DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SYLLABUS FOR M. Sc. (Electronics) PROGRAMME

CHOICE BASED CREDIT SYSTEM

RAJIV GANDHI UNIVERSITY,

RONO HILLS, DOIMUKH

About the Department

Welcome to the department of Electronics & Communication Engineering at Rajiv Gandhi University (A Central University), Rono Hills, Itanagar. The department was established in the year 2015 with the aim of providing leadership in the field of Electronics & Communication Engineering and interdisciplinary research. The initiative has been taken to establish state of art research laboratories in the area of VLSI Design and Technology, MEMS and Sensors, Embedded System, Wireless Communication and Signal Processing. Department provides healthy environment to students and faculties to carry out inter department collaborative research in area like Bio medical Engineering and robotics. A team of competent and dedicated teachers are engaged in relentless pursuit of excellence in this field of engineering.

About the M.Sc. (Electronics) Programme

The M.Sc. (Electronics) programme offered by the Department of Electronics and Communication Engineering, Rajiv Gandhi University is of two years' duration and is divided into four semesters. The various courses of the programme are designed to include classroom teaching, laboratory work, project work, viva, seminars and assignments.

The three Category of Courses are the Core Course, the Elective Courses and the Open Elective. The student is required to accumulate twenty-two credits each semester, a total of eighty eight credits, to fulfill the requirements for a Master of Science degree in Electronics.

M.Sc. (Electronics) Programme Details:

Programme Objectives (POs):

After completing the curriculum, the student will have a broad understanding of a variety of technological topics. Through fostering scholarly progression and intellectual development, this programme aims to give students with high-quality education and skills, allowing them to pursue a career of their choice. Through multi-dimensional education, the student will build a sense of self-confidence and self-reliance by cultivating abilities and encouraging all-round personality development. Professional ethical values will be taught, and the student will be equipped to contribute to society as a responsible individual.

Programme Specific Outcomes (PSOs):

After completing the two-year programme, the student will be able to explain and understand various branches of electronics, including communication electronics, optical electronics, circuit design, electrical machines and control systems, electronic materials and semiconductor devices, microprocessors, digital signal processing, and RF and microwaves. Under guidance, the student will be able to complete a brief research project including Basic and Advanced Electronics skills. The student will be prepared to work in industry or academics in a relevant role.

Programme Structure:

The M.Sc. (Electronics) programme is a two-year course divided into four-semester. A student is required to complete 88 credits for the completion of course and the award of degree.

		Semesters	**Semesters**
Part-I	First Year	Semester I	Semester II
Part-II	Second Year	Semester III	Semester IV

M.Sc.(Electronics) Programme (Semester Wise)

<u>Course Credit Scheme</u>

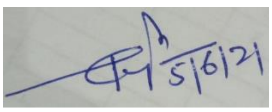
Semester	**Core Courses**			**Elective Course**			**Open Elective Course**			**Total Credits**
	No. of papers	Credits (L+T/P)	**Total Credits**	No. of papers	Credits (L+T/)	**Total Credits**	No. of papers	Credits (L+T/P)	**Total Credits**	
I	7	16 + 6	22							**22**

II	7	16 + 6	22							**22**
III	5	8+ 6	22	1	4	4	1	4	4	**22**
IV	1	10		3	4	12				**22**
Total Credits for the Course										**88**

Semester wise Details of M.Sc. (Electronics) Course

Semester I				
Name of the Course	**Credits in each core course**			
Course	Theory	Practical	Tutorial	Credits
ESC101:Network Analysis and Synthesis	4	-	-	4
ESC102:Semiconductor Devices and Material	4	-	-	4
ESC103:Digital Circuit Design	4	-	-	4
ESC104: Programming with C Language	4	-	-	4
ESL105: Semiconductor Devices and Material Lab.	-	2	-	2
ESL106:Digital Circuit Design Lab.	-	2	-	2
ESL107:Programming with C Language Lab.	-	2	-	2
Core course ‘n’ (total number) = 7	16	6	-	22
Total credits in core course	**22**			

Semester II				
Name of the Course	**Credits in each core course**			
Course	Theory	Practical	Tutorial	Credits
ESC201:Signals & Systems	4	-	-	4
ESC202:Microprocessors	4	-	-	4
ESC203:Analog Circuit Design	4	-	-	4
ESC204:Control Systems	4	-	-	4
ESL205:Signals & Systems Lab.	-	2	-	2
ESL206:Microprocessors Lab.	-	2	-	2
ESL207:Control Systems Lab.	-	2	-	2
Core course ‘n’ (total number) = 7	16	6	-	22
Total credits in core course	**22**			



Semester III				
Name of the Course	**Credits in each core course**			
Course	Theory	Practical	Tutorial	Credits
ESC301:Principle of Communication	4	-	-	4
ESC302:Embedded System Design	4	-	-	4
ESEXXX: Elective-I	4	-	-	4
Open elective#	4	-	-	4
ESC303:Seminar	2	-	-	2
ESL304:Principle of Communication Lab.	-	2	-	2
ESL305:Embedded System Design Lab.	-	2	-	2
Core course ‘n’ (total number) = 7	18	4	-	22
Total credits in core course	**22**			

 # This course is offer by other department.

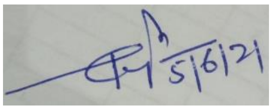
Semester IV				
Name of the Course	**Credits in each core course**			
Course	Theory	Practical	Tutorial	Credits
ESEXXX: Elective-II	4	-	-	4
ESCXXX: Elective-III	4	-	-	4
ESEXXX: Elective-IV	4	-	-	4
ESC403: Dissertation	10	-	-	10
Core course ‘n’ (total number) = 4	22		-	22
Total credits in core course	**22**			

Selection of Elective Courses:

List of Elective-I course	**Credits in each elective course**			
Course	Theory	Practical	Tutorial	Credits
ESE321: RF and Microwave Systems*	4	-	-	4
ESE322:Photonics: Principles and Applications*	4	-	-	4

List of Elective-II course	**Credits in each elective course**			
Course	Theory	Practical	Tutorial	Credits
ESE421:VLSI Technology*	4	-	-	4
ESE422: Digital Signal Processing*	4	-	-	4

List of Elective-III courses	**Credits in each elective course**



Course	Theory	Practical	Tutorial	Credits
ESE423: Photonic Devices & Optical Communication*	4	-	-	4
ESE424: Digital Communication *	4	-	-	4

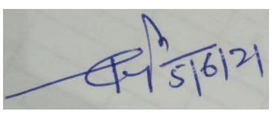
List of Elective-IV courses	**Credits in each elective course**			
Course	Theory	Practical	Tutorial	Credits
ESE425: EMI & EMC*	4	-	-	4
ESE426:Modern Communication*	4	-	-	4

Marks Distribution

Semester I				
Name of courses	**Marks Distribution**			
Course	End Semester	Sessional/ Internal	Practical/ External	Total
ESC101:Network Analysis and Synthesis	80	20	-	100
ESC102:Semiconductor Devices and Material	80	20	-	100
ESC103:Digital Circuit Design	80	20	-	100
ESC104: Programming with C Language	80	20	-	100
ESL105:Semiconductor Devices and Material Lab.	-	60	40	100
ESL106:Digital Circuit Design Lab.	-	60	40	100
ESL107:Programming with C Language Lab.	-	60	40	100

Semester II				
Name of courses	**Marks Distribution**			
Course	End Semester	Sessional/ Internal	Practical/ External	Total
ESC201:Signals & Systems	80	20	-	100
ESC202:Microprocessors	80	20	-	100
ESC203:Analog Circuit Design	80	20	-	100
ESC204:Control Systems	80	20	-	100
ESL205:Signals & Systems Lab.	-	60	40	100
ESL206:Microprocessors Lab.	-	60	40	100
ESL207:Control Systems Lab.	-	60	40	100

Semester III




Name of courses	Marks Distribution			
Course	End Semester	Sessional/ Internal	Practical/ External	Total
ESC301:Principle of Communication	80	20	-	100
ESC302:Embedded System Design	80	20	-	100
ESEXXX: Elective-I	80	20	-	100
Open elective	80	20	-	100
ESC303:Seminar	-	60	40	100
ESL304:Principle of Communication Lab.	-	60	40	100
ESL305:Embedded System Design Lab.	-	60	40	100

Semester IV				
Name of courses	**Marks Distribution**			
Course	End Semester	Sessional/ Internal	Practical/ External	Total
ESEXXX:Elective -II	80	20	-	100
ESEXXX:Elective-III	80	20	-	100
ESEXXX:Elective-IV	80	20	-	100
ESC403: Dissertation	-	120	80	200

Eligibility for Admissions:

Candidates who have passed and secured minimum of 50% in 3 Years B.Sc. (Major) programs in Electronics / Physics / Instrumentation/ Information Technology / Computer Science / Mathematics or other allied subject from any Indian University recognized by UGC.

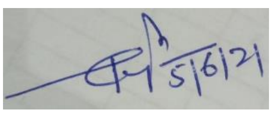
Course Wise Content Details for M.Sc. (Electronics) Programme:

MASTER OF SCIENCE

(Electronics)

Semester I

Course Code: ESC101



Course Name: Network Analysis and Synthesis (Credits: 04)

Marks: 100

Course Objectives:

To equip the students with rigorous theoretical and practical knowledge to analyze and synthesize networks.

Course Outcomes:

- Apply the knowledge of basic circuital law and simplify the network using reduction technique.
- Analyze the circuit using Kirchoff's law and network theorem.
- Infer and evaluate transient response, steady state response, network functions.
- Equip with network synthesis study.

Unit I: Network Theorems: Applications of Thevenin and Norton's theorem, Reciprocity theorem, Compensation theorem, Superposition theorem & Tellegen's theorem.

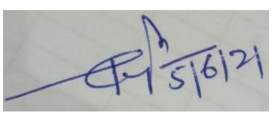
Unit II: Time Domain Analysis of Networks: Differential equation approach (first and higher order differential equations), initial conditions in networks. Laplace Transformation: Introduction to the Laplace transform approach, partial fraction expansion, Heaviside's expansion theorem, transform impedance and transform circuits, network functions, poles and zeroes of network functions and restrictions on pole and zero locations for driving-point functions and transfer function, stability of active network .

Unit III: Two Port Network Parameters: Transmission and inverse transmission parameters, hybrid and inverse hybrid parameters, relation between parameter sets, and interconnection of two port network. Graph Theory: graph tree, link branches, basic tie and cut set, matrices for planar networks, loop and nodal method of analysis

Unit IV: Network Synthesis: Properties of Hurwitz polynomial and positive real function, synthesis of LC, RC and RL network, Foster form and Cauer form.

Suggested Reading:

1. M. E. Van Valkenburg, "Network Analysis", 3rd ed., Pearson.
2. M. E. Van Valkenburg, "Network Synthesis", PHI.
3. DeCarlo, R. A. and Lin, P. M., "Linear Circuit Analysis: Time Domain, Phasor and Laplace Transform Approaches", Oxford University Press.
4. Hayt, Kemmerley and Durbin, "Engineering Circuit Analysis", 8th Ed. Tata McGraw- Hill.
5. Kuo, F. F., "Network Analysis and Synthesis", 2nd Ed., Wiley India.



Course Code: ESC102
Course Name: Semiconductor Devices and Material (Credits: 04)

Marks: 100

Course Objective:

To provide basic knowledge and concepts of Semiconductor materials and devices.

Course Outcomes:

- Ability to apply basic concepts of Inorganic and Organic Semiconductor materials for electronic device application in modern electronic industry.
- Detailed knowledge of various classifications and applications to VLSI, LEDs and solar cells.
- Holistic view of the latest progress in two-dimensional (2D)-one-dimensional (1D) and nano materials.
- Emphasis on nano-electronic applications such as Schottky barrier transistors, flexible Electronics.

Unit I: Inorganic and Organic Semiconductor: Energy bands, carrier transport, mobility, drift- diffusivity, excess carrier, injection and recombination of the excess carriers, carrier statistics; High field effects: velocity saturation, hot carriers and avalanche breakdown.

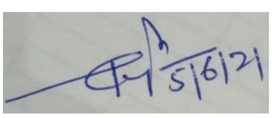
Unit II: Majority carrier Devices: MS contacts rectifier and non-rectifier, MIS structures, MESFET, hetero-junction, HEMT and band diagrams, I-V and C-V characteristics.

Unit III: MOS structures: Semiconductor surfaces; The ideal and non-ideal MOS capacitor band diagrams and CVs; Effects of oxide charges, defects and interface states. MOSFET: Structures and Device Characteristics, Short-Channel effects. Charge coupled Devices (CCDs), application to VLSI.

Unit IV: Nonvolatile Memory Device. Optoelectronic Devices: solar cell, photo detectors, LEDs, laser diodes. **Nano structures and concepts:** quantum wells, supper lattice structures, nanorod, quantum dot, CNTs, 2D materials: grapheme, BN, MoS_2 etc, matamaterials.

Suggested Reading:

1. Donald A. Neamen, Semiconductor Physics and Devices Basic Principles, 3rd edn. McGraw-Hil (2003)
2. B.G. Streetman and Sanjay Banerjee, Solid State Electronic Devices, 6th Edn., Prentice Hall, 2006.
3. S. M. Sze and Kwok K. Ng Physics of Semiconductor Devices, Wiley (2013).
4. M. Hussa, A. Dimoulas and A. Molle, 2D Materials for NanoElectronics,



CRC press (2016)
5. M.S.Tyagi, Introduction to Semiconductor Materials and Devices, Willey, Student Edition

Course Code: ESC103 Course

Name: Digital Circuit Design

(Credits: 04)

Marks: 100

Course Objective:

The course offers students to learn how to minimize the Boolean expression by advanced digital design techniques, programmable logic devices; to understand analysis, designing and reduction techniques for sequential circuits by using Algorithmic state machine and asynchronous sequential circuit design by using transition table. Also course explains concept of fault diagnosis; VHDL programming language and digital designing tools like FPGA, ASIC.

Course Outcomes:

- To learn how to design digital systems, from specification and simulation to construction and debugging.
- To learn techniques and tools for programmable logic design.
- To understand the limitations and difficulties in modern digital design, including wiring constraints, high-speed, etc.
- To design, construct, test, and debug a moderate-scale digital circuit.
- Familiarity with the latest state-of-the-art system on chip (SoC) design methods using FPGAs and ASIC design chips.
- Through the practical assignments, experience will be achieved from both using tools as well as designing their own system.

Unit I: Introduction to Computer-aided design tools for digital systems: SIMO, MIMO. The tabulation method(Quin Mc-clusky), Determination of Prime implicants, Selection of Essential Prime implicants, Iterative Consensus, Generalized Consensus method, Map-entered variables method of Multiple output minimization.

Analysis and Design of combinational System: Multiplexers, ROMs, PLAs, PALs, SPLDs, SRAM.

Unit II: Sequential Circuit Design: Analysis of clocked synchronous sequential circuits and modelling- State diagram, state table, state table assignment and reduction-Design of synchronous sequential circuit design of iterative circuits-ASM chart and realization using ASM.

Unit III: Asynchronous Sequential Circuit Design: Analysis of asynchronous sequential circuit, flow table reduction, races-state assignment, transition table and problems in

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transition table, design of asynchronous sequential circuit-Static, dynamic and essential hazards, data synchronizers, mixed operating mode asynchronous circuits, Clock skew, set up and hold time of a flip-flop. Behavioral models of combinational and sequential logics.

Unit IV: Fault Diagnosis and Introduction To VHDL: Introduction to testing and fault diagnosis in digital circuits: fault modeling, test generation and fault simulation, fault diagnosis, design for testability and built-in self-test.

Introduction to VHDL Programming language, data objects, classes and data types, Operators, Overloading, and logical operators. Types of delays Entity and Architecture declaration, Introduction to behavioral, dataflow and structural models Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics Introduction to FPGAs, ASIC Programming Technology for designing and its device Architecture.

Suggested Reading:

1. M Morris Mano, Digital logic and computer design; PHI.
2. J.F.Wakerly: Digital Design, Principles and Practices, 4th Edition, Pearson Education, 2005
3. Ken Martin, ”Digital Integrated Circuit Design”, Oxford University Press, 2002..
4. N.N.Biswas, ”Logic Design Theory “, Prentice Hall, 1993
5. H. Taub and D. Schilling, Digital Integrated Electronics, McGraw Hill, 1977.
6. D. A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International student Edition, McGraw Hill, 1983.
7. F.J. Hill and G.L. Peterson, Switching Theory and Logic Design, John Wiley, 1981.
8. Z. Kohavi, Switching and Finite Automata Theory, McGraw Hill, 1970.
9. Charles H Roth: Digital Systems Design using VHDL, Thomson Learning, 1998
10. Stephen M.Trimberger “Field Programmable Gate Array Technology” Springer International Edn.
11. VHDL, Primer: J Bhasker, 3rdEdn- Pearson Education
12. VHDL, Programming by Example: Douglas L. Perry, 4thEdn.-TMH.

Course Code: ESC104
Course Name: Programming with C Language
(Credits: 04)

Marks: 100

Course Objectives:

To express algorithms and draw flowcharts in a language independent manner. To teach how to write modular, efficient and readable C programs. To impart knowledge in creating and using Arrays of the C data types. To describe the techniques for creating program modules in C using functions and recursive functions. To demonstrate creation of derived data types and perform operations on files. To familiarize pointers and dynamic memory allocation functions to efficiently solve problems

Upon completion of the course, the students will be able to write, compile and debug programs in C language, Use different data types in a computer program, Design programs involving decision structures, loops, arrays and functions, Identify the difference between call by value and call by reference, Use pointers to understand the dynamics of memory, Create and perform different file operations.

Course Outcomes:

Upon completion of the course, the students will be able to:

- Write, compile and debug programs in C language.
- Use different data types in a computer program.
- Design programs involving decision structures, loops, arrays and functions.
- Identify the difference between call by value and call by reference
- Use pointers to understand the dynamics of memory
- Create and perform different file operations.

UNIT- I Introduction to the C Language – Algorithm, Pseudo code, Flow chart, Background, Programs, Identifiers, Data Types, Variables, Constants, Input / Output, Operators(Arithmetic, relational, logical, bitwise etc.), Expressions, Precedence and Associatively, Expression Evaluation, Type conversions.

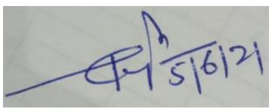
UNIT- II Statements- Selection Statements(making decisions) – if and switch statements, Repetition statements (loops)-while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Simple C Program examples.

UNIT- III Functions- Introduction to Structured Programming, Functions- basics, user defined functions, inter function communication(call by value, call by reference), Standard functions. Storage classes-auto, register, static, extern, scope rules, arrays to functions, recursive functions, example C programs.

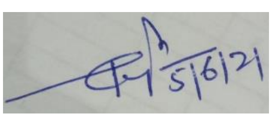
UNIT – IV Arrays and String– Basic concepts, one-dimensional arrays, two – dimensional arrays, multidimensional arrays, C programming examples Pointers – Introduction (Basic Concepts), pointers to pointers, compatibility, Pointer Applications, Arrays and Pointers, Pointer Arithmetic, memory allocation functions, array of pointers, pointers to void, pointers to functions, command –line arguments, Introduction to structures and unions. Strings – Concepts, C Strings, String Input / Output functions, string manipulation functions, string /data conversion. Input and Output – Concept of a file, streams, text files and binary files, Differences between text and binary files, State of a file, Opening and Closing files, file input / output functions (standard library input / output functions for files), file status functions (error handling),Positioning functions.

Suggested Reading:

1. Computer Science: A Structured Programming Approach Using C, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. The C Programming Language by Brian Kernighan and Dennis Ritchie 2nd edition
3. Let Us C Yashavant kanetkar BPB.
4. Absolute beginner's guide to C, Greg M. Perry, Edition 2, Publisher: Sams Pub., 1994.




5. Computer Programming and Data Structures by E Balagurusamy, Tata McGraw Hill.



Semester
II Course Code:
ESC201
Course Name: Signals &
Systems (Credits: 04)

Marks: 100

Course Objectives:

The concepts and theories of signals and systems form the foundation for further studies in areas such as analog and digital communication, analog and digital signal processing, control systems and circuit analysis and synthesis.

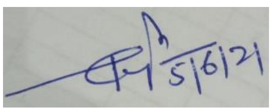
The aim of building complex systems that perform sophisticated tasks imposes on students a need to enhance their knowledge of signals and systems so that they are able to effectively use the rich variety of analysis and synthesis techniques in an application- specific manner.

Course Outcomes:

1. By the end of course, students will be able to understand mathematical description and representation of both continuous-time and discrete-time signals and systems and their properties.
2. Further, the fundamental input-output relationship for LTI systems and the concept of correlation of energy and power signals will be discussed.
3. Through this unit, students will learn about the concept of frequency domain representations and how to decompose periodic signals into their frequency components.
4. Through this course, students will learn about sampling of continuous-time and discrete- time lowpass and bandpass signals.
5. This course will discuss block diagram representation of a system, and methods of realization of a given system H (z) through different realization structures.
6. Students will be able to correlate the Laplace and Z-transforms of sample signals and understand mapping of s-plane into the z-plane.

Unit I: **Introduction to Signals & Systems:** Basic concepts and definitions of continuous and discrete time Signals, their classification, continuous and discrete time system and their properties, linear time invariant systems response for continuous time systems and discrete time systems. Properties of continuous and discrete LTI systems. System representation through differential equations and difference equations.

Unit II: Introduction to Fourier Transform: Fourier analysis, continuous and discrete time Fourier series and its properties, Fourier Transform for continuous and discrete time signals. Magnitude and phase spectra of continuous and discrete time signal, response of LTI system using Fourier transform. Applications of Fourier transform. Sampling theorem for low-pass signals, aliasing, sampling techniques, Impulse sampling, Natural sampling,



Flat-top sampling, Aperture effect.

Unit IV: **The Laplace Transform:** The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the Laplace Transform. Some Laplace Transform Pairs. The Unilateral Laplace Transform.

Unit V: **The z- Transform:** Basic principles of z-transform, z-transform definition, Unilateral and Bilateral Z-Transform, Relationship between z-transform and Fourier transform, Region of Convergence, Properties of ROC, Properties of z-transform, Poles and Zeros, Inverse z- transform using Contour integration, Power Series expansion and Partial fraction expansion.

Suggested Reading:

1. A.V. Oppenheim, A.S. Willsky, S.H. Nawab, "Signals & Systems", Prentice Hall Publication
2. S. Haykin, B. V.Veen "Signals & Systems", Wiley Publication
3. H. P. Hsu,"Signals & Systems" Schaum'sOutline Series

Course Code: ESC202
Course Name: Microprocessor
(Credits:04)

Marks: 100

Course Objective:

The student learns the fundamental solutions and concept of microprocessor. The various interfacing devices like ADC, 8255 and others will be able to interface. The students will able to write Assembly Programing language.

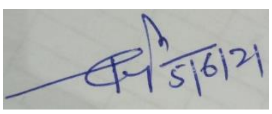
Course Outcomes:

At the end of this course, students will be able to

- Write an Assembly Language Programming for 8086 and 80386.
- Understand the interfacing of different peripheral.
- Understand the different memory organization.
- Understand the difference between Microprocessor and Microcontroller.

Unit-I: Architecture- 8085 Architecture, its register organization, Pin diagram, and Timings diagram, Machine language instruction formats, Addressing modes, Instruction set, Assembler directives. Program example.

Unit-II: Pin Diagram - Pin diagram, Minimum and Maximum Mode and Bus Timings, Ready and Wait states and 8086 based micro-computing system, Machine language instruction formats, Addressing modes,Instruction set, Assembler directives.



Unit-III: Programming- ALP, programming with an assembler, stack structure, Interrupts, Service subroutines and Interrupt programming and Macros.

Unit-IV: Peripheral- Memory Interfacing (DRAM), PPI- Modes of operation of 8255, interfacing to ADC & DAC Programmable timer- 8253, PIC 8259A, USART and their interfacing.

Suggested Reading:

1 "The Intel Microprocessors", Architecture, Programming and interfacing by Barry B. Bre
2 8086 Micro Processors by Kenrith J Ayala, Thomson Publishers.
3 Micro Processors and Interfacing Programming and Hardware by Douglas V. Hall.
4 The 8088 and 8086 Microprocessor- W.A. Triebel & Avtar Sing

Course Code: ESC203

Course Name: Analog Circuit Design (Credits:04)

Marks: 100

Course Objective:

- To develop the ability design and analyze MOS based Analog VLSI circuits to draw the equivalent circuits of MOS based Analog VLSI and analyze their performance.
- To develop the skills to design analog VLSI circuits for a given specification.

Course Outcomes:

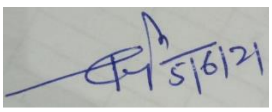
At the end of the course student will be able

- To draw the equivalent circuits of MOS based analog circuits and analyze their performance.
- To analyze the frequency response of the different configurations of an amplifier.
- To understand the feedback topologies involved in the amplifier design.
- To appreciate the design features of the differential amplifiers.

Unit I: Basic MOS device Physics: MOS I/V characteristics, Second order effects, MOS device models, Short channel effects and device models.

Single-stage amplifiers: Basic concepts, Common source stage, Source follower, Common gate stage, Cascode stage.

Unit II: Differential amplifiers: Single ended and differential operation, Basic differential pair, Common-mode response, Differential pair with MOS loads, Gilbert cell.



Passive and active current mirrors*:* Basic current mirrors, Cascode current mirrors, Active current mirrors.

Unit III: Frequency response of amplifiers: Common source stage, Source followers, Common gate stage, cascode stage, Differential pair.

Noise: Types of noise, Representation of noise in circuits, Noise in single stage amplifiers, Noise in differential pairs.

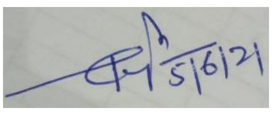
Unit IV: Feedback amplifiers: Feedback topologies, Effect of loading.

Operational Amplifiers: One stage OP Amps, two stage OP Amps, Gain boosting, Common- mode feedback, Input range limitations, Slew rate, Power supply rejection, Noise in Op Amps, Stability and frequency compensation.

Bandgap references, Introduction to switched capacitor circuits, Nonlinearity and mismatch.

Suggested Reading:

1. B. Razavi, "Design of Analog CMOS Integrated Circuits", McGraw-Hill edition 2002.
2. Paul. R. Gray and Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits", 4th edition, Wiley, 2001.
3. D. A. Johns and K. Martin, "Analog Integrated Circuit Design", Wiley,1997.
4. R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 3rd edition, Wiley, 2010.
5. P. E. Allen and D. R. Holberg, "CMOS Analog Circuit Design", Oxford UniversityPress, 2002.
6. Adel S. Sedra and K. C. Smith, "MicroElectronics Circuits", 6th edition, Oxford University Press India
7. Muhammad H. Rashid, "MicroElectronics Circuits: Analysis and Design", 2nd edition, Cengage, India.



Course Code: ESC204

Course Name: Control Systems

(Credits: 04)

Marks: 100

Course Objective:

This course is to develop an understanding of the fundamentals of control theory, determine and use models of physical systems in forms suitable for use in the analysis and design of control systems. In particular understand: the concept of feedback and its properties; stability analysis of a feedback system; the concept of stability and stability margins; the different tools that can be used to analyze the properties of control system and the steady state error in control system.

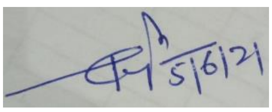
Course Outcome: This course is to develop an understanding of the elements of classical control theory as applied to the control of real life applications such as spacecraft, car etc. In particular understand: the concept of feedback and its properties; the concept of stability and stability margins; and the different tools that can be used to analyze the properties of control system.

Unit I: Introduction to Control systems: Necessity and examples of control systems, feedback control systems. Mathematical modeling of: electrical systems, mechanical systems, electro- mechanical systems. Laplace transforms, transfer functions, electrical analogues of other dynamical systems. State-space modelling of dynamical systems, Block diagrams, block diagram reductions. Signal flow graph, Mason's gain formula. Linearity, Time-invariance versus nonlinearity and time-variance Linearization, Distributed parameter systems

Unit II: Mathematical models: Obtaining solutions from mathematical models, Poles and zeros and their effects on solutions, Transient response of second order system, Time domain specifications for unit step response, Steady state error-linear continuous data control system. Generalized error coefficient and its evaluation, Correlation between static and dynamic error coefficients.

Unit III: Feedback control systems: Basic idea of feedback control systems, Definition of stability. Routh-Hurwitz test.Lyapunov theory.Bode plot, Nyquist plot, Nyquist stability criterion, gain and phase margins, and robustness. The root-locus technique, steps in obtaining a root-locus. Design of controllers using root-locus,Error analysis,

Unit IV: P, PI, PD and PID controllers: Proportional (P), Proportional Integrator(PI), Proportional Derivative(PD), Proportional Integrator Derivative(PID) controllers, Pole placement with state feedback, controllability. Pole placement with output feedback,



observability, Luenberger observer LQR controlLead compensator, lag compensator, lead-lag/lag-lead compensators, and their design.

Suggested Reading:

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th Edition,2009
2. Automatic Control Systems by Benjamin C.Kuo Wiley Publisher, 9th Edition, 2009.
3. Control Systems by S. HasanSaeed 6th Edition, Katson Books,2011
4. Control Systems Engineering by I.J.Nagrath and M. Gopal, New Age Intl., 2008
5. Control Systems by N.K.Sinha, New Age International (P) Limited Publishers, 3rd Edition, 1998

Semester III

Course Code: ESC301
Course Name: Principle of Communication
(Credits: 04)

Marks: 100

Course Objective:

At the end of this course students will be able to visualize how analog signals are converted to digital signals for voice and data transmission; the concept of multiplexing to fulfill the demand of high speed digital transmission across the globe; the various methods of generation of digital signals (ASK,FSK,PSK,QAM) according to the application requirements; implement optimization techniques, data coding, channel requirements, signal to noise ratio, bandwidth, error finding within the received information and information theory.

Course Outcomes:

- With advent of areas such as GSM, GPS, Bluetooth, RFID, DTMF, Mobile, Ethernet, RF, XBEE, Networking, Data Acquisition, Smart city and Smart Card, Internet of things the knowledge of the subject is an essential need.
- Today multiplexing have become an extremely important asset to telecommunication processes and has greatly improved the way that we transmit and receive independent signals over AM and FM radio, telephone lines, and optical fibers.
- Digital communication has become ubiquitous for success in the workplace. It helps in networking, demonstrates efficiency, stable foundation for documentation etc.
- The most important part in transmission is noise immunity. So after understanding the above topics the students will be able to implement optimization techniques and will have a better understanding of data coding, channel requirements, signal to noise ratio, bandwidth, error finding within the received information

Unit I: Amplitude Modulation- Introduction, Amplitude Modulation:Time & Frequency – Domain description, Switching modulator,Envelop detector.DOUBLE SIDE BAND-SUPPRESSED CARRIER MODULATION:Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing.SINGLE SIDE–BAND AND VESTIGIAL SIDEBAND METHODS OF MODULATION: SSB Modulation, VSB Modulation, Frequency Translation, Frequency-Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television

Unit II: **Angle Modulation-** Basic definitions, Frequency Modulation:Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase–Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Superheterodyne Receiver

Unit III: Random Variables & Process- Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions NOISE: Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth, Noise Figure.

Unit IV: Noise In Analog Modulation- Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and Deemphasis in FM.

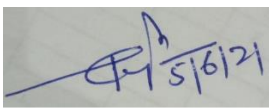
Suggested Reading:
1. B.P.Lathi,"Modern Digital and Analog Communication Systems", Oxford University Press Publication
2. H. Taub, D.L. Schilling, G. Saha,"Principles of Communications", McGraw-Hill International Publication
3. SimonHaykin,"Communication Systems”, Wiley India Publication. 3. H.P.HSU and D.Mitra,"Analog and Digital Communications", TataMcGraw-Hill Publication

Course Code: ESC302
Course Name: Embedded System Design
(Credits:04)

Marks: 100

Course Objective:

- Products using microprocessors generally fall into two categories-the first category uses high-performance microprocessors such as the Pentium in applications where system performance is critical.
- In the second category, performance is secondary while issues of space, power and rapid development are more critical than raw processing power.
- From this knowledge, the design and interfacing of microcontroller-based




embedded systems can be explored.

- This course is especially important for practicing technicians, hardware engineers, computer scientists and hobbyists for building projects in which data is collected and fed into a PC for distribution on a network.

Course Outcomes:

- Students will be able to understand the general concept of embedded systems.
- Students will learn to compare and contrast microprocessors and microcontrollers, and the advantages of microcontrollers for specific applications.
- This unit will also elaborate on the history, architecture and instruction set of 8051 microcontroller.
- By the end of this unit, students will understand the variations of speed, packaging, memory and cost per unit and how these affect choosing a microcontroller
- To assemble and run an 8051 program, detailing the execution of assembly language instructions.
- Through this unit, students will be able to contrast and compare serial versus parallel communication.
- To assemble and run an 8051 program, detailing the execution of assembly language instructions.
- Through this unit, students will be able to contrast and compare serial versus parallel communication.

Unit I: Introduction to Embedded Systems: Sensors and Actuators, Examples and Real world applications of Embedded Systems, Recent trends in Embedded Systems, Requirements of Embedded Systems.

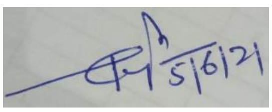
Unit II: Introduction to Microcontrollers: Overview of Microcontroller 8051, Architecture, Register Banks, Special purpose registers and Stack, On-chip RAM Space, Addressing Modes, Instruction Set.

Unit III: 8051 Microcontroller programming: Assembly language programming of 8051, Timer Programming in Assembly, 8051 Serial communication using USART protocol and Programming.

Unit IV: AVR Microcontroller: Integrated Development Environment (IDE) for Embedded Systems, Introduction to AVR family of Microcontrollers, AVR CPU, System Clock and Clock option.

Suggested Reading:

1. P.H. Dave, H.B. Dave,"Embedded Systems- Concepts Design and Programming", Pearson Publication.
2. Shibu KV,"Introduction to Embedded Systems", Tata McGraw Hill Publication.
3. M.A. Mazidi, J. G. Mazidi, R.D. McKinlay,"The 8051 Microcontroller and Embedded Systems", Pearson Publication.
4. M.A. Mazidi, S.Naimi, S.Naimi,"The AVR Microcontroller and Embedded Systems",



Pearson Publication.

Course Code:
ESC303 Course
Name: Seminar
(Credits: -02)

Marks: 100

Students will give presentations on current and emerging topics of Electronics.

Semester
III

Course Code:
ESE321
Course Name: RF & Microwave Systems
(Credits: 04)

Marks: 100

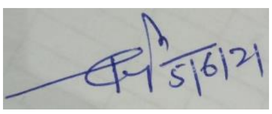
Pre-requisites: Maxwell’s equations, Electromagnetic theory, basics of transmission lines, TEM, TE and TM modes of propagation, Electromagnetic Wave Propagation in waveguide.

Course Objectives:
Knowledge of microwave technology is essential in developing the systems for mobile communication, satellite and RADAR. Such systems consist of microwave active and passive components. A design concept for RF and microwave systems will enable students to use their expertise in industry as well as R & D institutions.

Course outcomes:

- To understand the basic concepts of microwaves and propagation through the transmission lines, microwave components
- To learn the requirement of impedance matching and techniques
- To understand the generation of microwaves through the vacuum-based tubes
- To understand the working of microwave active circuits and study of various microwave semiconductor devices.
- To learn the test methods at the microwave frequencies
- To understand the design and concepts of microwave communication
- To understand the working of RADAR and its types.

Unit I: Introduction to microwave transmission- applications and limitations: Review of transmission lines and their properties, Microwave components: Directional coupler,



E&H plane Tee, Magic Tee, Circulator, Isolator, Frequency meter, Attenuator and Phase Shifter

Unit II: Impedance matching techniques: LC network, single and double stub tuning using the Smith chart, Tube based devices: klystron amplifiers, Reflex klystron oscillators, Magnetron oscillators, TWT amplifiers.

Unit III: Principles of Microwave amplifiers, oscillators and mixer: GUNN, IMPATT, TRAPATT, BARITT devices, PIN diode and TUNNEL diode.

Microwave Measurements: Power, Frequency, Impedance, VSWR, Network analyzer and spectrum analyzer.

Unit IV: Microwave LOS Communicatio: Microwave Transmitter and receiver systems, Introduction to RADAR, range equation, Continuous wave and Pulse radar, Synthetic aperture radar.

Suggested Reading:

1. Samuel Y.Liao, “Microwave Devices and Circuits”, 3rd edition, Pearson education
2. Kai Chang, “RF and Microwave Wireless Systems”, Wiley, 2015.
3. Kennedy, Davis, Prasanna, "Electronic Communication Systems", 5th Edition, Tata McGraw Hill.
4. R.E.Collin, “Foundations for microwave Engineering”, 2nd edition, Tata Mc Graw Hill, 1992.
5. Annapurna Das, Sisir.K.Das, “Microwave Engineering”, Tata McGraw Hill, 2000.

Course Code: ESE322
Course Name: Photonics: Principles and Applications (Credits:04)

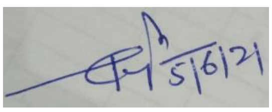
Marks: 100

Course Objective:

- Photonics is a key technology of the 21st century. It forms, for example, the basis for today's optical communications, environmental sensing, biomedical diagnostics in the life sciences, energy efficient lighting and solar energy harvesting.
- Upon completion of this course, students should understand the basic principles of modern physical optics and photonics. They should be able understand the principle of operation of modern photonic devices and optical communication.

Course Outcomes:

- Students will be able to understand the need for an electromagnetic description of propagation and properties of light waves.




- Students should understand the basic principles of light propagation and diffraction. They should be able to read the specifications of commercial optical instruments such as a scanner for a laser printer, or a spectrometer, and determine how these specifications impact the intended application.
- Students should understand the basic principles of various devices used in modern optical devices used in manipulation of optical signals and optical communication.
- Students will understand guided wave propagation, suface plasmon waves at metal interfaces and propagation through optical fibers in context to optical communication**,** the operation of lasers and optical fiber amplifiers which form the backbone of photonics technology.

Unit I: Light as electromagnetic wave: Review of Maxwell's equations and propagation of electromagnetic waves, various states of polarization, reflection and refraction of electromagnetic waves, Brewster angle, total internal reflection and evanescent waves, optics of metals.

Diffraction and Fourier Optics: Fraunhofer Diffraction of optical waves propagating through apertures, the effects on the resolution of imaging systems and the spreading and focusing of optical beams, Gaussian beams, introduction to Fourier analysis for treating diffraction. Fourier Optics, basics of Fourier transformation, spatial frequency, Fourier transform by diffraction and a lens, spatial frequency filtering.

Unit II: Anisotropic Media and Crystal Optics: Plane waves in anisotropic media, wave refractive index, uniaxial and biaxial media, wave plates and analysis of polarized light, electro- optic effect andacousto-optic effect, application to modulators. Faraday effect, optical isolators.Sagnac effect, gyroscopes. Nonlinear optics and applications.

Unit III: Guided Waves and Optical Fibers: Planar optical waveguides, Guided modes in symmetric dielectric waveguides, surface plasmon modes at dielectric metal interface, Step- and graded-index optical fibers, Multimode and single mode fibers, attenuation, material and modal dispersion, broadening of optical pulses in fibers. Introduction to guided wave integrated optical devices.

Unit IV: Lasers: Interaction of radiation and matter, Einstein's coefficients, line shape function, condition for amplification. Optical resonators, resonator losses and Q-factor, condition for laser oscillations. Longitudinal and transverse modes. Some laser systems including fiber amplifiers and fiber lasers.

References:

1. AjoyGhatak, Optics, Tata-McGraw Hill, 2017.
2. R.D. Guenther, Modern Optics, John Wiley and Sons, 1990.
3. A. K. Ghatak and K. Thyagarajan, Optical Electronics, Cambridge University, 1989.
4. M. Born and E. Wolf, Principles of Optics, Cambridge University Press, 1999.
5. B.E.A. Saleh and M.C. Teich, Fundamentals of Photonics, John Wiley and Sons, 2007.

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6. O. Svelto, Principles of Lasers, Springer, 2010.
7. A. Yariv and P. Yeh, Optical Waves in Crystals, Wiley-Interscience, 2002 .
8. A. K. Ghatak and K. Thyagarajan, Lasers, Macmillan Publishers, India, 2011.

Semester IV

Course Code:
ESE421 Course Name:
VLSI Technology
(Credits:04)

Marks: 100

Course Objectives:

- To provide students with rigorous foundation in MOS and CMOS devices and circuits.
- To provide exposure to students and to equip them for semiconductor and VLSI industry, R & D organization in the area of microElectronics.

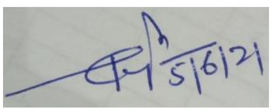
Course Outcomes:

- Implement the logic circuits using MOS and CMOS technology.
- Acquire the knowledge about various CMOS fabrication process and its modeling.
- Infer about the second order effects of MOS transistor characteristics.
- Analyse various circuit configurations and their applications.
- Analyse the merits of circuits according to the technology and applications.
- Understand the rapid advances in CMOS Technology.

Unit I: Passive element and integrated circuit design: Semiconductor resistors, design of diffused semiconductor resistors, thin-film resistors, resistor tolerances, monolithic and MOS capacitors, Complementary MOS structures, pattern generation, mask-alignment tolerance, minimum layout spacings, layout of silicon integrated circuits.

Unit II: Basic MOS device physics and MOSFET operation: Enhancement and Depletion mode MOSFETs, MOS I-V characteristics, second order effects, MOS device layout, MOS device capacitances, scaling, short channel effects, fundamental limit to scaling, MOS Spice model, Spice level 1 model, level-2 model (including parasitic S/D resistance), Introduction to BSIM models.

Unit III: Basic MOS Inverter design: voltage transfer characteristics, logic threshold, NAND/NOR logic, inverter with resistive, enhancement and depletion loads, noise margin, transit time and inverter delay, CMOS inverter: complete analysis, pass transistor, switch level RC delay model. **MOS design rules:** Combinational and sequential CMOS logic design, MOS memories and programmable logic arrays, non-volatile semiconductor



memories with MOS technology, MOS layers, Stick diagrams, CMOS design rules and layout, Lambda and micron design rules, DRC, layout *vs* schematic checks.

Unit IV: VLSI assembly technology and fabrication technologies: mechanism of yield loss in VLSI, modeling of yield loss mechanism, reliability requirements for VLSI: basic ideas of time dependent dielectric breakdown, antenna effect, IR drop and other reliability issues, Failure mechanism in VLSI, fault finding in VLSI chips, packaging of VLSI device, packaging type, packaging design consideration.

Suggested Reading:

1. N.H.E. Weste, D. Harris, “CMOS VLSI Design (3/e)”, Pearson, 2005.
2. Wayne Wolf, “Modern VLSI Design, 2^{nd} Edition”, Prentice Hall
3. Pucknell and Eshraghian, “Basic VLSI Design”, (3/e), PHI, 1996.
4. J. Rabey, M. Pedram, “Digital Integrated Circuits (2/e)”, PHI, 2003.
5. Sung-Mo (Steve) Kang and Yusuf Leblebici, “CMOS Digital Integrated Circuits Analysis and Design”, McGraw Hill, 2002.

Course Code: ESE422

Course Name: Digital Signal Processing

(Credits: 04)

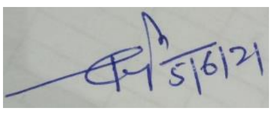
Marks: 100

Course Objectives:

The field of digital signal processing has grown enormously in the past decade to encompass and provide firm theoretical backgrounds for a large number of applications such as communication and speech, seismology, Radar and Sonar theory, etc. The importance of digital signal processing will eventually surpass that of analog signal processing for the same reasons that digital computers have surpassed analog computers.Since digital signal processing, for the most part, relies on the theory of discrete-time linear time-invariant systems, this will be studied as a major unifying influence for the entire field.

Course Outcomes:

- This course will explain the methods of windowing, frequency sampling design and minimum peak error design used in algorithms for designing digital filters.
- Through this unit, students will learn the techniques of mapping of differentials, impulse invariant transformation, bilinear transformation and matching poles and zeros.
- The course will also enable students to design filters using modern optimization algorithms such as minimum mean square method, minimum absolute error method, equiripple methods and time domain optimization to match a prescribed



time response.

- Students will be able to understand tradeoffs in complexities between the two classes of filters-FIR and IIR.
- By the end of this course, students will be able to understand the effect of quantization on digital filters and alsotwo-dimensional signal processing techniques.
- This course will also elaborate the application of DSP in Speech and RADAR.
- The course provides a comprehensive summary of the major areas of digital signal processing, including a powerful tool for analyzing discrete-time signals with the help of Z-transforms.

Unit I: Introduction to DSP: An overview of Digital Signal Processing (DSP), Theory of Discrete time Linear System (Representation of sequences, arbitrary sequences, LTI Systems, Causality, Stability, Difference Equations, Frequency response of 1^{st}& 2^{nd} Order Systems, Discrete Fourier series), Z-Transform(Unilateral & Bilateral Z-transform), Inverse Z-Transform, Properties of Z-Transforms, Convolution of Sequences (Infinite, Finite), Sectioned Convolution.

Unit II: **FIR Filters:** The Theory and Approximation of Finite duration Impulse Response Digital Filters (Issues in Filter Design), Characteristics of FIR filter with Linear phase and its frequency response, Positions of Zeros of linear phase FIR filters, Design techniques-windowing,

Rectangular window, Generalized Heming window, Kaiser window, Examples of Window Low- Pass Filter, Issues with windowing and Solution for optimization.

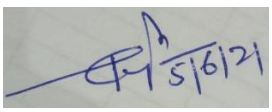
Unit III: **IIR Filters:** Theory and Approximation of Infinite response Digital Filter, Some Elementary properties of IIR filters-Magnitude squared Response, Phase Response, Grouped Delay, Impulse invariant Transformation, Bilinear Transformation, Matched Z-Transformation, optimization method for designing IIR Filter.

Unit IV: Finite word length effects in digital filters, Spectrum Analysis and Fast Fourier Transformation, An Introduction to the theory of Two-dimensional Signal Processing, Applications of Digital Signal Processing to Speech, RADAR.

Suggested Reading:

1. L.R. Rabiner, B. Gold, "Theory and Applications of Digital Signal Processing", Pearson Publication.
2. A.V. Oppenheim,"Digital Signal Processing", PearsonPublication.
3. J.G. Proakis, D.G.Manolakis,"Digital Signal Processing", Pearson Publication.
4. A. Antoniou, "Digital Signal Processing", Tata McGRAW Hill Publication.

Course Code:
ESE423
Course Name: Photonic Devices and Optical Communication
(Credits:04)



Marks: 100

Course Objectives:

- Photonic Devices have emerged as the key technology for optical communications, environmental sensing, biomedical diagnostics in the life sciences, energy efficient lighting and solar energy harvesting.
- Upon completion of this course, students should understand the functioning and design of most photonic devices in use.

Course Outcomes:

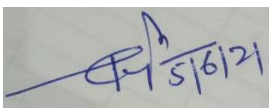
- At the end of the Course students will be able to understand the basic components and devices of photonic integrated circuits.
- At the end of the Course, students should understand propagation in optical fiber couplers, fiber Bragg grating and long period fiber gratings and their applications
- At the end of Course, students should understand the area of silicon photonics which is an upcoming area of photonic integration with Electronics.
- At the end of Course students will understand the operation of optical communication systems, the limitations of photodiodes and avalanche photodiodes, understand direct optical amplification. explain the basics of optical modulation and multiplexing, design a fiber link of given length operating at a given wavelength, and at a prescribed bit error rate by use of optical repeaters and relate an integrated view of engineering by explaining the fundamental analogies between electrical and optical communication systems.

Unit I: Guide Wave Integrated Optic Devices: Planar and channel waveguides, Waveguide platforms on various materials and their fabrication techniques. Waveguide directional couplers,tapered waveguides and *Y*-junction splitters/combiners, Ring resonators, Mach-Zehnder interferometers/modulators.Sagnac interferometer/gyroscope. Coupling in and out of Photonic Integrated Circuits: Optical mode converters, prism and grating couplers.Wavelength-division multiplexing components: Mulitplexers, Demultiplexers, Multimode interferometers, Arrayed- waveguide gratings.

Unit II: **Fiber Optic Devices:** Splitters and combiners in optical fibers, fiber directional couplers as WDM component. Coupled mode analysis optical fiber Bragg and long period gratings, applications of fiber gratings as WDM components in add-drop multiplexers/circulators and fiber sensors.

Unit III: Silicon Photonics: Motivation towards silicon photonics, Silicon on Insulator (SOI) waveguides or nanowires.Optical fiber to silicon waveguide: edge, grating, evanescent coupling, spot-size converters.III-V integration with silicon photonics.Photonic modulators: electro-optical and thermo-optical effects. Phase and amplitude modulators.Thermal phase shifter, thermo-optic switch.Franz-Keldysh effect and FK electro-optical modulators.

Unit IV: Computational Photonics: Concepts of eigenmodesapproach, finite difference and finite element methods, finite difference timedomain(FDTD) methods and beam propagation methods. Identification of method that is amenable to a specific class of



photonic structures, and themethod that should be avoided except in special circumstances and developand use basic computational codes for a variety of realistic applications inintegrated photonic structures.

References:

1. A. K. Ghatak and K. Thyagarajan, Optical Electronics, Cambridge University, 1989.
2. Optical Electronics in Modern Communications by A. Yariv, Oxford, 5th Edition, 1997B.E.A. Saleh and

M.C. Teich, Fundamentals of Photonics, John Wiley and Sons, 2007.

3. J.M. Senior, Optical Fiber Communications: Principles and Practice, Pearson Education India, 2010.

4. Gerd Keiser, Optical Fiber Communication, McGraw Hill Education, 2017.

Course Code: ESE424
Course Name: Digital Communication

(Credits:04)

Marks: 100

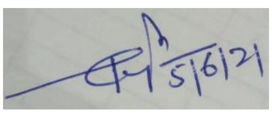
Course Objectives:

- To know the principles of sampling & quantization
- To study the various waveform coding schemes
- To learn the various baseband transmission schemes
- To understand the various band pass signaling schemes
- To know the fundamentals of channel coding

Course Outcomes:

- Associate and apply the concepts of Bandpass sampling to well specified signals and channels.
- Able of differentiate different types of coding and digital modulation.
- Test and validate symbol processing and performance parameters at the receiver under ideal and corrupted bandlimited channels.
- Able to apply the concept of various digital filter.
- Able to understand and various error correction coding.

Unit I: Information Theory- Discrete Memoryless source, Information, Entropy, Mutual Information – Discrete Memoryless channels – Binary Symmetric Channel, Channel Capacity – Hartley – Shannon law – Source coding theorem – Shannon – Fano & Huffman codes.



Unit II: Waveform Coding & Representation- Prediction filtering and DPCM – Delta Modulation – ADPCM & ADM principles-Linear Predictive Coding- Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ – Manchester

Unit III: Baseband Transmission & Reception - ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding – Eye pattern – Receiving Filters-Matched Filter, Correlation receiver, Adaptive Equalization

Unit IV: Digital Modulation Scheme And Error Control Coding- Geometric Representation of signals – Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK – QAM – Carrier Synchronization – Structure of Non-coherent Receivers – Principle of DPSK. Channel Coding Theorem – Linear Block Codes – Hamming Codes – Cyclic Codes – Convolutional Codes – Viterbi Decoder.

Suggested Reading:

1. Simon Haykin, "Digital Communication Systems", John Wiley & sons, FirstEdition,2014, ISBN978-0-471-64735-5.
2 John G Proakis and Masoud Salehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
3. B.P.Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4111 Edition, 2010, ISBN: 978-0- 198-07380-2.
4. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
5. Bernard Sklar and Ray, "Digital Communications- Fundamentals and Applications", Pearson Education, Third Edition, 2014, ISBN: 978- 81-317-2092-9.

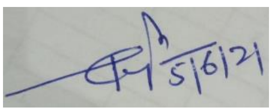
Course Code: ESE425
Course Name: Electromagnetic Interference and Compatibility (EMI & EMC)
(Credits: 04)

Marks: 100

Pre-requisites: Maxwell’s equations, Electromagnetic theory, basics of transmission lines, microwave parameters and measurements.

Course Objectives:

Importance of product marking like CE is essential for widely acceptance for the electrical and electronic products. Knowledge of EMI generation and its reduction methods is integral part for designing any product at initial stage. A good design practice for compliance will make the students to incorporate their skills in the commercial world.



Course outcomes:

- To understand the EMI and EMC concepts and their importance for the electrical and electronic products
- To understand EMC standards and various test methods for EMI/EMC
- To learn the control techniques for EMI
- To understand the design process for EMC systems

Unit I: Introduction to EMI/EMC: EMI scenarios, EMI sources, coupling mechanism & modes- common and differential modes, EMI victims, classification of disturbance phenomena, Time & frequency domain analysis, Emission and Susceptibility.

Unit II: EMI/EMC Standards & Measurements: Standard making bodies, commercial & MIL Standards (FCC, CISPR etc.), Emission and Immunity tests, Test instrumentation, compliance & diagnostic testing.

Unit III: EMI Control Techniques: Grounding & Cabling, Filtering & Shielding, Transient suppression & ESD Control.

Unit IV: Design for EMC (Emission & Susceptibility control at PCB level): Components & Circuit selection, Circuit layout, Partitioning, Chassis bonding, Grounding, PCB stack-up, Transmission line termination, Decoupling, PSU design.

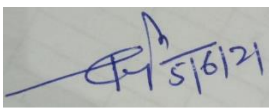
Suggested Reading:

1. Dipak L. Sengupta, Valdis V. Liepa "Applied Electromagnetics and Electromagnetic Compatibility" Wiley Inter Science, 2006.
2. Clayton R. Paul, "Introduction to Electromagnetic Compatibility", 2nd edition, Wiley, 2006.
3. Bogdan Adamczyk "Foundations of Electromagnetic Compatibility" Wiley, 2017.
4. Xingcun Colin Tong, "Advanced Materials and Design for Electromagnetics Interference Shielding" CRC Press.

Course Code: ESE426
Course Name: Modern Communication Systems (Credits:04)

Marks: 100

Pre-requisites: Signals and systems, Fourier Transforms, concept of multiplexing and various modulation techniques, channel requirements, signal-to noise ratio and bandwidth.



Course Objective:

This course enables students to attain successful professional careers by applying their engineering skills in communication system design to meet out the challenges in industries and academia. The course develops a strong foundation in the field of Satellite Communication, earth and space subsystems involved and their importance; multiple access techniques, recent technological developments in Mobile communication systems; Understand what Internet of Things is, RFID Technology, Sensor Technology and Satellite Technology.

Course Outcomes:

- To provide students with strong fundamental concepts and also advanced techniques and tools to build various communication systems.
- To enable students to attain successful professional careers by applying their engineering skills in communication system design to meet out the challenges in industries and academia.
- To engage students in lifelong learning, adapt emerging technology and pursue research for the development of innovative products.

Unit I: Satellite Communication: Radiation and propagation of waves**:** fundamental of EM waves and their effects ground, sky and space waves propagation, Orbits and Launching Methods, Space Link Budget, Space and Earth Segment, Satellite Services;

Unit II: Wireless Communication: Fundamental concepts in wireless, Basic Terminologies, cellular technology, Standards evolved, Mobile Radio Propagation, Mobile System and Network Architectures, Advanced Wireless IP network Architectures, Wireless Standards.

Unit III: Data transfer and Computer Networking: Packet switching, ISDN, ATM, LAN, WAN, Internet and WAP, Digital Radio Communication Systems; Multiple Access Techniques: Frequency Hopping Spread Spectrum (FHSS) systems, Direct Sequence Spread Spectrum, Code Division Multiple Access of DSSS;

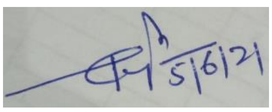
Unit IV: Internet of Things: Introduction, Fundamental IoT Mechanisms and Key Technologies, Radio Frequency Identification Technology, Resource management in IoT, IoT Privacy, Security and Governance, Business models for IoT

Suggested Reading (Unit-I):

1. Dennis Roddy, “Satellite Communications”, McGraw Hill, 1996.
2. Tri.T.Ha, “Digital Satellite Communications”, Mcmillan Publishing Company, 1986.
3. Dr.D.C. Agarwal, “Satellite Communications”, Khanna Publishers, 2001.
4. Trimothy Pratt, Charles W. Bostian, “Satellite Communications”, John Wiley & Sons, 198

Suggested Reading (Unit-II):

1. Rappaport, T.S., “Wireless Communications”, Principles and Practice, Prentice Hall, NJ, 1996.
2. William Stallings, “Wireless Communication and Networking”, Pearson Education,



2002.
3. Siegmund M. Redl, Mathias K. Weber, Malcolm W. Oliphant, “An Introduction to GSM”, Artech House Publishers, 1995.
4. Kraus, J.D., “Antennas”, II Edition, John Wiley and Sons, NY, 1977.
5. Collin, R.E. and Zucker, F., - “Antenna theory: Part I”, Tata McGraw Hill, NY, 1969

Suggested Reading (Unit-III):

1. Mani Subramanian, "Network Management Principles and Practice", Addison Wisely, New York,
2000.

Suggested Reading (Unit-IV):

2. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer
4. Parikshit N. Mahalle&Poonam N. Railkar, “Identity Management for Internet of Things”, River Publishers, ISBN: 978-87-93102-90-3 (Hard Copy), 978-87-93102-91-0 (ebook).
5. HakimaChaouchi, “The Internet of Things Connecting Objects to the Web” ISBN : 978-1- 84821-140-7, Willy Publications
6. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2nd Edition, Willy Publications
7. Daniel Kellmereit, Daniel Obodovski, “The Silent Intelligence: The Internet of Things”,. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978-0989973700.
8. Fang Zhaho, Leonidas Guibas, “Wireless Sensor Network: An information processing approach”, Elsevier, ISBN: 978-81-8147-642-5.

Course Code: ESC403
Course Name: Dissertation
(Credits: 10)

Marks: 100

Students will undertake projects to enhance their understanding in various emerging areas. This will help to equip students with the current trends and will instill in them a spirit of enquiry and scientific temperament.

5/6/21