishing in textiles (UV resistant, antibacterial, hydrophilic, self-cleaning, flame retardant finishes) – Modern textiles Cosmetics – Formulation of Gels, Shampoos, Hairconditioners.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Describe the basic science behind the properties of materials.
2. Interpret the creation, characterization, and manipulation of nanoscale materials.
3. Comprehend the exciting applications of nanotechnology at the leading edge of scientific research
4. Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.
5. Understand the usage of nanotechnology in textiles and cosmetics

TEXT BOOKS:

1. Neelina H. Malsch (Ed.),Biomedical Nanotechnology, CRC Press (2005)
2. Udo H. Brinker, Jean-Luc Mieusset (Eds.), Molecular Encapsulation: Organic Reactions in Constrained Systems,Wiley Publishers (2010).

REFERENCE BOOKS:

1. Lynn J. Frewer, Willehm Norde, R. H. Fischer and W. H. Kampers, Nanotechnology in the Agri-food sector, Wiley-VCH Verlag, (2011).
2. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007).
3. W.N. Chang,Nanofibres fabrication, performance and applications, Nova Science Publishers Inc, (2009)

U20OEC75 **ELECTRONIC MATERIALS**

L	T	P	C
3	0	0	3

Pre-requisite: Solid state physics, material structure and bonding

COURSE OBJECTIVES:

- Understanding the various materials and its properties contribution towards electrical and electronics field. This course covers the properties of materials behind the electronic applications.

UNIT I: INTRODUCTION (9)

Structure: atomic structures and bonding, types of bonding, band formation. Defects and imperfections in solids: Point, Line and Planer defects; Interfacial defects and volume defects. Classification of materials based on bonding: conductors, semiconductors and insulators.

UNIT II: CONDUCTING MATERIALS (9)

Introduction, factors affecting the conductivity of materials, classification based on conductivity of materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and steel) and its applications, high resistivity materials (manganin, constantin, nichrome, tungsten) and their applications. Superconductors: Meissner effect, classification and applications.

UNIT III: SEMICONDUCTING AND MAGNETIC MATERIALS (9)

Semiconductors: Introduction, types of semiconductors, temperature dependence of semiconductors, compound semiconductors, basic ideas of amorphous and organic semiconductors. Magnetic Materials: classification of magnetic materials, ferromagnetism-B-H curve (Qualitative), hard and soft magnetic materials, magneto materials applications.

UNIT IV: DIELECTRIC AND INSULATING MATERIALS (9)

Dielectric Materials: Introduction, classification, temperature dependence on polarization, properties, dielectric loss, factors influencing dielectric strength and capacitor materials, applications. Insulators: Introduction, thermal and mechanical properties required for insulators, Inorganic materials, organic materials, liquid insulators, gaseous insulators and ageing of insulators, applications.

UNIT V: OPTOELECTRONIC AND NANO ELECTRONIC MATERIALS (9)

Optoelectronic materials. Introduction, properties, factor affecting optical properties, role of optoelectronic materials in LEDs, LASERs, photodetectors, solar cells. Nano electronic Materials: Introduction, advantage of nanoelectronic devices, materials, fabrication, challenges in Nano electronic materials.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Learners are able to

1. Understand the basic electrical and magnetic properties of crystalline solids and amorphous materials
2. Understand the difference between electronic structures and physical properties of semiconductors, metals and dielectrics
3. Understand the physics of magnetic phase transitions and superconductivity
4. Measure and analyze basic optical parameters of semiconductors
5. Understand the basic design of major microelectronic and opto electronic devices, their features and limitations

TEXT BOOKS:

1. S.O. Kasap “Principles of Electronic Materials and Devices”, 3rd edition, McGraw-Hill Education (India) Pvt. Ltd., 2007.
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