SHIVAJI UNIVERSITY, KOLHAPUR

SYLLABUS

For

M.Sc. Electronics

(Semester Pattern)
Sem. III to IV

Estd. 1962
NAAC 'A' Grade

Choice Based Credit System
(CBCS)

To be implemented From

June, 2020 onwards

Department of Electronics
Shivaji University, Kolhapur

M.Sc. Electronics
Choice Based Credit system
With effect from June 2020

Rules and Regulations:

1. Core courses will be offered only to the students of M.Sc. Electronics.
2. The pre-requisites for discipline specific elective (DSE) courses will be decided by the departmental committee.
3. M.Sc. II Sem. III and Sem. IV DSE-304 and DSE-404 will be offered for minimum 07 students in view of the infrastructure of the department. Discipline specific electives to be offered or otherwise will be at the sole discretion of the departmental committee.
4. Students will be encouraged to opt for additional credits. This provision is in view of rewarding the advanced learners. The decision will be at the sole discretion of the departmental committee.
5. Minimum attendance required to appear for semester-end examination will be 75% for each credit course.

6. The nature of semester-end examination question paper will be as follows :

Core / Elective course

Maximum marks 80
Time 3 Hrs

- There shall be total seven questions of equal marks out of which Q. No. 1 is compulsory.
- From Q. No. 2 to Q. No. 7 candidate has to attempt any four questions.
- Q. No 2 to Q. No.7 shall have sub questions.

Q.1. Write short answers (Any four). (16)
a)
b)
c)
d)
e)
f)

Q.2. (16)
a)
b)

Q.3. (16)
a)
b)

Q.4. (16)
a)
b)

Q.5. (16)
a)
b)

Q.6. (16)
a)
b)

Q.7. (16)
a)
b)

7. In addition to ascertain the successful assimilation of the prescribed credits the evaluation will be carried out as per the pattern defined in 6.
8. Minimum passing standard will be 40 %. There will be separate heads of passing for internal and semester-end examinations.
9. The practical examination and project evaluation of semester end examination will be adjudged by one internal and one external examiner.

M.Sc. Electronics (CBCS Pattern)

	Sr.No.	Course Code	Title of the Course	Teaching Scheme (h/w)		
				Theory & Practical		
				Lectures (per week	Hours (per week)	Credit
M.Sc. Part II - Semester III (Duration – Six months)						
CGPA	1	CC-301	Control Theory	4	4	4
	2	CCS-302	Computer Networks	4	4	4
	3	CCS-303	Microcontroller System Design and ARM Architecture	4	4	4
	4	DSE-304	Industrial Automation	4	4	4
	5	DSE-304	Biomedical Instrumentation	4	4	4
	6	DSE-304	MATLAB Programming for Numerical Computation	4	4	4
	7	DSE-304	Hardware-Software Co-design	4	4	4
	8	DSE-304	Satellite Communications	4	4	4
	9	DSE-304	Soft Computing	4	4	4
	10	DSE-304	VHDL Programming	4	4	4
	11	CCPR-305	Practical	16	16	8
Total (C)				**-**	**-**	**24**
Non-CGPA	1	AEC-306	-	2	2	2
	2	EC (SWM MOOC)-307	Number of lectures and credit shall be as specified on SWAYAM MOOC			
M.Sc. Part II - Semester IV (Duration – Six months)						
CGPA	1	CC-401	Digital Signal Processing	4	4	4
	2	CCS-402	Analog and Digital Circuit Design	4	4	4
	3	CCS-403	Real Time Embedded Systems	4	4	4
	4	DSE-404	Advanced Drives	4	4	4
	5	DSE-404	Artificial Intelligence & Machine Learning	4	4	4
	6	DSE-404	IoT & Data Analytics	4	4	4
	7	DSE-404	ARM Programming and Embedded Communication Protocols	4	4	4
	8	DSE-404	FPGA Based Systems	4	4	4
	9	DSE-404	Antennas	4	4	4
	10	DSE-404	Mechatronics	4	4	4
	11	DSE-404	Cellular Mobile Communications	4	4	4
	12	CCPR-405	Practical	16	16	8
Total (D)				**-**	**-**	**24**
Non-CGPA	1	SEC-406		2	2	2
	2	GE-407		2	2	2
Total (C+D)				**-**	**-**	**48**

Course Nomenclature –

- CC - Core Course
- CCPR - Core Course Practical
- AEC - Mandatory Non-CGPA compulsory Ability Enhancement Course
- SEC - Mandatory Non-CGPA compulsory Skill Enhancement Course
- CCS - Core Course Specialization
- DSE - Discipline Specific Elective
- EC (SWM MOOC) - Non-CGPA Elective Course
- GE - Generic Elective

Program Outcomes for M.Sc. in Electronics

Program Learning Outcomes detail the knowledge, skills and abilities that a student will demonstrate upon successful completion of the program.
A post-graduate of the M.Sc. Electronics Program will demonstrate:
PO1: Domain Specific knowledge: Apply the knowledge of mathematics, science, electronics to the solution of complex science & engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex science & engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex science & engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex science & engineering activities with an understanding of the limitations.

PO6: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO7: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO8: Communication: Communicate effectively on complex science & engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO9: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO10: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Program Specific Outcomes for M.Sc. in Electronics

A post graduate of the Electronics i.e. M.Sc. Electronics Program will demonstrate:
PSO1: Professional Skills: An ability to understand the basic concepts in and to apply them to various areas, like Electronics, Communications, Signal processing, VLSI, Embedded systems etc., in the design and implementation of complex systems.

PSO2: Problem-Solving Skills: An ability to solve complex Electronics Science and Engineering problems, using latest hardware and software tools, along with analytical skills to arrive cost effective and appropriate solutions.

PSO3: Successful Career and Entrepreneurship: An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an Entrepreneur.

M.Sc. Part II - Semester III

CC-301: Control Theory

Course Objectives

1. To develop an understanding of concepts related to control theory
2. To develop an ability to design and analyze control systems
3. To understand concept of stability and stability analysis of a feedback system
4. To understand different tools that can be used to analyze control system

Course Outcomes

1. Understand various concepts related to control system
2. Able to design and analyze control system
3. Understand the importance of stability of control system
4. Understand time and frequency response of control system
5. Learn various types of controllers like P, PI, PD and PID

Module 1: Introduction (15)

Basic concepts of control system, Classifications, Open loop and closed loop systems, Effect of feedbacks on control system performance, Transfer functions, Pole & zero concept, Mathematical modeling of electrical systems and mechanical systems, Block diagram reductions, Signal flow graph, Mason's gain formula.

Module 2: Time Domain Analysis and stability (15)

Type and order of control system, Typical tests signal, Time response of first and second order systems to unit step input, Steady state error, Time domain specifications for unit step response. Concept of Stability: absolute, relative and marginal, Nature of system response, Stability analysis using Routh Hurwitz's criterion, Root locus technique, Construction of root locus.

Module 3: Frequency Domain and State Variable Analysis (15)

Steady state response of a system to sinusoidal input, Relation between time and frequency response, Frequency response specifications, Stability analysis with Bode plot, Nyquist stability criterion. Introduction to state space analysis, State space representation for i) Electrical Network ii) nth order differential equation and iii) Transfer function. State model from transfer function using: Direct, parallel, cascade and decomposition method.

Module 4: Control system components and controllers (15)

Modeling and transfer function of control system components - Potentiometer, DC motor and Tachometer. Design concepts of Proportional (P), Proportional Integral (PI), Proportional Derivative (PD), Proportional Integral Derivative (PID) controllers, Compensator Networks - lag and lead.

Reference Books

1. Katsuhiko Ogata, "Modern Control Engineering", 5th Edition, PHI.
2. Farid Golnarghi and Benjamin C. Kuo, "Automatic Control System", 9th Edition, PHI.
3. Norman S. Nise, "Control System Engineering", 5th Edition, Wiley.
4. I. J. Nagrath and M.Gopal, "Control Systems Engineering", 5th Edition, New Age International Publication
5. Les Fenical "Control Systems", 1st Edition, Cengage Learning India.
6. S.K. Bhattacharya, "Control Systems Engineering", 1st edition, Pearson education

CCS-302: Computer Networks

Course Objectives:

1. To learn the different transmission medias, topologies and devices.
2. To learn OSI and TCP-IP model
3. To learn the classes of IP addresses

Course Outcomes:

1. Understand basic concept of computer networks.
2. Understand network software & network standardization.
3. Understand the role of networking devices.

Module 1: **(15)**

Introduction to Computer Networks: Introduction: Definition of a Computer Network; What is a Network?, Components of a computer network: Use of Computer networks; Networks for companies, Networks for people, Social Issues: Classification of networks; Based on transmission technology, Based on the their scale, Local area networks, Metropolitan area networks, Wide area networks, Wireless networks:

Module 2: **(15)**

Network Software & Network Standardization: Introduction: Networks Software; Protocol hierarchy, Design issues for the layers, Merits and De-merits of Layered Architecture, Service Primitives: Reference models; The OSI Reference Model, The TCP/IP Reference Model, Comparison of the OSI & the TCP/IP Reference Models: Network standardization; Who's who in the telecommunication world?, Who's who in the standards world, Who's who in the Internet standards world? Detailed over view of layers of OSI and TCP/Ip

Module 3: **(15)**

Physical Layer: Introduction: Network topologies; Linear Bus Topology, Ring Topology, Star Topology, Hierarchical or Tree Topology, Topology Comparison, Considerations when choosing a Topology: Switching; Circuit switching, Message switching, Packet switching, Implementation of packet switching, Relationship between Packet Size and Transmission time, Comparison of switching techniques: Multiplexing; FDM – Frequency division multiplexing, WDM – Wavelength division multiplexing, TDM – Time division multiplexing:

Module 4: **(15)**

Networking Devices: Introduction; Goal of networking devices: Repeaters; Uses of Repeaters: Hubs; Classification of Hubs, Stackable Hubs, USB Hub: Switches; Switching Methods, Comparison of switching methods, Working with Hubs and Switches, Cables Connecting Hubs and Switches, Managed Hubs and Switches, Port Density: Bridges; Bridge Implementation Considerations, Types of Bridges: Routers; Dedicated Hardware versus Server-Based Routers, Advantages and Disadvantages of dedicated hardware routers, Drawbacks of Routers: Gateways; Advantages of gateways, Gateways Functionality: Other Devices; Modems, Proxy Server, Wireless router, Brouter, Wireless Access Point (WAPs).

References

1. Computer Networks Protocols, Standards and Interface – Black C. Computer Networks – Stalling A.S.
2. Computer Networks – Tannenbaum A.S.
3. Internetworking with TCP/IP : Principles, Protocols and Architecture – Comer Computer Networks and Distributed Processing - Martin J.
4. Windows Network Programming – Devis R.
5. Unix Network Programming – Steven W.R.

CCS-303: Microcontroller System Design and ARM Architecture

Course Objectives:

At the end of course the students will be able to:

1. Understand the applications of Microcontrollers.
2. Familiarize with the need of microcontrollers in embedded system.
3. Familiarize with architecture and features of typical Microcontrollers.
4. Design interfacing of real world input and output devices
5. Understand various hardware & software tools for developing applications.

Course Outcomes:

1. Demonstrate knowledge of the architecture of a modern microcontroller
2. Understand the different architectures of microcontroller
3. Able to programming the microcontroller
4. Able to interface external devices to microcontroller

Module 1: **(15)**

Review of microcontroller solutions for control/measurement systems, their analog and digital features (8051, PIC): architectural benefits, Key characteristics, Digital I/O, interrupts, timer/counters, RTC, analog comparator, ADC, PWM, UART, I2C, clock oscillators, low power operating modes, watchdog timer, ISP/IAP techniques.

Module 2: **(15)**

System Design: Minimum system with 89C51/PIC microcontrollers to monitor frequency, voltage, displacement, liquid level, weight, speed, traffic light control system with software development for above. Isolation Techniques: Realys, opto-couplers and their specifications, Interfacing of Relays and optocouplers with microcontrollers, isolation methods for heavy and a.c. loads. Signal Transmission: V to I and I to V Conversion, V to F and F to V Conversion, Electrostatic Shielding and Grounding.

Module 3: **(15)**

Transducers and digital sensors for temperature, pressure and speed, signal conditioning, Instrumentation Amplifiers for RTD, thermocouple, bridge and LVDT, System design with 89C51 for measurement and control of temperature, pressure, speed using ON/OFF, Proportional and PID modes, stability aspects of the system, s/w development.

Module 4: **(15)**

ARM Architecture: Introduction to ARM microprocessor and its features, Architecture, Programming model, Processor Operating States, registers, Exceptions, ARM organization – 3-stage/5- stage pipelined ARM organization.

References

1. K.J. Ayala, The 8051 Microcontroller, Thomson Press (India) Ltd.
2. Microcontrollers: theory and applications By Ajay V Deshmukh, TMH.
3. Microprocessors application in Process control – S.I. Ahson, TMH.
4. Transducer Interfacing Handbook, D.H. Sheingold, Analog Devices Technical Handbook Norwood, USA.
5. ARM System-on-chip Architecture, Steve Furber, Addison Wesley
6. Datasheets and application notes of 8051 (P89C51RD2), AVR (ATMEGA32), PIC (16F877) and TI MSP430 microcontrollers

DSE-304: Industrial Automation

Course Objectives

1. To develop an understanding of concepts related to industrial automation
2. To develop an ability to design controllers for control system
3. To understand use of PLC and SCADA for industrial applications

Course Outcomes

1. Able to identify the process model and analyze process dynamics
2. Understand the performance of various control modes
3. Able to program PLC for process control
4. Understand SCADA

Module 1: Process Models **(15)**

Control System Evaluation:- Stability, steady-state regulation, transient regulation, Analog and digital processing

Controller Principles :- Process Characteristics - process equation, process load, process lag, self regulation Control system parameters - Error, variable range, control parameter range, control lag, dead time, cycling.

Module 2: Tuning of Controllers **(15)**

Control modes: - Discontinuous - two position, multi position, floating control, Continuous – proportional, integral, derivative & composite modes Control paradigms-Cascade control.,

Module 3: Programmable Controllers and SCADA **(15)**

Programmable Logic Controller (PLC) – functional diagram, operation, programming. PLC system, I/O modules and interfacing, processor, construction of PLC ladder diagrams, PLC Programming. Ladder diagrams for process control. Introduction to Supervisory Control and Data Acquisition (SCADA): Architecture, communication requirements and applications.

Module 4: Digital Controller design **(15)**

Controller design techniques, PID controller, State Space Method – Controllability and Observability, Full-state feedback Regulators Tracker, Regulator design by pole placement

References

1. John W. Webb and Ronald A. Reiss, Programmable Logic Controllers – Principle and Applications, Fifth Edition, PHI
2. JR. Hackworth and F.D Hackworth Jr., Programmable Logic Controllers - Programming Method and Applications. – Pearson, 2004.
3. L. Umanand, Power Electronics Essentials and Applications, Wiley.
4. Curtis D. Johnson, Process Control Instrumentation Technology, Eighth Edition, Pearson Education Limited. 2014.

DSE-304: Biomedical Instrumentation

Course Objectives:

1. The student should be made to illustrate origin of bio potentials and its propagations
2. To understand the different types of electrodes and its placement for various recordings.
3. To design bio amplifier for various physiological recordings
4. To learn the different measurement techniques for non-physiological parameters.
5. To Summarize different biochemical measurements

Course Outcomes:

1. Demonstrate Differentiate different bio potentials and its propagations.
2. Illustrate different electrode placement for various physiological recordings
3. Design bio amplifier for various physiological recordings
4. Explain various technique for non-electrical physiogical measurements
5. Demonstrate different biochemical measurement techniques.

Module 1: **(15)**

Fundamentals of Biomedical Engineering:
Terminology of Medicine and Medical Devices, Generalized Medical Instrumentation System, Alternative Operational Modes, Medical Measurement Constraints, Classifications of Biomedical Instruments , Interfering and Modifying Inputs, Compensation Techniques Biostatistics Generalized Static Characteristics Generalized Dynamic Design Criteria Commercial Medical Instrumentation Development Process Regulation of Medical Devices.

Module 2: **(15)**

Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode– skin interface, half cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes.
Electrode Configurations: Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG, ERG and EOG – unipolar and bipolar mode.

Module 3: **(15)**

Bio Amplifier: Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference. 4.

Module 4: **(15)**

Measurement of Non-Electrical Parameter: Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers - systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

References

1. Leslie Cromwell, ―Biomedical Instrumentation and measurement, 2nd edition, Prentice hall of India, New Delhi, 2015.
2. John G. Webster, ―Medical Instrumentation Application and Design‖, 4th edition, Wiley India Pvt Ltd,New Delhi, 2015.
3. Joseph J. Carr and John M. Brown, ―Introduction to Biomedical Equipment Technology‖, Pearson Education, 2004. 3. Myer Kutz, ―Standard Handbook of Biomedical Engineering and Design‖, McGraw Hill Publisher, 2003.
4. Khandpur R.S, ―Handbook of Biomedical Instrumentation, 3rd edition, Tata McGraw-Hill New Delhi, 2014 EC8553 D

DSE-304: MATLAB Programming for Numerical Computation

Course Objectives:

The objective of this course is to introduce students to computational methods using MATLAB.
At the end of this course, a student would:

1. Learn basics of MATLAB programming Get introduced to numerical methods for engineering problems
2. Will be able to use MATLAB to solve computational problems

Course Outcomes:

MATLAB is a popular language for numerical computation. This course introduces students to MATLAB programming, and demonstrate its use for scientific computations. The basis of computational techniques are expounded through various coding examples and problems, and practical ways to use MATLAB will be discussed.

Module 1: **(15)**

Introduction to MATLAB Programming
Basics of MATLAB programming, Array operations in MATLAB, Loops and execution control, Working with files: Scripts and Functions, Plotting and program output
Defining errors and precision in numerical methods, Truncation and round-off errors Error propagation, Global and local truncation errors

Module 2: **(15)**

Numerical Differentiation and Integration Methods of numerical Numerical Differentiation in single variable, Numerical differentiation: Higher derivatives, Differentiation in multiple variables, Newton-Cotes integration formulae, Multi-step application of Trapezoidal rule, MATLAB functions for integration

Module 3: **(15)**

Linear Equations
Linear algebra in MATLAB, Gauss Elimination, LU decomposition and partial pivoting, Iterative methods: Gauss Siedel, Special Matrices: Tri-diagonal matrix algorithm

Module 4: **(15)**

Newton Raphson method and MATLAB routines fzero and fsolve. Regression and Interpolation Ordinary Differential Equations (ODE) Higher order Runge-Kutta methods

References

Textbook: Fausett L.V. (2007) Applied Numerical Analysis Using MATLAB, 2nd Ed., Pearson Education

Reference Book: Chapra S.C. and Canale R.P . (2006) Numerical Methods for Engineers, 5th Ed., McGraw Hill

DSE-304: Hardware-Software Co-design

Course Objectives:

1. To learn the basic concepts in C programming.
2. To identify and learn C language extensions for cross-platform development,
3. To learn C coding for 8051 microcontroller.

Course Outcomes:

On completion of this course the student will be able to,

1. Write C programs.
2. Define application specific storage requirements for the data and code.
3. Write application programs in C for 8051 microcontroller.

Module 1: **(15)**

ANSI C language fundamentals – characteristics of C language, C v/s assembly, C compiler, preprocessor, preprocessor directives, character set, identifiers, keyword, data types, constants and variables, statements, expressions, operators, precedence and associativity of operators, input-output, assignments, control structures: decision making and branching.

Module 2: **(15)**

Arrays, Pointers and Functions: Declaration, arrays – one, two dimensional arrays, array elements, passing an array to a function, relation between array and pointer, pointer arithmetic, array processing using pointers, user defined v/s library functions, function prototypes, formal v/s actual arguments, parameter passing, writing modular programs, storage classes: auto, extern, global, static

Module 3: **(15)**

C language extensions for 8051 – Keywords, Memory areas, memory models, data types, bit, sbit, sfr, sfr16, bit addressable objects, Absolute variable location, pointers – generic pointers, memory specific pointers, pointer conversions, function declarations, interrupt functions, Reentrant functions.

Module 4: **(15)**

Rapid application development with C for 8051 – Hello world program, development tools, comparison of assembly language programming with HLL programming

Writing C code for: port i/o, external interrupt processing, Serial Communication, interfacing 16*2 LCD, interfacing ADC and DAC, Interfacing I^2C EEPROM/RTC.

Reference Books

1. Henry Mullish, Herbert L. Cooper, The Spirit of C - An introduction to modern programming, Jaico Publishing House
2. Byron Gottfried, SCHAUM'S Outlines, Programming with C, Tata McGraw - Hill Education.
3. E. Balagurusamy, Programming in ANSI C, McGraw Hill Education.
4. Keil Software, Inc., Keil C51 compiler users guide, Keil Elektronik GmbH.
5. J.S. Parab, V. G. Shelake, R. K. Kamat, G. M. Naik, Exploring C for microcontrollers – A Hands on Approach, Springer

DSE-304: Satellite Communications

Course Objectives:

1. To study modulation encoding and decoding for satellite systems
2. To study various aspects of satellite channel and satellite transponder
3. To study various multiple access formats for satellites

Course Outcomes :

1. The students will be able to understand various modulation, encoding and decoding techniques involved in satellite communications
2. They will be able to understand various aspects of satellite channel and satellite transponder
3. They will be able to understand various multiple access formats used in satellite communications

Module 1: Modulation, Encoding and Decoding (15)

History of satellite communications, review Orbital mechanics, Analog modulation, Digital Encoding, Spectral shaping, Digital decoding, Error correction Encoding, Block Waveform Encoding, Digital Throughput

Module 2: Satellite channel (15)

Electromagnetic field propagation, Antennas, Atmospheric losses, receiver Noise, Carrier to Noise ratios, satellite link analysis, Frequency Reuse by dual polarization, Spot beams in satellite downlinks.
Satellite ranging systems

Module 3: Satellite Transponder, FDMA format (15)

Transponder model, the satellite front end, RF filtering of digital carriers, Satellite signal processing, Transponder Limiting, Non linear satellite amplifiers, Effect of non linear amplification on digital carriers
FDMA - FDMA system, Nonlinear amplification with multiple FDMA Carriers, FDMA, FDMA Nonlinear analysis, FDMA channelization, AM/PM conversion with FDMA, Satellite switched FDMA

Module 4: TDMA and CDMA formats (15)

TDMA -The TDMA system, preamble design, Satellite Effects on TDMA performance, Network synchronization, SS TDMA
CDMA - Direct Sequence CDMA system, Performance of DS CDMA, satellite systems, Frequency Hopped CDMA, Antijam advantages of spectral spreading, Code Acquisition and Tracking

Reference Books

1. Robert M. Gagliardi, Satellite Communications, New Delhi : CBS Publishers and Distributors, 2000
2. Timothy Pratt, Charles W. Bostian, Jeremy E. Allnutt, Satellite Communications, Singapore : John Wiley and Sons Inc. 2003
3. Dennis Roddy, Satellite Communications. New York : McGraw-Hill, 2001

DSE-304: Soft Computing

Course Objectives

1. To develop an understanding of concepts related to soft computing
2. To understand use of fuzzy systems
3. To develop an ability to design neural networks

Course Outcomes

1. Able to understand concepts related soft computing
2. Understand the use of fuzzy systems
3. Able to design and train neural network

Module 1: Fuzzy Systems (15)

Fuzzy Set: Crisp and non-crisp set, Capturing uncertainty, Definition of Fuzzy Set, Graphical Interpretations, Fuzzy Operations, Fuzzy Reasoning, Fuzzy Inference, Application Examples.

Module 2: Fundamental of Neural Network (15)

Comparison between Biological and Artificial Neural Networks, Concept of Artificial Neural Network, Advantages and Application domains of Artificial Neural Network, Models of Artificial Neuron: McCulloch-Pitts Model, Basic Elements, Activation Functions, Artificial Neural Network Architectures: Single and Multi Layer, Feed Forward, Recurrent, Learning Process, Types of Learning.

Module 3: Supervised Learning (15)

Perceptron Networks: Theory, Learning Rule, Architecture and Training process
Adaptive Linear Neuron: Theory, Delta Rule, Architecture and Training process
Back Propagation Network: Theory, Architecture and Training process
Radial Basis Function Network: Theory, Architecture and Training process

Module 4: Unsupervised Learning (15)

Fixed Weight Competitive Nets: Theory, Architecture, Training Algorithm
Kohonen Self-Organizing Feature Maps: Theory, Architecture, Training Algorithm
Learning Vector Quantization: Theory, Architecture, Training Algorithm
Adaptive Resonance Theory Network: Adaptive Resonance Theory 1 and Adaptive Resonance Theory 2.

Reference Books

1. George J. Klir, Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and Applications", PHI
2. K. Tanaka, "An introduction to Fuzzy Logic for Practical Application", Springier, New York
3. S. N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Wiley, India (P) Ltd., 1st Indian Edition
4. S. Rajsekaran, G. A. VijayalaxmiPai, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and applications", PHI, New Delhi.
5. Rajkumar Roy, Mario Koppen, "Soft Computing and Industry: Recent Applications", Springer.

DSE-304: VHDL Programming

Course Objectives

1. To introduce HDL programming languages.
2. To make the students able to write VHDL codes for various combinational and sequential designs.
3. To make students able to understand Concurrent Statements.
4. To make students able to understand sequential Statements.

Course Outcomes

1. Students get introduced with HDL programming languages.
2. Students become able to write VHDL codes for various combinational and sequential designs.
3. Students become able to understand basics of VLSI design with Concurrent Statements in VHDL.
4. Students become able to understand basics of VLSI design with sequential Statements in VHDL.

Module 1: Introduction to VHDL (15)

History of VHDL, Advantages of HDLs over Sequential Languages, VHDL library and package declaration, VHDL Component, Entity syntax, Signal modes, Architecture syntax, Process, Concurrent Signal Assignments. Concept of RTL Synthesis. Simulation. Introduction to EDA Tools. Design Flow.

Module 2: Objects and Data Types (15)

Class: Constant, Variable, Signal. Data Types: Boolean, Integer, Character, Bit, Array, Type Declaration, Vectors and slices, bit string literals, Concatenation, Aggregate, Enumerated. 9-Value Logic: std_logic vs std_ulogic. Sub types, Multidimensional Array. Relational and Arithmetic Operators. Init value. Generics. Signal assignment, Concurrency, Delay in VHDL Statements.

Module 3: Concurrent Statements (15)

Concept of Concurrent statements, Concurrent VHDL Construction: *process* statement with design example, *when-else* statement with design example, *with-select* statement, signal declaration and *block* statements with program example

Module 4: Sequential Statements (15)

Sequential VHDL Construction: *if-then-else* statements, *case* statement, *variable* declaration and assignments. Loops: *for* and *while.* Architecture modeling styles. Design Examples: Multiplexor, De-Multiplexor, Decoder, Encoder, Synchronous counters using state machines.

Reference Books

1. VHDL Primer, J. Bhaskar, Pearson Education.
2. VHDL for Designers, Stefan S and Lennart Lindh, Prentice Hall.
3. VHDL by Douglas L. Perry, Mc Graw Hill Publications.

M.Sc. Part II - Semester IV

CC-401: Digital Signal Processing

Course Objectives

1. To develop an understanding of concepts related to digital signal processing
2. To develop an ability to design and analyze digital filters
3. To understand different tools that can be used to compute DFT

Course Outcomes

1. Understand Discrete Fourier Transform (DFT), its properties and applications
2. Understand the use of Fast Fourier Transform (FFT) algorithm
3. Able to design and analyse FIR and IIR digital filters
4. Understand architecture of digital signal processor and applications of DSP

Module 1: Discrete Time Signals and Systems (15)

An overview of Digital Signal Processing (DSP), Discrete time signals: Representation, Standard discrete time signals, Classification of discrete time signals and systems, Manipulations of discrete time signals, Sampling of analog signals, Aliasing, Sampling theorem. Discrete time system: Block diagram representation of discrete time systems, Convolution Sum, Causality and Stability condition in terms of the Impulse Responses.

Module 2: Z Transform and Analysis of Discrete Time System (15)

Z-Transform and region of convergence (ROC), Inverse Z-Transform, Properties of Z-Transform, Analysis of Linear Time Invariant (LTI) systems in Z domain: System function of LTI system, Transient and Steady state responses, Causality and Stability of System. Solution of difference Equations, Frequency Domain Sampling: Discrete Fourier Transform (DFT), Inverse Discrete Fourier Transform (IDFT), DFT as Linear Transformation, Fast Fourier Transform (FFT) Algorithms: Radix2 Decimation in Time (DIT) and Decimation in Frequency (DIF) algorithms to compute DFT.

Module 3: Design and Realization of Digital Filters (15)

Finite Impulse Response (FIR) filter structure and design: Direct and cascade forms, frequency sampling and linear phase structure. Windowing method, Frequency sampling method of design, Infinite Impulse Response (IIR) filter structure and design: Direct form, Cascade form, Parallel form. Impulse invariance, Bilinear Transformation method of design

Module 4: DSP Architecture (15)

Architectural features of DSP processors: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSP, Multiple access memory, Multiport Memory, Pipelining, Special addressing modes, On-chip Peripherals, Fixed point and floating point numeric representation and arithmetic, Different generations of DSP Processors, Applications of DSP to image and speech processing.

Reference Books

1. John G Prokis, Manolakis, Digital Signal Processing-Principles, Algorithms and Application, 4th Edition, Pearson Education Publication
2. Salivahanam, A Vallavaraj, C. Guanapriya, Digital Signal Processing, 1st Edition, Tata McGrawHill, New Dehli
3. P. Ramesh Babu, Digital Signal Processing, 4th Edition, Scitech Publication.
4. A. Ambardar, Digital Signal Processing: A Modern Introduction, Cengate Learning India Pvt Ltd, New Dehli
5. P. Pirsch, Architectures for Digital Signal Processing, John Wiley publication, New Delhi
6. Phil Lapsley, DSP Processor Fundamentals: architectures and Features, Wiley publication
7. S.K. Mitra,Digital Signal Processing Computer Based Approach, TMH. New Dehli. 2009
8. M. Bhaskar, Digital Signal Processorsby B.Venkataramani, Architecture, programming and applications, TMH, New Dehli

CCS-402: Analog and Digital Circuit Design

Course Objectives:

At the end of course the students will be able to:

1. Design the power supply .
2. To design circuits and systems for particular applications using linear integrated circuits
3. To design the digital system and circuit for particular applications.

Course Outcomes:

1. Able to design regulators and power supply
2. Able to analyze and design Multivibrator and Oscillators
3. Understand the analysis and design circuits using operational amplifiers
4. Understand the design of digital circuits

Module 1: **(15)**

Zener series and shunt regulators, transistors as series and shunt regulators, regulator design with discrete components and IC 741/78xx, current sources and their design with discrete components and ICs, SMPS design.

Module 2: **(15)**

Design of multivibrators, (AMV, MMV, BMV) using ICs (555, 741), schimitt trigger, triangular waveform generator, design of oscillators (wein bridge, phase shift colpitt, harltey) using 741, PLL IC LM565, VCO LM566, analog multiplexer IC4051/52, design of RF tuned amplifier

Module 3: **(15)**

CMOS-TTL and TTL-CMOS interfaces, design of counter using FF and counter ICs, Oscillator design using Schmitt trigger (7414), inverter and NAND gate, MMV using gates and ICs (74/54121, 74221), design of binary to gray code converter, design of BCD to excess-3, excess-3 to BCD converter, design of full adder using MUX, design of 16-1 using 4 4-1 MUXs, design of parity checker, memory interfacing, RAM ROM and EEPORM

Module 4: **(15)**

Design of ON OFF, proportional and PID controller, design of capacitance and inductance meter, design of DVM using 7107, design of frequency synthesizer, design of digital multimeter.

Reference Books

1. Introduction to system design using ICs- B.S. Sonde, Wiley Western Ltd.
2. Circuit Consultants Handbook , Hemmnigway
3. Microprocessor and Microcontroller – BPB handbook
4. Digital Fundamentals, Floyd, USB, New Delhi
5. Designing with OP-AMP analog and digital ICs, S.Francio, McGraw Hill.
6. Application and Design with analog ICs, J.Michel Jacob, Printice Hall of India

CCS-403: Real Time Embedded Systems

Course Objectives:

1. To learn the basic concepts of Real Time.
2. To identify hardware and software components for real time embedded systems.
3. To learn PIC microcontroller architecture and programming.
4. To learn real time operating system.

Course Outcomes:

On completion of this course the student will be able to,

1. To understand the application specific real time constraints.
2. Design and develop real time embedded systems.
3. To develop PIC microcontroller applications with emphasis on real time response.
4. To employ RTOS components for real time designs.

Module 1: **(15)**

Introduction to Real time embedded systems, Microchip PIC microcontroller: PIC microcontroller features, scaling of PIC MCU families, overview of baseline, midrange, enhanced midrange, and high-end core devices.
Core architecture: PIC Architecture, Program memory, Addressing Modes, Instruction set.
MPLAB IDE overview: Using MPLAB, Toolbars, Select Development Mode And Device Type, Project, Text Editor, Assembler, MPLAB Operations.

Module 2: **(15)**

PIC MCU Hardware: reset, clock, control registers, register banks, program memory paging, Ports, interrupts, Timer and Counter, watchdog timer, power up timer, sleep mode, state machine programming.
Overviews of PIC tools – Development softwares, compilers, debug tools.

Module 3: **(15)**

Introduction to RTOS, Scheduler, objects, services. Tasks, task states and scheduling, synchronization, communication and concurrency.
Kernel objects: Semaphores, queues, pipes, event registers, signals, and condition variables.
Exceptions and interrupts: Introduction, Exception v/s Interrupt, Applications of exceptions and interrupts.

Module 4: **(15)**

Timer and timer services: Introduction, Real-time clock and system clock, Programmable interval timers, Timer ISRs, Timing wheels, soft timers.
I/O subsystem: Basic I/O concepts, The I/O subsystem.
Memory Management: Introduction, Dynamic memory allocation in Embedded systems, Fixed-size memory allocation, blocking v/s non-blocking memory functions, H/W memory management units

Reference Books

1. Ajay V Deshmukh, Microcontrollers: theory and applications, TMH.
2. Myke Predko, Programming & Customizing PICmicro Microcontrollers, TMH.
3. Tim Wilmshurst, Designing Embedded Systems with PIC Microcontrollers, Newnes.
4. David W Smith,PIC in Practice, Newnes.
5. John Morton, PIC: Your Personal Introductory Course, Newnes.
6. Qing Li, Caroline Yao, Real-Time Concepts for Embedded Systems, CMP Books.
7. David E. Simon, An Embedded Software Primer, Addison-Wesley.
8. Raj Kamal , Embedded Systems: Architecture, Programming and Design, 2nd Edition, McGraw-Hill Education, ISBN-10: 00701253
9. Jean J. Labrosse, MicroC OS II: The Real Time Kernel, Publisher: CMP Books, ISBN-10: 9787820103

DSE-404: Advanced Drives

Course Objectives:-

1. To impart knowledge on the operation, application and control of power conversion systems employing electric drive to cater to industrial needs.
2. To familiarize the operation principles, and design of starting, braking, and speed control arrangements for electric motors and their applications.
3. To provide strong foundation to asses performance of different industrial drives considering issues such as, energy efficiency, power quality, economic justification, environmental issues, and practical viabilities.
4. To impart industry oriented learning

Course Outcomes:-

1. Classify types of electric drives systems based on nature of loads, control objectives, performance and reliability.
2. Combine concepts of previously learnt courses such as, electrical machines, Control and power electronics to cater to the need of automations in industries.
3. Select most suitable type and specification of motor drive combination for efficient conversion and control of electric power.
4. Set up control strategies to synthesize the voltages in dc and ac motor drives.

Module 1: Basic of Electrical machines (15)

D.C. motors, Types of D.C. motors, torque speed characteristics. Induction motors, Types of Induction motors. Synchronous machines.

Module 2: (15)

Separately excited DC motors with rectified single phase supply- single phase semi converter and single phase full converter for continuous and discontinuous modes of operation. Three phase semi converter and three phase full converter for continuous and discontinuous modes of operation. Closed loop control of phase controlled DC motor Drives: - Open loop Transfer function of DC Motor drive, Closed loop Transfer function of DC Motor drive ,Phase-Locked loop control. Chopper controlled DC motor drives, Closed loop control of chopper fed DC motor Drives

Module 3: D.C. Motor Control (15)

AC motor Control: Voltage Source Inverter Fed Induction motor drives : - Scalar control- Voltage fed Inverter control-Open loop volts/Hz control-Speed control with slip regulation-Speed control with torque and Flux control-Current controlled voltage fed Inverter Drive.

Current Source Inverter Fed Induction motor drives : - Current-Fed Inverter control-Independent current and frequency control-Speed and flux control in Current-Fed Inverter drive-Volts/Hz control of Current-Fed Inverter drive-Efficiency optimization control by flux program.

Slip power recovery schemes: - Slip-power recovery Drives-Static Kramer drive, Static scherbius drive. Vector control of Induction Motor.

Module 4: Stepper motors (15)

Classification, types, modes of excitations, Drive requirements, Unipolar voltage drive for various reluctance, motor bipolar voltage drive for permanent magnet and hybrid step motors. Drives for specific applications: - Drive considerations for textile mills, steel rolling mills, cranes and hoist drives, cement mills, sugar mills, paper mills, coal mills, centrifugal pumps.

References

1. Electronic drives- Concept & Applications –Vedam Subrahmanyam(THM)
2. Power Semiconductor drives-S.B.Dewan, G.R.Sleman, A.Strauphan (Wiley Int. Publ.)
3. Power Electronics – By P.C.Sen.
4. Power Electronics –C.W. Lander (MHI Publication
5. Power Electronics and Motor Control – Shepherd, Hulley, Liang – II Edition, Cambridge University Press
6. Modern Power Electronics and AC Drives –B. K. Bose-Pearson Publications

DSE-404: Artificial Intelligence and Machine Learning

Course Objective:

1. To endow with various disciplines of Artificial Intelligence and its applications.
2. To explore knowledge representation techniques in AI.
3. To demonstrate Machine Learning through Artificial Neural Networks.

Course Outcomes:

1. Apply problem solving by intelligent search approach.
2. Represent knowledge using AI knowledge representation techniques.
3. Design Machine Learning solution to real life problems.

Module 1: **(15)**

Overview: foundations, scope, problems, and approaches of AI.
Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents
Artificial Intelligence programming techniques
Problem-solving through Search: forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

Module 2: **(15)**

Knowledge Representation and Reasoning: ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.
Planning: planning as search, partial order planning, construction and use of planning graphs

Module 3: **(15)**

Representing and Reasoning with Uncertain Knowledge: probability, connection to logic, independence, Bayes rule, bayesian networks, probabilistic inference, sample applications.
Decision-Making: basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

Module 4: **(15)**

Machine Learning and Knowledge Acquisition: learning from memorization, examples, explanation, and exploration. learning nearest neighbor, naive Bayes, and decision tree classifiers, Q-learning for learning action policies, applications.
Sample Applications of AI, student project presentations.
Brief Survey of selected additional topics: perception, communication, interaction, and action; multiagent systems.

Reference Books

1. Artificial Intelligence & Expert Systems, Dan W. Patterson, Prentice Hall of India, 2005
2. Artificial Intelligence, Elaine Rich, Kerin Knight, Tata McGraw Hill Publishing Company, New Delhi, 2nd Ed, 2004
3. Artificial Intelligence : A Modern Approach, Stuart Russel, Pearson Education, 3rd. Ed., 2011
4. Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, S. Rajasekaran, G. A. Vijayalakshmi Pai, Prentice-Hall of India, 2003
5. S. N. Sivanandam, Principles of Soft Computing, Wiley India, 2007
6. Artificial Intelligence & Soft Computing Behavioral & Cognitive Modeling of the Human Brain, Amit Konar, CRC Press, New York, 2008
7. Introduction to Machine Learning, Ethem Alpaydin, PHI Learning Pvt. Ltd, 3rd Ed., 2014

DSE-404: IoT and Data Analytics

Course Objectives:

IoT Fundamentals curriculum provides students with a comprehensive understanding of the Internet of Things (IoT). It develops foundational skills using hands-on lab activities that stimulate the students in applying creative problem-solving and rapid prototyping in the interdisciplinary domain of electronics, networking, security, data analytics, and business.

Course Outcomes:

1. Participants who complete the IOT Fundamentals: Big Data & Analytics course will be able to perform the following functions: Describe the various systems that support a typical data center
2. Explain how server virtualization consolidates idle resources, reduces cost and provide better services to the business
3. Explain how the Software Defined Networking (SDN) framework plays the key role in data center virtualization
4. Understand the steps of the Data Analysis Lifecycle and apply it in real life

Module 1: **(15)**

Data and the Internet of Things, Concepts of Big Data & Analytics, and the role of Big Data in IoT systems. Fundamentals of Data Analysis Basics of descriptive statistics, the practical aspects in acquiring data from a sensor and how to create visual representations of the data.

Module 2: **(15)**

Data Analysis Exploring data using statistics and visualization to extract information and create hypotheses.

Module 3: **(15)**

Advanced Data Analytics and Machine Learning, Storytelling with Data

Predictive analytics, the supervised and unsupervised approaches to machine learning, Applying models to make predictions from the data. Transforming analytics results into a clear and convincing narrative and visual communication.

Module 4: **(15)**

Architecture for Big Data and Data Engineering

basic principles behind important scalable solutions for Big Data such as Apache Hadoop and the related ecosystem of technologies.

Text & References

1. The Second Machine Age: Work, Progress and Prosperity in a Time of Brilliant Technologies by Erik Brynjolfsson and Andrew McAfee. ISBN-10: 0393239357
2. Getting started with Internet of Things, by Cuno Pfister, Shroff; First edition (17 May 2011), ISBN-10: 9350234130
3. Big Data and The Internet of Things, by Robert Stackowiak, Art licht, Springer Nature; 1st ed. edition (12 May 2015), ISBN-10: 1484209877
4. Web Reference: Cisco.netacad.net

DSE-404: ARM Programming and Embedded Communication Protocols

Course Objectives:

1. To learn ARM programmers modes and instruction set.
2. To learn I^2C, SPI and CAN protocols; and their use in embedded system communications.

Course Outcomes:

On completion of this course the student will be able to,

1. To write programs for ARM architectures.
2. To write programs for communication between microcontrollers, or microcontroller and smart interfaces using I^2C, SPI and CAN protocols.

Module 1: **(15)**

The ARM instruction set:

Introduction, exceptions, conditional execution, Branch and branch with link, software interrupt, data processing instructions, multiply instructions, data transfer instructions.

Architectural support for HLLs: Data types, Expressions, Conditional statements, loops.

Module 2: **(15)**

Inter-Integrated Circuit (I2C) BUS:

I2C bus specification, general characteristics, bus signals, Address mechanism, Applications – microcontroller interfacing examples for I2C EEPROM, RTC, ADC, and digital temperature sensors.

Module 3: **(15)**

Serial peripheral interface (SPI):

Introduction, Specifications, master slave configuration, applications - microcontroller interfacing examples for SPI EEPROM, RTC, ADC and digital temperature sensors.

Module 4: **(15)**

Recent embedded protocols:

Controller Area Network (CAN): Specifications, basic concepts, Frame types, bus signals, Error handling, Addressing.

Introduction to IButton devices, 1-wire protocol.

Reference Books

1. David Seal, ARM Architecture reference manual, Addison-Wesley Professional; 2nd Edition, 2001. ISBN-10: 0201737191
2. Steve Furber, ARM System-on-chip Architecture, Addison Wesley. (2nd Edition) 2000 ISBN-10: 0201675196
3. The I2C-bus specification, http://www.semiconductors.philips.com/i2c, Philips semiconductor, 2000.
4. PIC/AVR datasheets for I2C, SPI functions.
5. Overview and use of the SPI PICmicro Serial Peripheral Interface, Microchip Inc. http://www.microchip.com.
6. Robert Bosch GmbH, CAN Specification, 1997.

DSE-404: FPGA Based Systems

Course Objectives:

1. To introduce FPGA Design Flow for system design.
2. To make the students able to Compare FPGA and other Reconfigurable Devices.
3. To make students able to understand VLSI design Technology.
4. To make students able to design and test the FPGA based system

Course Outcomes:

On completion of this course the student will be able to,

1. Students become able to understand FPGA Design Flow for system design.
2. Students become able to Compare FPGA and other Reconfigurable Devices.
3. Students become able to understand VLSI design Technology.
4. Students become able to design and test the FPGA based system

Module 1: Programmable Logic Technology (15)

Basics and Types Programmable Logic, PLA, PAL, GAL, SPLDs, CPLD: Families, Features, Architecture – XC 9500, Functional Block, Macrocell, Product Term Allocator, Switch Matrix, I/OBs. Pin Locking, Timing Models. ISP Features and Advantages.

Module 2: FPGA Technology (15)

FPGA Architecture, Features, Basic Building Blocks of FPGA: CLBs, IOBs, CLB Function Generators: F, G, H. Architectural Resources, Programmable Interconnects, Power Distribution in FPGA, Configuration. FPGA vs CPLD.

Module 3: FPGA Design Flow (15)

Introduction to HDL Programming, Advantages of HDLs over Sequential Programming Languages, Objects and Data Types in VHDL, Architecture Modeling Styles in VHDL, Finite State Machines Coding using VHDL: Stepper Motor Driver, Synchronous Counters

Module 4: EDA Tools for FPGA Platform Development (15)

EDA Tools (Xilinx ISE) Design Flow, Embedded Development Kit: Core Generator, ICON and ILA Cores. Chip Scope-Pro based testing platform.

Reference Books

1. VHDL Primer, J. Bhaskar, Pearson Education.
2. VHDL for Designers, Stefan S and Lennart Lindh, Prentice Hall.
3. VHDL by Douglas L. Perry, Mc Graw Hill Publications.
4. Digital Principles and Practices, John F. Wakerly, Prentice Hall International Editions.
5. Xilinx Chipscope Pro to Visualize FPGA Internal Signals, Pawan Gaikwad, LAP Lambert Academic Publishing.

DSE-404: Antennas

Course Objectives:

1. To study radiation integrals, auxiliary potential functions and linear wire antennas
2. To study point sources, their arrays and principle of pattern multiplication
3. To study some loop, traveling wave and broadband antennas

Course Outcomes :

1. Students will review basic antenna concepts, understand auxiliary potential functions, linear wire antennas
2. They will be able to understand point sources-their arrays, pattern multiplication
3. They will also be able to understand loop, traveling wave and broad band antennas

Module 1: Basic Antenna Concepts (15)

Radiation pattern, Beam area, Radiation power density, Radiation intensity, Directivity, Gain, Aperture concept, Antenna efficiency, Half power beamwidth, Beam efficiency, Bandwidth, Polarization, Input impedance, Antenna radiation efficiency, Antenna vector effective length and effective areas, Maximum directivity and maximum effective area, Effective height, Friss transmission formula, Duality of antennas, Antenna temperature

Module 2: Radiation Integrals and Auxiliary potential functions Linear wire antennas (15)

Vector potential for an electric current source, Vector potential for magnetic current source, Electric and magnetic fields for electric and magnetic current sources, Solution of the inhomogeneous vector potential wave equation, Far field radiation, Infinitesimal dipole, Small dipole, Region Separation, Finite length dipole, Half-wavelength dipole, Linear elements near or on infinite perfect conductors, Ground effects

Module 3: Point Sources and arrays of point sources (15)

Power theorem and its application to an isotropic source, Radiation Intensity, Source with Hemispheric, unidirectional cosine, bidirectional cosine, sine(doughnut), sine- squared (doughnut), unidirectional cosine-squared power patterns, Directivity, Source with arbitrary shape Gain, Field patterns, Arrays of two isotropic point sources, Nonisotropic but similar point sources and the principle of pattern multiplication, pattern synthesis by pattern multiplication, Nonisotropic and dissimilar point sources, Linear arrays of n isotropic point sources of equal amplitude and spacing, Null directions

Module 4: Loop, Traveling wave, broadband and other types of antennas (15)

Small circular loop, Circular loop of constant current, Circular loop with nonuniform current, Ground and Earth curvature effects, Polygonal loop antennas, V antenna, Rhombic antenna, Helical antenna, electric-magnetic dipole, Yagi-Uda array of linear elements, Yagi-Uda array of loops, basics of microstrip antennas, Plane reflector, Corner reflector

Reference Books

1. John D.Kraus, Antennas, New Delhi: Tata McGraw-Hill Publishing Company Ltd, 1999
2. Constantine A.Balanis,Antenna Theroy Analysis and Design, Wiley India P. Ltd, 2010

DSE404: Mechatronics

Course Objectives:

To understand

1. the basic principles in the area of Mechatronics
2. sensors and signal conditioning.
3. basic modules, dynamic responses and transfer functions.
4. theoretical and practical preparation of students and apply skills in robotics.

Course Outcomes:

Ability to

1. learn and identify the Mechatronics
2. acquires signal conditioning and pneumatics for Mechatronics
3. understand responses, i/o systems and loops.
4. train to gross up the knowledge and analyses robotics systems.

Module 1: **(15)**

Introducing Mechatronics, Sensors and Transducers, Signal Conditioning, Digital Signals, Digital Logic

Module 2: **(15)**

Pneumatic and Hydraulic Actuation Systems, Mechanical Actuation Systems, Electrical Actuation Systems.

Module 3: **(15)**

Basic System Model, System Models, Dynamic Responses of System, System Transfer Functions, Frequency Response.

Module 4: **(15)**

Closed-loop Controllers, Input/Output Systems, Communication Systems, Fault Finding, Mechatronic Systems.

Reference Books

1. William. Bolton, Mechatronics, fourth Edition, New Delhi : Pearson Education in South Asia, 2011.

DSE 404: Cellular Mobile Communications

Course Objectives:

To understand

1. the basic principles in the area of Cellular Mobile Communications
2. Handoffs calls and operational techniques.
3. cell construction and concepts
4. theoretical and practical preparation of students and apply skills in mobile communications.

Course Outcomes:

Ability to

1. learn and identify the mobile communication system.
2. acquires transceiver characteristics in mobile communication system
3. work out the operation of digital systems.
4. train to solve computational problems and analyses for mobile communication.

Module 1: **(15)**

Introduction to Cellular mobile systems, Elements of Cellular radio system Design, specifications of analog systems, Cell coverage for signal and traffic

Module 2: **(15)**

Cell-site antennas and mobile antennas, Co-channel interference reduction, Types of non co-channel interference, Frequency management and channel assignment

Module 3: **(15)**

Handoffs and dropped calls, operational techniques and Technologies, switching and traffic

Module 4: **(15)**

Introduction to digital systems, Digital cellular systems, Intelligent cell construction and Applications, Features of handset, SMS, Security.

Reference Books:

1. William C.Y. Lee, Mobile Cellular Telecommunications : Analog and Digital Systems, Singapore : McGraw-Hill, 1995
2. William C.Y. Lee, Mobile Communication Engineering, McGraw-Hill.