Third Year I –Semester

CODE	SUBJECT NAME	Category	Instruction periods per Week				MAX MARKS		CREDITS
			LECTURE	TUTORIAL	PRACTICAL	TOTAL	SESSIONAL MARKS	SEMESTER END MARKS	
ECE 311	Open Elective- I	OE	3	1	-	4	40	60	3
ECE 312	Communication Systems Engineering	PC	4	1	-	5	40	60	4
ECE 313	Microprocessors and Applications	PC	3	1	-	4	40	60	3
ECE 314	Computer Architecture & Organization	ES	3	1	-	4	40	60	3
ECE 315	Integrated circuits and Applications	PC	3	1	-	4	40	60	3
ECE 316	Antennas & Wave Propagation	PC	3	1	-	4	40	60	3
ECE 317	Microprocessors & Applications Laboratory	PC	-	-	3	3	50	50	2
ECE 318	IC Laboratory	PC	-	-	3	3	50	50	2
ECE 319	Quantitative Aptitude & Verbal Aptitude-I	HS	4	-	-	4	100	-	2
Total			23	6	6	35	440	460	25

Open Elective- I: (for ECE, offered by other departments) Refer Annexure-I

Third Year II –Semester

CODE	SUBJECT NAME	Category	Instruction periods per Week				MAX MARKS		CREDITS
			LECTURE	TUTORIAL	PRACTICAL	TOTAL	SESSIONAL MARKS	SEMESTER END MARKS	
ECE 321	Microwave & Radar Engineering	PC	3	1	-	4	40	60	3
ECE 322	Digital Signal Processing	PC	4	1	-	5	40	60	4
ECE 323	Microcontrollers & Embedded Systems	PC	3	1	-	4	40	60	3
ECE 324	Professional Elective-I	PE	3	1	-	4	40	60	3
ECE 325	Digital Communications	PC	3	1	-	4	40	60	3
ECE 326	Communication Systems Engineering Laboratory	PC	-	-	3	3	50	50	2
ECE 327	Microcontrollers & Embedded Systems Laboratory	PC	-	-	3	3	50	50	2
ECE 328	Soft Skills Laboratory	HS	-	-	3	3	100	-	2
ECE 329	Quantitative Aptitude & Verbal Aptitude-II	HS	4	-	-	4	100	-	2
Total			20	5	9	34	500	400	24

Professional Elective-I

1. Analog IC Design
2. EMI / EMC
3. Electronic Measurements and Instrumentation
4. Telecommunications and switching Networks

Industrial Training during summer vacation after Third Year II –Semester. But its grade will be accorded with the 4-1 courses of the program

INTRODUCTION TO EMBEDDED SYSTEMS	
ECE 311(a)	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Nil

Course Objectives:

- To introduce the student to the basics of embedded systems
- To learn about the components of embedded systems
- To familiarize the student with embedded systems by providing examples from various fields

Course Outcomes:

By the end of the course, the student will be able to:	
1.	learn about the general principles of computer architecture
2.	learn about the working of a simple embedded system and embedded system applications
3.	learn the hardware aspects of embedded systems
4.	understand the sensors, ADCs and actuators used in embedded systems
5.	understand the real world examples of embedded systems

Mapping of Course Outcomes with Program Outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	2	-	-	-	-	-	-	-	-	-	-	1
	2	2	-	-	-	-	-	-	-	-	-	-	1
	3	2	-	-	-	-	-	-	-	-	-	-	1
	4	2	1	-	-	-	-	-	-	-	-	-	2
	5	3	2	-	-	-	-	-	-	-	-	-	2

SYLLABUS

UNIT I: **8 Periods**

Basics of computer architecture and the binary number system

Basics of computer architecture, computer languages, RISC and CISC architectures, number systems, number format conversions, computer arithmetic, units of memory capacity

UNIT II: **8 Periods**

Introduction to embedded systems

Application domain of embedded systems, desirable features and general characteristics of embedded systems, model of an embedded system, microprocessor Vs microcontroller, example

of a simple embedded system, figure of merit for an embedded system, classification of MCUs: 4/8/16/32 bits, history of embedded systems, current trends

UNIT III: 10 Periods

Embedded systems-The hardware point of view

Microcontroller unit(MCU), a popular 8-bit MCU, memory for embedded systems, low power design, pull up and pull down resistors

UNIT IV: 12 Periods

Sensors, ADCs and Actuators

Sensors: Temperature Sensor, Light Sensor, Proximity/range Sensor; Analog to digital converters: ADC Interfacing; Actuators Displays, Motors, Opto couplers/Opto isolators, relays.

UNIT V: 12 Periods

Examples of embedded systems

Mobile phone, automotive electronics, radio frequency identification (RFID), wireless sensor networks(WISENET), robotics, biomedical applications, brain machine interface

Text Books:

1. Lyla B Das, *Embedded systems: An Integrated Approach*, 1st Ed., Pearson, 2013

Reference Books:

1. Shibu, K.V., *Introduction to Embedded Systems*, 1st Ed., TMH, 2009
2. Kanta Rao B, *Embedded Systems*, 1st Ed., PHI
3. Frank Vahid & Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley,

ELECTROMAGNETIC INTERFERENCE AND COMPATABILITY	
ECE 311(b)	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sectional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Objectives:

- To introduce the concepts of electromagnetic interference and electromagnetic compatibility
- It presents different kinds of electromagnetic interference coupling principles.
- To study the electromagnetic interference control techniques
- To discuss electromagnetic interference measurements and standards

Course Outcomes:

By the end of the course the student will be able to :	
1.	Gain enough knowledge to understand the concept of EMI / EMC related to product design & development.
2.	Analyze the different EM coupling principles and its impact on performance of electronic system.
3.	Know how to bring down the electromagnetic interference highlighting the concepts of both susceptibility and immunity
4.	Acquire broad knowledge of various EM radiation measurement techniques
5.	Gain enough knowledge to understand the present leading edge industry standards in different countries

Mapping of Course Outcomes with Program Outcomes:

		PO											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO	**1**	2		1			1						2
	2	1	2	1									1
	3	3	2	3			2						2
	4	3	2	3	1			1	1				1
	5	3	2	3									2

SYLLABUS

Unit I: EMI / EMC Concepts **12periods**

EMI-EMC definitions and Units of parameters; Sources and victim of EMI; Conducted and Radiated EMI Emission and Susceptibility; Transient EMI, ESD; Radiation Hazards.

Unit II: EMI Coupling Principles **12periods**

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling, cross talk ; Field to cable coupling ; Power mains and Power supply coupling.

Unit III: EMI Control Techniques 12periods

Shielding- Shielding Material-Shielding integrity at discontinuities, Filtering- Characteristics of Filters-Impedance and Lumped element filters-Telephone line filter, Power line filter design, Filter installation and Evaluation, Grounding- Measurement of Ground resistance-system grounding for EMI/EMC-Cable shielded grounding, Bonding, Isolation transformer, Transient suppressors, Cable routing, Signal control. EMI gaskets

Unit IV: EMI /EMC Measurements 12periods

Open area test site; TEM cell; Anechoic chamber; Tx /Rx Antennas, Sensors, Injectors / Couplers, and coupling factors; EMI Rx and spectrum analyzer.

Unit V: EMI /EMC and Standards 12periods

Civilian standards-CISPR, FCC, IEC, EN; Military standards-MIL461E/462. Frequency assignment - spectrum conversation. British VDE standards, Euro norms standards in Japan - comparisons. EM Emission and Susceptibility standards and Specifications.

REFERENCES:

1. V. P. Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, New York, 2000.
2. R. C. Paul, "Introduction to Electromagnetic Compatibility", John Wiley and Sons, Inc, 1992.

COMMUNICATION SYSTEMS ENGINEERING	
ECE 312	**Credits: 4**
Instruction: 4 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:

Engineering Mathematics, Signals and Systems, Electronic Circuit Analysis.

Course Outcomes:

By the end of the Course, the students will be able to:	
1.	Analyze about various blocks in a Communication System.
2.	Analyze and design the analog modulator and demodulator circuits.
3.	Apply the concepts to explain about various blocks in Transmitters and Receivers.
4.	Analyze and design the pulse analog modulation techniques and evaluate the performance of analogue communication systems in the presence of noise.
5.	Gain knowledge of satellite orbits, its launching methods, Link design, earth segment and space segment components.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO											PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	3	2	3	-	-	-	-	-	-	1	-	2	3	2	3
	2.	3	3	3	-	-	-	-	-	-	1	-	3	3	3	3
	3.	3	3	3	-	-	-	-	-	-	1	-	2	3	3	2
	4.	3	3	3	-	-	-	-	-	-	1	-	3	3	2	2
	5.	3	3	1	-	-	-	-	-	1	1	-	3	3	1	3

SYLLABUS

UNIT I **15 periods**

Introduction to Communication Systems:

Basic Block Diagram of Communication Systems; Principles of Analog and Digital Communication; Linear Modulation Systems: Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Square law modulator and diode detector, DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, Costas loop, Hilbert transform , properties & applications, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, VSB, Applications of AM Systems.

UNIT II **15 periods**

Non Linear Modulation Systems:

Angle Modulation, Phase and Frequency Modulation and their Relationship, Phase and Frequency Deviation, NBFM, WBFM, Spectrum of an FM Signal, Bandwidth of Sinusoidal Modulated FM Signal, Carson's rule, Effect of the Modulation Index on Bandwidth, Comparison of FM and PM; Generation of FM Waves: Direct Method-Varactor diode, Indirect Method-

Armstrong Method; Detection of FM Waves: Balanced Frequency discriminator, Phase locked loop, Comparison of FM and AM.

UNIT-III **10 periods**

Radio Transmitters & Receivers: Radio Transmitters: AM and FM Transmitters, SSB Transmitters; Radio receiver: Tuned radio frequency receiver, Superhetrodyne receiver, AM Receivers – RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers – Amplitude Limiting.

UNIT-IV **15 periods**

Noise & Noise performance of AM & FM systems:
Thermal noise, shot noise, Flicker Noise and Transition Noise, Signal to Noise ratio, Noise equivalent bandwidth, Noise equivalent temperature , Noise figure , Figure of merit, Noise in AM Systems: DSB-SC, SSB-SC, AM with carrier (Envelope Detector); Noise in FM, pre-emphasis & De-emphasis, threshold effect, problems.**Analog Pulse Modulation Techniques:**Pulse modulation and its types, PAM, PWM, PPM, concepts of Time Division Multiplexing, Frequency Division Multiplexing.

UNIT-V **10 periods**

Satellite Communications:
Introduction, History of Satellites, Kepler's laws, Satellite orbits, Geosynchronous Satellites, Launch vehicle, `Antenna look angle, Satellite system link models- Uplink, Transponder, Down link model, Cross-Links, satellite system parameters, satellite system Link equations, satellite system Link Budget.

Text Books

1. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," 2nd Edition, Oxford University Press, 2010.
2. Simon Haykins, "*Communication Systems*," Wiley, Fifth edition, 2009.
3. P.Ramakrishna Rao, "*Analog communications*" Tata McGraw Hill Education Private Limited. 2011.

Reference Books

1. H P Hsu, "*Analog and digital communications*" Schaum's outlines, McGraw-Hill Education; 2 edition, 2002.
2. Wayne Tomasi, "*Electronic Communications Systems: Fundamentals Through Advanced*,"- Pearson Education, Fifth Edition, 2011.
3. Robert J. Schoenbeck, *Electronic Communications Modulation and Transmission*, PHI N. Delhi, 1999.
4. G. Kennedy, "*Electronic Communication Systems*," McGraw Hill, 2nd Edition, 1977.

MICROPROCESSORS AND APPLICATIONS	
ECE 313	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Digital Electronics.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Able to program 8085 microprocessor to meet the specific requirements of the client
2.	Able to organize the hardware involved in BIU & EU of 8086 microprocessor & analyze the minimum and maximum mode 8086 systems using timing diagrams
3.	Able to program 8086 microprocessor to meet the specific requirements of the client
4.	Able to interface 8086 microprocessor to semiconductor memories (SRAM & EPROM), stepper motor to meet the specific requirements of the Client, Also able to generate a specific waveform by designing an interface between a CRO and 8086 microprocessor & able to convert a given analog sample value into its equivalent digital value by designing an interface between 8086 microprocessor and analog input using A/D converter to meet the meet the specific requirements of the Client
5.	Able to design interface between peripheral devices and 8086 microprocessor using 8259 (Programmable Interrupt Controller) to get services from 8086 microprocessor on Interrupt basis & able to interface USART to 8086 to perform serial communication.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	-	1	-	-	-	-	-	-	-	-	-	3	-	2
	2	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2
	3	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2
	4	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2
	5	2	-	2	-	-	-	-	-	-	-	-	-	3	-	2

SYLLABUS

UNIT I: **16 Periods**

Overview of 8085 (Architecture & Instruction Set):

Introduction to Microprocessors and Microcomputers, Internal Architecture and Functional Description of INTEL 8085 Microprocessor, Interrupt Structure of 8085, Instruction Set of 8085 μP and Sample programs.

UNIT II: **08 Periods**

8086 Architecture:

Architecture of 8086, Register organization, Memory segmentation. Physical memory organization. signal description of 8086, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings.

UNIT III: **15 Periods**

Instruction Set and Assembly Language Programming of 8086: Addressing modes, instruction set, assembler directives(Significant), macros and operators. Simple programs involving arithmetic, logical, branch and string manipulation instructions.

UNIT IV: **09Periods**

Interfacing – I:

Memory interfacing to 8086 (Static RAM & EPROM).

Methods of parallel data transfer, 8255A Internal block diagram and system connections, 8255A operational modes and initialization, constructing and sending 8255A control words, interfacing to 8086. Interfacing Stepper motor, D/A and A/D converters

UNIT V: **08 Periods**

Interfacing – II:

8086 Interrupts and response, Interrupt vector table, Types of Interrupts, 8259 PIC Architecture and interfacing, cascading of interrupt controller to 8086, 8253/8254, modes of 8253 & Interfacing.

Serial data transfer schemes: Asynchronous and Synchronous data transfer schemes. 8251 USART architecture and interfacing to 8086. RS-232.

Text Books:

1. Ramesh S. Gaonkar, *Architecture Programming and Applications*, 3rd Edition, Penram International Pvt. Ltd.
2. D. V. Hall, *Microprocessors and Interfacing*, Revised 2nd edition 2006, TMH,.
3. A.K. Ray and K.M. Bhurchand, *Advanced Microprocessors and Peripherals*, 2nd edition, 2006, TMH.

Reference Books:

1. John Uffenbeck, *The 8086/8088 Family: Design, Programming And Interfacing*, PHI
2. N. Senthil Kumar, M. Saravanan, and S. Jeevananthan, *Microprocessors and Microcontrollers*, OUP India

COMPUTER ARCHITECTURE AND ORGANIZATION	
ECE314	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites: Digital Electronics.

Course Objectives:

- To learn how computers work, how to analyze their performance, how computers are designed.

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Work with the typical assembly language instructions of a computer
2.	Organize the hardware involved in the CPU of a computer
3.	Design CPU & control unit of a basic computer
4.	Use computing resources such as memory and I/O in an effective manner to improve the performance of a computer
5.	Illustrate the concept of pipelining and multiprocessors

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	1	-	-	-	-	-	-	-	-	-	-	-	2	2	3
	2	1	2	2	-	-	1	-	-	-	-	-	-	3	2	3
	3	1	2	2	-	-	1	-	-	-	-	-	1	2	3	3
	4	1	-	-	-	-	-	1	-	-	-	-	1	1	1	2
	5	1	1	-	-	-	-	-	-	-	-	-	-	1	1	1

SYLLABUS

UNIT I : **9 Periods**

Register Transfer and Microoperations :

Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit

UNIT II : **12 Periods**

Basic Computer Organization :

Instruction Codes, Computer Registers, Computer Instructions, hardwired control unit, Instruction Cycle, Memory Reference Instructions

Microprogrammed Control :

Control Memory, Address Sequencing, Microinstruction Formats, Micro program Example, Design of Control Unit

UNIT III : 9 Periods

CPU Organization

Introduction, General Register Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, , Stack Organization. Reduced Instruction Set Computer(RISC) and CISC architectures

UNIT IV : 9Periods

Memory Organization

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory

UNIT V : 11 Periods

Input - Output Organization

Peripheral Devices, Input - Output Interface, Asynchronous Data Transfer, Modes of Transfer, Priority Interrupt, Direct Memory Access (DMA),Introduction to pipelining, multiprocessors

Text Book

1. M. Morris Mano, *Computer System Architecture*, 3rd Ed., PHI, 1996

Reference Books

1. V. Carl Hamacher, Zvonko G. Vranesic and Safwat G. Zaky, *Computer Organization*, 5th Ed., McGraw Hill International, 2011
2. Sivarama P. Dandamudi, *Fundamentals of computer Organization and design*, Springer, 2002
3. William Stallings, *Computer Organization & Architecture - Designing for performance*, 8th Ed., Pearson Education India, 2013
4. John D. Carpinelli, *Computer Systems Organization & Architecture*, 1st Ed., Pearson Education India, 2000
5. Sajjan G. Shiva, *Computer design and architecture*, 3rd Ed., Marcel Dekker, 2000
6. Hennessy- Patterson, *Computer Architecture: A quantitative approach*, 5 th edition, Morgan Kaufmann, 2011

INTEGRATED CIRCUITS AND APPLICATIONS	
ECE315	**Credits:3**
Instruction: 3 periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites:

Network Theory and Synthesis, Electronic Circuits and Analysis-II

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Analyze the static and dynamic electrical behavior of CMOS circuits.
2.	Design and analyze active filters of an op-amp& IC Voltage regulators
3.	Design circuits for several applications using IC 555 Timer, PLL, analog multiplier ICs etc.
4.	Design several circuits using D/A and A/D convertor.
5.	Design the combinational and Sequential circuits using digital ICs.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	2	-	-	-	-	-	-	-	-	1	1	1	1
	2	2	2	2	-	-	-	-	-	-	-	-	1	1	1	1
	3	3	2	2	-	-	-	-	-	-	-	-	1	1	1	1
	4	2	2	2	-	-	-	-	-	-	-	-	1	1	1	1
	5	2	2	2	-	-	-	-	-	-	-	-	1	1	1	1

SYLLABUS

UNIT I: **12 Periods**

Digital Circuits:

CMOS logic, electrical behavior of CMOS circuits-Static and Dynamic, Low -Voltage CMOS logic and interfacing, CMOS/TTL interfacing

UNIT II: **12 Periods**

Voltage regulators & Active Filters:

IC Voltage regulators - Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator

Filter Fundamentals: Filter types, Realizing Practical Filters: Sallen-Key LPF and HPF Realizations-BPF Realization-Notch Filter (Band Reject) Realization - All Pass Filters, Switched Capacitor filter

UNIT III:

Timer, Phase Locked Loop and Analog Multiplier: **12 Periods**

IC 555 Timer: Functional block diagram and description, Monostable, Astable operation and their applications, 556 Voltage Controlled Oscillator - -Phase Locked Loop-Operation of 565 PLL-Closed loop analysis of PLL- PLL Applications: Frequency Synthesis - Frequency Translation - AM and FM detection, analog multiplier ICs.

UNIT IV: **12 Periods**

Analog to Digital and Digital to Analog Converters :

Digital to Analog converters - Binary weighed and R-2R Ladder types - Analog to digital converters - Continuous - Counter ramp, successive approximation, single, dual slope and parallel types

UNIT V: **12 Periods**

Combinational Logic ICs - Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs, Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers

Sequential Logic ICs: Familiarity with commonly available 74XX & CMOS 40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Text Books:

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001
2. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", New Age Science, 2010
3. John F Wakerly, “Digital Design-Principles and practices”, 4th Ed., Pearson, 2008

Reference Books:

1. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.
2. Sonde, B.S, “Introduction to System Design using Integrated Circuits”, Second Edition, Wiley Eastern Limited, New Delhi, 1994
3. Michael Jacob J., "Applications and Design with Analog Integrated Circuits ", Prentice Hall of India, 1996.
4. Robert F Coughlin and Fedrick F Driscoll ―Operational amplifiers and linear Integrated Circuits‖, 6th edition, Prentice Hall of India, New Delhi, 2006.
5. Richard J. Higgins "Electronics with Digital and Analog Integrated Circuits‖, Prentice Hall of India, New Delhi, 1983.
6. George Clayton and. Steve Winder - Operational Amplifiers, 5th edition. Elsevier, 2003
7. Sergio Franco - Design with operational amplifiers and analog integrated circuits, 3rd ed., McGraw-Hill Education, 2001

ANTENNAS AND WAVE PROPAGATION	
ECE 316	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: EMFT

Course Outcome:

By the end of the course, the students will be able to:	
1	Analyze the basic antenna parameters by applying the concepts & properties of electromagnetism
2	Determine the fundamental parameters of practical antennas operating at various frequencies from LF to Microwave applications.
3	Analyze & design the linear antenna arrays.
4	Assess antenna performance by using suitable measurement technique.
5	Identify & Analyze the characteristics of radio wave propagation.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1	3	2	2	-	-	1	1	-	-	-	-	1	1	2	2
	2	3	3	2	-	-	1	1	-	-	-	-	2	3	3	2
	3	3	3	3	-	-	1	1	-	-	-	-	2	3	3	1
	4	2	2	1	-	-	-	-	-	-	-	-	1	1	1	1
	5	2	2	1	-	-	-	-	-	-	-	-	1	1	1	2

SYLLABUS

UNIT I **12 Periods**

Radiation Mechanism and Antennas Basics

Antenna definition, Functions of antennas , Network theorems, Properties of antennas, Antenna parameters. Radiation mechanism, Radiation fields of alternating current element, Radiated power and radiation resistance; Radiation, induction and electrostatic fields. Different current distributions in linear antennas, Radiation from half-wave dipole, quarter wave mono pole and their characteristics. Radiation patterns of alternating current element, dipoles and monopoles.

UNIT II **12 Periods**

Types of Antennas & Applications

Introduction, Isotropic radiators, Directional antennas, omnidirectional antennas, Resonant antennas, Non-resonant antennas, LF, HF, VHF and UHF antennas. Folded dipole, V-Antennas, Inverted V-antennas, Rhombic antenna, Yagi-Uda antenna, Log-periodic antennas, Loop antenna, Helical antennas. Microwave Antennas: Rod reflector, Plane reflector, Corner reflector, Parabolic reflector, Types of parabolic reflectors, Feed systems for parabolic reflectors, Shaped beam antennas, Horn antennas, Corrugated horns, Slot antennas, Slots in the walls of rectangular waveguides, Babinet's principle, Lens antennas, Microstrip antenna and feeding techniques.

UNIT III **12 Periods**

Analysis & Synthesis of Linear Arrays

Two-element uniform array, Uniform linear arrays, Field strength of a uniform linear array, First sidelobe ratio (SLR), Broadside and End-fire arrays, Patterns of array of non-isotropic radiators, Multiplication of patterns, Generalized expression for principle of pattern multiplication, Radiation pattern characteristics, Binomial arrays.Transmission loss between transmitting and receiving antennas - FRIIS formula, Antenna temperature and signal-to-noise ratio. Schelkunoff Synthesis methods, Fourier transform method, Linear array design by Woodward-lawson method, Dolph-chebychev method (Tschebyscheff distribution), Taylor method, Laplace transform method, Standard amplitude distributions. Introduction to planar & phased arrays.

UNIT IV **12 Periods**

Antenna Measurements

Introduction, Drawbacks of measurements of antenna parameters, Methods to overcome drawbacks in measurements, Methods for accurate measurements, TEM cell, GTEM cell, Anechoic chamber, Measurement ranges, Indoor and outdoor ranges, Antenna impedance measurements, Measurement of radiation resistance, Gain measurements, Measurement of antenna bandwidth, Directivity measurement, Measurement of sidelobe ratio, Measurement of radiation efficiency, Measurement of antenna aperture efficiency, Measurement of polarization of antenna, Phase measurement.

UNIT V **12 Periods**

Wave Propagations

Propagation characteristics of EM Waves, Factors involved in the propagation of radio waves, Ground wave propagation, Ground wave field strength by Maxwell's equations, Reflection of radio waves by the surface of the earth, Roughness of earth, Reflection factors of earth, Wave tilt of the ground wave, Tropospheric wave propagation, Atmospheric effects in space wave propagation, Duct propagation, Radio horizon, Troposcatter, Fading of EM waves in Troposphere, Line of sight (LOS), Ionospheric propagation, Characteristics of ionosphere, Refractive index of ionosphere, Phase and group velocities, Mechanism of Ionospheric propagation, reflection and refraction, Characteristic parameters of Ionospheric propagation, Sky wave field strength, Fading and diversity techniques, Faraday's rotation, Effect of earth's magnetic field.

Text Book

1. C.A. Balanis, *Antenna Theory*, John Wiley & Sons, NY, 3rd edn., 2005.
2. G.S.N. Raju, *Antennas and Wave Propagation*, Pearson Education (Singapore) Pvt., Ltd., New Delhi, 2007.

Reference Books:

1. E. C. Jordan and K. G. Balmain, *EM Waves and Radiation Systems*, PHI – N. Delhi,2nd Edn., 2000.
2. J.D. Kraus, *Antennas*, McGraw Hill, NY,2nd Edn., 1988.

MICROPROCESSORS & APPLICATIONS LABORATORY	
ECE 317	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:

Microprocessors and Applications

Course Objectives:

- To program both 8085 and 8086 to meet the requirements of the user.
- To interface various peripherals
- To handle interrupts
- To design a microcomputer to meet the requirement of the user

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Program 8085 & 8086 microprocessor to meet the requirements of the user.
2.	Interface peripherals like switches, LEDs, stepper motor, Traffic lights controller, etc..,
3.	Handle interrupts
4.	Design a microcomputer to meet the requirement of the user

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2	2	2	-	-	-	2	1	-	1	2	2	2
	2	3	2	2	2	2	-	-	-	2	1	-	1	2	2	2
	3	2	2	2	2	1	-	-	-	2	1	-	1	1	1	2
	4	2	2	3	3	2	-	-	-	2	1	-	1	2	3	3

List of Experiments

Experiments using 8085 Microprocessor trainer:

1) Write a program, which loads Registers, A, B, C, and D with the same constant. Try to optimize the program in such a way that the smallest numbers of program bytes are used. Test the program in single step mode. After each step, test the register of interest.

   Assume that 4 bytes of data are stored at consecutive locations of the data-memory starting at (x). Write a program, which loads Registers E with (x), D with (x+l), C with (1+2) and A with (x+3).

   a. Assume that l byte of data is stored at data memory location (x). Write a program which tests bit 5 of (X). Write 'FF' in (x+1), if bit 5=0 and write '00' at the same location if bit 5=1.
   b. Write a program which tests the zero-condition of a data byte specified at data memory location (x). If it is zero '00' should be stored at (x+1) location, if non-zero 'FF' should be stored at the same location.

c. A binary number is stored at data-memory location (x) Compute the number of its logical 1's and store the result at y.
d. Comment on the instructions used in the above three programs and write about the effect of flags with the instructions used.

2) Two unsigned binary numbers are stored at data-memory locations (x) and (x+1).
   a. Compute the sum of the two numbers and store the result at y, ignoring the possible overflow.
   b. Write a program to compute (x+1) - (x). The magnitude of the result should be stored at (y) and the sign (00 if positive, 01 if negative) at (y+1). Understand the 2's compliment Arithmetic.
3) N binary numbers stored at consecutive data memory locations starting at (x) where N is defined at data memory location 'NUMBER'.
   a. Find the largest number and display it in the data field and arrange them in ascending order.
   b. Find the smallest number and display it in the data field and arrange them in descending order.
4) Two 8-bit binary numbers are stored at data memory locations (x) and (x+1) compute product of the two numbers using, a). Successive addition method. b). Shifting and adding method store the result in (y) and (y+1).

<u>Experiments using 8086 Microprocessor trainer/TASM/MASM:</u>

5) Addition of a) 16-bit numbers b) 32-bit numbers
6) Factorial of a number, Fibonacci series
7) Hexadecimal and decimal counters
8) Sorting of numbers

<u>Interfacing experiments with 8086 Microprocessor trainer:</u>

9) Interfacing of D/A converter
10) Interfacing of A/D converter
11) 8255 Study Card – Interfacing I/O Devices
12) Interfacing of stepper motor
13) Interfacing of 7-segment display/Traffic light controller

Note: A student has to perform a minimum of 10 experiments.

Text Books:

1. Ramesh S. Gaonkar, *Architecture Programming and Applications*, 3rd Edition, Penram International Pvt. Ltd.
2. D. V. Hall, *Microprocessors and Interfacing*, Revised 2nd edition 2006, TMH,.
3. A.K. Ray and K.M. Bhurchand, *Advanced Microprocessors and Peripherals*, 2nd edition, 2006, TMH.

INTEGRATED CIRCUITS LABORATORY	
ECE318	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:

Digital Electronics, Integrated Circuits and Applications

Course Objectives:

- To understand the linear and non-linear applications of operational amplifiers(741)
- To familiarize with theory and applications of 555 timers.
- To design and construct waveform generation circuits using Op-Amp
- To design multivibrator circuits using IC555
- To design and analyze combinational and sequential logic circuits

Course Outcomes:

By the end of the course, the student will be able to	
1.	Design the circuits using op-amps for various applications like adder, subtractor, integrator, differentiator and Schmitt trigger
2.	Design active filters for the given specifications and obtain their frequency response characteristics.
3.	Design and analyze multivibrator circuits using op-amp and 555Timer
4.	Design and analyze various combinational circuits like multiplexers, and de-multiplexers, binary adder, subractor, etc
5.	Design and analyze various sequential circuits like flip-flops, counters etc

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2	2	2	-	-	-	2	1	-	1	3	3	2
	2	2	2	1	2	2	-	-	-	2	1	-	1	2	2	2
	3	2	2	1	2	2	-	-	-	2	1	-	1	2	2	2
	4	2	2	2	1	2	-	-	-	2	1	-	1	2	2	2
	5	2	2	3	1	2	-	-	-	2	1	-	1	2	2	2 y t

List of Experiments:

1) Application of Operational Amplifiers
2) Design and testing of Active LPF & HPF using op-amp
3) Design of Schmitt Trigger using op-amp
4) Design of Astable multivibrator using a) op amp b) IC 555
5) Line and load regulation of three terminal IC Voltage Regulator.

6) Operation of R-2R ladder DAC and flash type ADC
7) Simulation of any 4 Experiments 1, 2, 3, 4 , 5 and 6 using Multisim software
8) Minimization and Realization of a given Function using Basic Gates (AND, OR, NOR, NAND, EXOR).
9) Design and implementation of code converters using logic gates (i) BCD to excess-3 code (ii) Gray to binary
10) Design of binary adder and subtractor
11) Design and implementation of Multiplexer and De-multiplexer using logic gates.
12) Implementation and Testing of RS Latch and Flip-flops – D, JK and T.
13) Design of synchronous counters
14) Design of asynchronous counters

Note: A student has to perform a minimum of 12 experiments.

Text Books:

1. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001
2. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", New Age Science, 2010
3. John F Wakerly, “Digital Design-Principles and practices”, 4th Ed., Pearson, 2008
4. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.

QUANTITATIVE APTITUDE - I	
ECE 319	**Credits: 2**
Instructions: 4 Periods/week	Sessional Marks: 100

Prerequisites: Nil

Course Objectives:

Quantitative Aptitude -I

- To prepare the students on various principles related to numerical computations.
- To explain concepts related to numerical estimation.
- To illustrate and explain the fundamentals related to geometry and mensuration.

Verbal Aptitude-I:

- To categorize and explain principles of grammar in order to minimize errors in English.
- To list and quote high frequency words by giving relevant examples.
- To categorize, apply and use data as per the requirement.
- To construct and make use of idioms, phrasal verbs and other expressions used in professional contexts.
- To critically evaluate reading material for better comprehension

Course Outcomes:

Quantitative Aptitude –I

By the end of the course student will be able to :	
1.	Solve problems related to numerical computations in company specific and other competitive tests
2.	Recall and use the concepts to solve problems numerical estimation with respect to company specific and competitive tests.
3.	Apply basic principles related to geometry and mensuration & solve questions in company specific and competitive tests.

Verbal Aptitude-I:

By the end of the course student will be able to :	
1.	Detect grammatical errors in the text/sentences and rectify them while answering their competitive company specific tests and frame grammatically correct sentences while writing.
2.	Answer questions on synonyms, antonyms, hyponyms, hypernyms and other vocabulary based exercises while attempting company specific and other competitive tests.
3.	Use their logical thinking ability and solve questions related to reasoning based exercises.
4.	Choose the appropriate word/s/phrases suitable to the given context in order to make the sentence/paragraph coherent
5.	Analyze the given data/text and find out the correct responses to the questions asked based on the reading exercises; identify relationships or patterns within groups of words or sentences.

SYLLABUS

Section –A (Quantitative Aptitude –I)

UNIT I **6 Periods**

Numerical computation:

Applications based on Numbers, Chain Rule, Ratio Proportion

UNIT II **6 Periods**

Numerical estimation - I

Applications Based on Time and work, Time and Distance

UNIT III **4 Periods**

Numerical estimation – II

Applications based on Percentages, Profit Loss and Discount, Simple interest and Compound Interest Partnerships, Shares and dividends

UNIT IV **4 Periods**

Data interpretation

Data interpretation related to Averages, Mixtures and allegations, Bar charts, Pie charts, Venn diagrams

UNIT V **4 Periods**

Application to industry in Geometry and Mensuration

Books for practice

1. Quantitative aptitude by RS Agarwal, S Chand Publications
2. Verbal and non verbal Reasoning by RS Agarwal from S Chand publications

References

1. Barron's by Sharon Welner Green and Ira K Wolf (Galgotia Publications pvt. Ltd.)
2. Quantitative Aptitude by U Mohan Rao Scitech publications
3. Quantitative Aptitude by Arun Sharma McGrawhill publications
4. Quantitative Aptitude by Ananta Asisha Arihant publications
5. Quantitative Aptitude by Abhijit Guha
6. Quantitative Aptitude by Pearson publications
7. Material from 'IMS, Career Launcher and Time' institutes for competitive exams.
8. Elementary and Higher algebra by HS Hall and SR knight.

Websites:

www.m4maths.com

www.Indiabix.com

800score

Official GRE site

Official GMAT site

Section –B (Verbal Aptitude –I)

UNIT I **7 Periods**

Grammar:

Parts of speech(with emphasis on appropriate prepositions, co-relative conjunctions, pronouns-number and person, relative pronouns), articles(nuances while using definite and indefinite articles), tenses(with emphasis on appropriate usage according to the situation), subject – verb agreement (to differentiate between number and person) , clauses (use of the appropriate clause , conditional clauses), phrases(use of the phrases, phrasal verbs), degrees of comparison(comparing apples and oranges, comparison and number), modifiers(misplaced and dangling modifiers, absence of modifiers), determiners, parallelism in structure(symmetry in two part sentences), word order, subjunctive mood, redundancy, special types of sentences, miscellaneous types, identifying errors in a given sentence, correcting errors in sentences.

UNIT II **4 Periods**

Vocabulary:

Synonyms and synonym variants (with emphasis on high frequency words), antonyms and antonym variants (with emphasis on high frequency words), homonyms, hyponyms, hypernyms and General idioms.

UNIT III **5 Periods**

Reasoning:

Critical reasoning (understanding the terminology used in CR- premise, assumption, inference, conclusion), Sequencing of sentences (to form a coherent paragraph, to construct a meaningful and grammatically correct sentence using the jumbled text), to use logical reasoning and eliminate the unrelated word from a group.

UNIT IV **4 Periods**

Usage:

Sentence completion (with emphasis on signpost words and structure of a sentence), contextual meanings (to use the appropriate word according to the situation), supplying a suitable beginning/ending/middle sentence to make the paragraph coherent, idiomatic language (with emphasis on business communication), punctuation depending on the meaning of the sentence, run on errors, sentence fragments, coma splices.

UNIT V **4 Periods**

Reading Comprehension:

Types of passages (to understand the nature of the passage), types of questions (with emphasis on inferential and analytical questions), style and tone (to comprehend the author's intention of writing a passage), strategies for quick and active reading(importance given to skimming, scanning), summarizing ,reading between the lines, reading beyond the lines, techniques for answering questions related to vocabulary (with emphasis on the context), supplying suitable titles to the passage, identifying the theme and central idea of the given passages.

Books for Practice

1. Practical English Grammar A. J. Thomson, A. V. Martinet by Oxford University press
2. Remedial English Grammar for Foreign Students by FT wood published by Macmillan Publishers
3. Objective English-Edgar Torpe, Showick Thorpe-Pearson Education
4. Cambridge and Oxford Dictionaries

Reference Books and websites:

1. Barron's by Sharon Welner Green and Ira K Wolf (Galgotia Publications Pvt.Ltd.)
2. Websites: Indiabix, 800 score, official CAT, GRE and GMAT sites
3. Material from 'IMS, Career Launcher and Time' institutes for competitive exams.
4. Collins Cobuild English Grammar by Goyal Publishers
5. Word Power Made Easy by Norman Lewis-Goyal Publishers

MICROWAVE & RADAR ENGINEERING	
ECE 321	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Outcomes:

By the end of the course, the student will be able to:	
1	Understand and use the microwave components in design of different microwave setup
2	Analyze and design microwave circuits using S- Parameters
3	Understand the principles involved in generating /amplifying microwave signals and different devices there of.
4	Carry out microwave measurements for the designed gadgets.
5	Understand the basic of Radar Engineering that includes range equation radar block diagram and different types of radars

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	3	2	-	-	-	1	1	-	-	-	-	1	3	3	1
	2	3	2	1	-	-	-	-	-	-	-	-	2	3	3	3
	3	3	2	-	-	-	1	1	-	-	-	-	1	3	1	3
	4	2	2	3	-	-	1	1	-	-	-	-	2	2	2	2
	5	3	1	1	-	-	-	-	-	-	-	-	2	3	1	2

SYLLABUS

UNIT I **12 periods**

Microwave Components:

Introduction to Microwaves, advantages and applications; Coaxial Line Components; Theory of Guided Waves- Waves in between parallel plates parallel plate, Wave Guide – Derivation of Field Equations, Modes of Propagations, and their parameters, Types of Wave-guides; Excitation methods for different TE modes, Wave impedance in waveguide; Attenuators; Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors.

UNIT II **12 periods**

Microwave Circuits:

Scattering Matrix and its Properties. Scattering Matrix of E Plane Tee, H plane Tee and Magic Tee, Directional coupler & its types, Ferrite Devices-Scattering Matrix of Circulator, Isolator, Gyrator Applications.

UNIT III **12 periods**

Microwave Signal Generators and Amplifiers:

Resonant Cavity Devices, Reflex Klystron, Two – Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes, Crystal Diode.

UNIT IV **12 periods**

Microwave Measurements:

Introduction to Microwave bench setup, Measurement of Frequency, Wavelength, VSWR, Unknown impedance, attenuation. Coupling, Isolation and Directivity measurements of Directional coupler. Microwave power measurement, dielectric constant measurement, .

UNIT V **12 periods**

Radar Engineering :

Radar Range Equation, Radar Block Diagram and Operation, Prediction of Range, Minimum Detectable Signal, Receiver Noise, Radar Cross-section, Transmitter Power, PRF and Range Ambiguities, Radar Antenna Parameters, System Losses and Propagation Effects. Types of radars- MTI & Pulse Doppler Radar, Tracking Radar –Principles; Synthetic Aperture Radar, Phased Array Radar.

Text Books:

1. Simon Kingsley and Shaun Quegan, "*Understanding Radar Systems*", SciTech Publishing, 1999.
2. G.S.N. Raju, "*Microwave Engineering*",1st ed., IK International Publishers,
3. G. Sasibhushan Rao, "*Microwave & Radar Engineering*" ,1st ed., Pearson Education,2014.

Reference Books:

1. G.S.N Raju, "*Radar Engineering and Fundamentals of Navigational Aids*", 1st ed. IK International Publishers, 2008
2. M.I. Skolnik, "*Introduction to Radar Systems*", McGraw Hill, 2007.
3. R. R. Collin, "*Foundations for Microwave Engineering*", 2nd ed., McGraw Hill.2015.

DIGITAL SIGNAL PROCESSING	
ECE 322	**Credits : 4**
Instruction : 4 periods & 1 Tutorial/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: ECE 214

Course Outcomes:

By the end of the course, the student will be able to:	
1	Mathematically classify different types of signals and perform basic operations on time and amplitude and Represent DT signals in the Frequency domain using Fourier Analysis and Z-Transforms.
2	Transform a DTS into frequency domain using DFT and FFT and compare these two methods with respect to their computation complexity.
3	Design and realize IIR and FIR digital filters for a arbitrary frequencies and attenuation values .
4	Implement sampling rate conversion using decimation and interpolation applied in digital filter banks.
5	Explain the DSP processors which can be used for practical applications and also acquired knowledge on various applications of Digital Signal Processors in speech processing.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1	1	2	-	-	-	-	-	-	2	1	1	1
	2	2	2	-	1	2	-	-	-	-	-	-	2	2	3	1
	3	2	3	2	1	2	-	-	-	-	-	-	2	3	3	2
	4	2	1	1	1	2	-	-	-	-	-	-	2	2	3	1
	5	1	1	-	1	1	-	-	-	-	-	-	2	1	2	1

SYLLABUS

UNIT I **12 Periods**

Introduction to Digital Signal Processing & Applications of Z-Transforms : Classification of signal & systems – linear shift invariant systems – stability and causality , time response analysis of discrete time systems, frequency domain representation of discrete time signals and systems.
Z-Transforms: Introduction, The Z – Transforms, Properties of Z-Transform, Inverse Z-transforms, Analysis of Linear Time invariant system using Z-Transforms

UNIT II **12 Periods**

Discrete Fourier Series & Fourier Transforms and FFTs: Discrete Fourier Series, Properties of discrete Fourier series, Discrete Fourier transforms: Properties of DFT, Circular convolution, linear convolution of sequences using DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT III **12 Periods**

IIR & FIR Digital Filter Design Techniques: Introduction, Analog low pass filter design, Butterworth and Chebyshev approximations, Frequency transformations, Design of HPF

Design of IIR Digital filters from analog filters, Bilinear Transformations method, Impulse and Step invariance method. Design Examples: Analog-Digital transformations, Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.

UNIT IV **12 Periods**

Multirate Digital Signal Processing: Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion. Digital Filter Banks, sub band coding of speech signals.

UNIT V **12 Periods**

Introduction to DSP Processors & DSP Applications: Introduction to programmable DSPs - Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs, Multiple Access Memory - Multiport memory - VLSI architecture – Pipelining - Special addressing modes - On-Chip Peripherals - Architecture of TMS 320C5X - Introduction, Bus Structure - Central Arithmetic Logic Unit - Auxiliary Register - Index Register - Block Move Address Register - Parallel Logic Unit - Memory mapped registers - program controller - Some flags in the status registers - On-chip registers, On-chip peripherals.

DSP Applications: Application of DSP in Speech Processing – DSP applications in Bio-Medical Engineering.

Text Books:

1. John G. Proakis, Dimitris G.Manolakis, *Digital Signal Processing, Principles, Algorithms, and Applications:* Pearson Education / PHI, 2007.
2. K Raja Rajeswari, *Digital Signal Processing* I.K. International Publishing House.
3. A.V.Oppenheim and R.W. Schaffer, *Discrete Time Signal Processing,* PHI.
4. B.Venkataramani, M.Bhaskar, *Digital Signal Processors – Architecture, Programming and Applications,*TATA McGraw Hill, 2002.

Reference Books:

1. Alan V. Oppenheim and Ronald W. Schafer, *Digital Signal Processing,* PHI.
2. Sanjit K. Mitra, *Digital Signal Processing "A – Computer Based Approach"*,Tata Mc Graw Hill.
3. C. Britton Rorabaugh, *DSP Primer* Tata McGraw Hill, 2005.
4. Robert J. Schilling, Sandra L. Harris CL *Fundamentals of Digital Signal Processing using Matlab* Engineering;

MICROCONTROLLERS & EMBEDDED SYSTEMS	
ECE 323	**Credits:3**
Instruction: 3 Periods & 1 Tut/week	Sessional Marks:40
End Exam: 3 Hours	End Exam Marks:60

Prerequisites:

Digital Electronics, Computer Architecture & Organization, Microprocessors and Interfacing

Course Outcomes:

By the end of the course, the student will be able to:	
1.	**Acquire** knowledge of the architecture and operation of Intel 8051 microcontroller and Analyze the hardware features like timers, memory, interrupts and serial communication available in 8051 Microcontroller Family of devices
2.	**Develop** assembly language programs for data transfer, arithmetic, logical, and branching operations using instruction set of 8051 and apply them in control applications
3.	**Develop** applications that will provide solution to real world problems by Interfacing 8051 Microcontroller with various peripherals such as ADC, DAC, keyboard, display, Interrupt and Serial communication modules.
4.	**Evaluate** the Embedded system design flow from the requirements to the deployment level and analyze the hardware/software tradeoffs involved in the design of embedded systems.
5.	**Express** the implementation of ARM and SHARC Processors in terms of architecture, and memory organization. Also evaluate the performance metrics of simple and networked Embedded systems

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO											PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1
	2	2	2	1	-	1	-	-	-	-	-	-	2	1	1	1
	3	2	2	2	2	2	-	-	-	-	-	-	2	1	1	1
	4	2	2	1	-	-	-	-	-	-	-	-	1	1	1	1
	5	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1

SYLLABUS

UNIT I: **12 Periods**

8051 Microcontroller:

Introduction to Microcontrollers, comparing Microprocessors and Microcontrollers, Architecture of 8051 Micro controller, Register organization of 8051, SFRs, Addressing modes of 8051.

Pin configuration of 8051, Input/Output Ports and Circuits, External Memory, Counters/Timers and modes of Timers, Serial data Input/Output, Interrupts.

UNIT II: **12 Periods**

Assembly Language Programming of 8051

Programming the 8051. Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic. Jump and Call Instructions.

UNIT III: **16 Periods**

Interfacing 8051

Interfacing with Keyboards, Displays, D/A and A/D converters, Multiple Interrupts, Serial Data Communication.

UNIT IV: **10 Periods**

Introduction To Embedded Systems

Embedded systems overview, design challenge, Processor technology, IC technology, Design Technology, Trade-offs.

UNIT V: **12 Periods**

Introduction to advanced architectures

ARM and SHARC, Processor and memory organization and Instruction level parallelism; Networked embedded systems: Bus protocols, I2C bus and CAN bus; Internet-Enabled Systems, Design Example-Elevator Controller.

Text Books:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D Mc Kinlay , *The 8051 Microcontroller and Embedded Systems Using Assembly and C*, 2nd Edition, Pearson Education, 2008.
2. Frank Vahid, Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley.
3. Rajeshwar Singh, Dr.D.K.Singh, *Embedded System Design,* 1st Ed., Dhanpat Rai, 2010

Reference Books:

1. Kenneth. J. Ayala, Dhananjay V. Gadre, *The 8051 Microcontroller & Embedded Systems Using Assembly and C*, 1st edition, Cengage learning, 2010
2. David E. Simon, *An Embedded Software Primer*, Pearson Education
3. Satish Shah, *8051 Microcontrollers: MCS 51 Family and Its Variants*, 1/e, Oxford University Press, 2010
4. B. Kanta Rao, *Embedded Systems,* 1st Ed., PHI, 2011
5. Wayne Wolf, *Computers as Components-principles of Embedded computer system design,* Elsevier

ANALOG IC DESIGN	
ECE 324(a)	**Credits : 3**
Instruction : 3 Periods & 1 Tut/Week	Sessional Marks : 40
End Exam : 3 Hours	End Exam Marks : 60

Prerequisites:

Network Analysis and Synthesis, Electronic Circuits Analysis-I, Electronic Circuits Analysis-II

Course Outcomes:

By the end of the course, the student will be able to:
1. Understand the basic MOS device physics and models
2. Analyze and design single stage amplifiers
3. Analyze and design differential amplifiers
4. Analyze and design current sources/sinks/mirrors
5. Analyze and design basic operational amplifiers circuits

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1
	2	2	2	1	-	1	-	-	-	-	-	-	2	1	1	1
	3	2	2	2	2	2	-	-	-	-	-	-	2	1	1	1
	4	2	2	1	-	-	-	-	-	-	-	-	1	1	1	1
	5	2	2	1	-	-	-	-	-	-	-	-	2	1	1	1

SYLLABUS

UNIT-I: **12 Periods**

Basic MOS Device Physics:

MOSFET as a switch, MOSFET structure and symbols, Threshold voltage, Derivation of I-V characteristics, second order effects.

UNIT-II: **12 Periods**

Device Modeling:

DC Models, Small signal models, use of device models in circuit analysis, DC MOSFET model, and small signal MOSFET model, High frequency MOSFET Model, Measurement of MOSFET Model parameters.

UN IT-III: **12 Periods**

Single stage amplifiers:

Basic concepts, CS stage with resistive load, CS stage with diode connected load, CS stage with Current-Source load, CS stage with Triode load, CS stage with Source degeneration, Source follower, Common gate stage, Cascode stage

UNIT-IV: **12 Periods**

Differential amplifiers:

Single ended and differential operation, qualitative and quantitative analysis of Basic differential pair, common mode response, differential pair with MOS Loads

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

UNIT-V: 12 Periods

Operational amplifiers:

Performance parameters, one stage op-amps, two stage op-amps, gain boosting, common mode feedback, input range limitations, slew rate, power supply rejection.

Text books:

1. Behzad Razavi , *Design of Analog CMOS Integrated Circuits,* Tata McGraw-Hill, 1st edition, 2002.

2. Randall Geiger, Phillip Allen, Noel Strader, *VLSI Design Techniques for Analog and Digital Circuits,* Tata McGraw-Hill, 1st edition, 2010.

References:

1. Douglas R. Holberg, P. E. Allen Phillip E. Allen, *CMOS Analog Circuit Design,* 2nd edition, 2002

ELECTROMAGNETIC INTERFERENCE / COMPATABILITY	
ECE 324(b)	**Credits : 3**
Instruction : 3 periods & 1 Tutorial/Week	Sectional Marks : 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Outcomes :

By the end of the course, students will be able to :
1. Understand the concept of EMI / EMC, related to product design & development.
2. Analyze the different EM coupling principles and its impact on performance of electronic system.
3. Ensure that a designed system conforms itself to certain standard through a thorough understanding of various standards in different countries.
4. Have broad knowledge of various EM radiation measurement techniques.
5. Model a given electromagnetic environment/system so as to comply with the standards.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2		1			1						2			3
	2	1	2	1									1	2	3	
	3	3	2	3			2						2	2	3	
	4	3	2	3	1			1	1				1	2		
	5	3	2	3									2	2	3	

SYLLABUS

UNIT I **12 Periods**

Introduction to overview of EMI/EMC/ESD/EMP: EM environment, Historical Notes, Problems of EMI, Frequency Conservation, Assignment & spectrum, practical experiences, Occurrence of EMI, Concepts of EMI/EMC-definitions, Sources of noise, Natural and Nuclear Sources of EMI, Conducted and Radiated Emissions and Susceptibility. Introduction - EMI Testing and Compliance Tests, ESD, EMP.

UNIT II **12 Periods**

Elimination/Reduction Methodologies: Grounding Techniques, Shielding Techniques, Electrical Bonding Techniques, Cabling Techniques, Power Supply Filters, Power Supplies, Connectors and Components/ Accessories.

UNIT III **12 Periods**

EMC Regulation/ Standards:

Introduction to different commercial and defense Standards like FCC, CISPR/IEC, VDE, IEEE/ ANSI, MIL-STD

UNIT IV **12 Periods**

EMI/EMC Measurement Technologies:

Introduction to various instruments used in the measurements and their characteristics, Radiated Interference Measurements, Conducted Interference Measurements, Pitfalls in EMI

Measurements, Measurements of pulsed EMI, Introduction of Measurement Environment – OATS, Anechoic Chamber, TEM, GTEM cell. Software in EMI/EMC Measurements, Different EMI Test Instruments and their comparisons.

UNIT V **12 Periods**

EMI/EMC Modeling: Modeling of filter for suppression of EMI in the design, choice of various electronic components, Pulse Interference Immunity, EMC computer modeling and Simulation, Signal Integrity EMC design, Guidelines, Probabilistic

Text Book

1. IMPACT, *EMI/EMC for Engineering Colleges*, RSTE ,1997.
2. Kodali, V.P., "*Engineering EMC- Principles, Measurements, Technologies and Computer Models*", 2nd Ed., IEEE Press, NY, 2000.

Reference Books:

1. Paul, R.C, "*Introduction to EMC"*, 2nd Ed., John Wiley & Sons Inc., 2006.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION	
ECE 324(c)	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites: Nil

Course Outcomes:

At the end of the course, the student will be able to:	
1.	Measure various parameters with accuracy, precision and resolution and understand the operation of PMMC and EMMC with their applications
2.	Understand the principle of operation, working of different electronic instruments
3.	Apply the knowledge of cathode ray oscilloscopes and understand the functioning, specification, applications of signal analyzing instruments
4.	Understand principles of measurement associated with different bridges
5.	Select appropriate passive or active transducers for measurement of physical phenomenon

Mapping of course outcomes with POs and PSO's:

		PO												PSO		
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO	1	2	1	1	1	-	-	-	-	-	-	-	1	2	-	3
	2	1	1	2	2	-	-	-	-	-	-	-	1	2	1	2
	3	1	1	1	3	-	-	-	-	-	-	-	2	1	2	2
	4	2	2	2	3	-	-	-	-	-	-	-	1	1	2	2
	5	1	1	2	2	-	-	-	-	-	-	-	3	1	2	1

SYLLABUS

UNIT-I **[10 periods]**

Basic measurement concepts:

Objectives of engineering measurement, performance characteristics-static and dynamic. Errors in measurement, sources of error, types of errors, statistical analysis, classification of standards, permanent magnet moving coil(PMMC) meter, DC ammeter, DC voltmeter, voltmeter sensitivity, series ohmmeter, shunt ohmmeter, Electrodynamometer, problems

UNIT-II **[15 periods]**

Basic electronic instruments:

Instruments for measuring basic parameters-Amplified DC meter, AC voltmeter using rectifier, true RMS responding voltmeter, electronic multimeter, Q-meter, vector-impedance meter, vector voltmeter, rf and power measurement

Digital instruments: digital voltmeters and its different types-ramp, stair case ramp,integrating, continuous balance, successive approximation, resolution and sensitivity of digital meters, Digital multimeter, digital frequency meter, digital measurement of time, phase meter

UN IT-III **[15 periods]**

Oscilloscopes and signal analysis:

Introduction, ,oscilloscope block diagram cathode ray tube, crt circuits, vertical deflection system, delay line, horizontal deflection system, oscilloscope probes and transducers, Measurement of amplitude, time, frequency and phase (Lissajous method). Principle of sampling oscilloscope, digital storage oscilloscope

Signal analysis-basic wave analyzer, heterodyne wave analyzer, harmonic distortion analyzer, spectrum analyzer

UNIT-IV Bridge measurements: **[10 periods]**

Wheatstone bridge, Kelvin bridge, digital read-out bridges, microprocessor controlled bridge AC bridges: Measurement of inductance-Maxwell's bridge, hay bridge, Anderson Bridge. Measurement of capacitance- Schering Bridge, measurement of frequency-Wien bridge, wagners earth connection

UNIT-V **[10 periods]**

Transducers

Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples, and Thermistors), Velocity, Acceleration, vibration, pH measurement signal conditioning circuits, data acquisition systems, telemetry systems, IEEE 488 standard bus

Text Books:

1. A.D.Helfrick and W.D.Cooper, "modern Electronic Instrumentation and Measurement Techniques", PHI, 5th edition, 2002
2. Electrical and Electronic Measurements and Instrumentation by A.K.Sawhney, 2002 edition

Reference Books:

1. H.S.Kalsi,"Electronic instrumentation", second edition, TMH, 2004.
2. Oliver and Cage,"electronic measurements and instrumentation, TMH

TELECOMMUNICATION SWITCHING AND NETWORKS	
ECE 324(d)	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:

Digital Electronics, Signals and Systems, Electronic Circuit Analysis.

Course Outcomes:

By the end of the Course, the students will be able to:	
1.	Understand and describe the concepts of multiplexing and switching.
2.	Apply probability related concepts to resolve traffic and network related issues
3.	Analyze and solve problems in traffic engineering
4.	Recognize the significance of ISDN and outline its architecture
5.	Obtain an overview of end to end transmission in data networks

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	2	1										2	3	1	1
	2.	3	3	2	1								1	3	2	2
	3.	3	3	3	1								1	3	3	2
	4.	2		1									2	3		1
	5.	2	1	2									3	2	1	2

SYLLABUS

UNIT-I **10 Periods**

Telecommunication Switching Systems :

Basics of Switching Systems, Principles of Cross Bar Switching. Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Two Stage Networks, Three Stage Networks.

UNIT-II **10 Periods**

Time Division Switching :

Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching, Three Stage Combination Switching.

UNIT-III **20 Periods**

Telephone Networks :

Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Signaling Techniques: In Channel Signaling, Common Channel Signaling.

Traffic Engineering : Network Traffic Load And Parameters, Grade Of Service, Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems

UNIT-IV **10 Periods**

Integrated Services Digital Network (ISDN) :

Motivation For ISDN, Network & Protocol Architecture, Transmission Channels, User Network Interfaces, Numbering, Addressing, ISDN Standards, Broadband ISDN.

UNIT-V **15 Periods**

Data Networks :

Data transmission in PSTNs, Switching techniques for data transmission, Data communication architecture, Link-to-link layers, End-to-End layers, Local Area Networks, Metropolitan Area Networks, Data Network Standards, Protocol Stacks, Internetworking.

Text Book:

1. Thyagarajan Viswanath, "*Telecommunication Switching Systems and Networks*" PHI, 2000.

Reference Books:

1. J. Bellamy, "*Digital telephony*", 2nd edition, 2001, John Wiley.
2. B.A. Forouzan, "*Data Communication & Networking*", 3rd Edition, 2004, TMH.
3. J E Flood, "*Telecommunication switching, Traffic and Networks*", 2002, Pearson Education.

DIGITAL COMMUNICATIONS	
ECE 325	**CREDITS: 3**
Instruction: 3 Periods & 1 Tutorial/Week	Sessional Marks: 40
End Exam : 3 Hours	End Exam Marks: 60

Prerequisites:

Digital Electronics, Communication Systems, Electronic Circuit Analysis.

Course Outcomes:

By the end of the Course, the student will be able to:	
1.	Compare and analyze various baseband and bandpass digital modulation techniques
2.	Calculate probability of error for various digital modulation techniques to analyze the performance of DCS in the presence of noise.
3.	Analyze the performance of spread spectrum code acquisition and tracking circuits.
4.	Evaluate the channel capacity and Calculate efficiency of various source encoding techniques.
5.	Implement channel coding techniques and comprehend error correction and detection.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	3	3	2		2*				2*			1			
	2.	3	3							1*			1			
	3.	2	3	1						1*			1			
	4.	3	3	1						1*			1			
	5.	3	3	1						1*			1			

SYLLABUS

UNIT-I **15 Periods**

Analog to Digital Conversion and transmission:

Analog to digital conversion- Pulse Code Modulation, Differential Pulse Code Modulation, Delta Modulation, Adaptive Delta Modulation, Noise in Pulse-Code and Delta-Modulation Systems; Digital modulation techniques- Binary Amplitude-Shift Keying, Binary Phase-Shift Keying, Differential Phase-Shift Keying, Quadrature Phase-Shift Keying (QPSK), M-ary PSK, Quadrature Amplitude Shift Keying (QASK), Binary Frequency Shift-Keying, M-ary FSK.

UNIT-II **15 Periods**

Data Reception:

A Base-band Signal Receiver, Probability of Error, The Optimum Filter, White Noise: The Matched Filter, Probability of Error of the Matched Filter, Coherent Reception: Correlation, Phase-Shift Keying, Frequency-Shift Keying, Non-coherent Detection of FSK, Differential PSK, QPSK, Error Probability for QPSK, MSK, Comparison of Modulation Systems.

UNIT-III **10 Periods**

Spread Spectrum Modulation: Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences, Acquisition (Coarse Synchronization) of a DS Signal, Tracking of a DS Signal.

UNIT-IV **10 Periods**

Information theory and coding: Concept of amount of information and its properties, Entropy and its properties, Information rate, mutual information and its properties; Source coding: Shannon's theorem, Shannon-Fano coding, Huffman coding, channel capacity of a Gaussian noise channel, bandwidth-S/N trade off.

UNIT-V **15 Periods**

Channel Coding: Linear Block Codes-Introduction, Matrix description of Linear block codes, cyclic codes, Error detection and error correction capabilities of linear block codes, Hamming codes; Convolution Codes- encoding of convolution codes, Graphical approach: state, tree and trellis diagram.

Text Books:

1. H.Taub and D.Schilling, "*Principles of Communication Systems*"- TMH, 2003.
2. P.Ramakrishna rao, "*Digital Communication*" – Mc,Graw Hill editon, 2011.

Reference Books

1. Simon Haykin, "*Digital communications*"- John Wiley, 2005.
2. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," (2nd Edition).
3. K.Sam shanmugam, "*Digital and Analog Communication Systems*" - John Wiley, 2005.

COMMUNICATION SYSTEMS ENGINEERING LABORATORY	
ECE 326	**CREDITS: 2**
Practicals: 3 Periods/Week	Sessional Marks: 50
End Exam : 3 Hours	End Exam Marks: 50

Prerequisites:
Communication Systems, Signals and Systems, Electronic Circuit Analysis.

Course objective:
- To realize practical Modulator and Demodulator circuit.
- To analyse Analog modulated signals in time and frequency domain.
- To design practical filter circuits for communication system.
- To analyse the sampling and multiplexing technique.
- To Design a practical pre-emphasis and de-emphasis circuit.
- To study and measure the characteristics of practical AM Super Heterodyne Radio Receiver.

Course Outcomes:

By the end of the Course, the student will be able to:	
1.	Design and Simulate different Modulation schemes
2.	Design high pass and Low-pass filters used in communication system.
3.	Perform multiplexing on analog signals and Retrieve useful information by observing AM and FM in frequency domain.
4.	Design and Simulate a Practical Pre-emphasis and De-emphasis circuit.
5.	Measure the characteristics of practical AM Super Heterodyne Radio Receiver using Spectrum Analyzer, Cathode Ray Oscilloscope & Digital Multi Meter.

		PO												**PSO**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	1.	3	2	3	2	3				2	1		3	3	2	3
	2.	3	2	3	2	3				2	1		3	3	3	3
	3.	3	3	2	3	3				2	2		3	3	3	2
	4.	3	3	3	3	3				2	1		3	3	2	2
	5.	3	3	3	3	3				1	2		3	3	3	3

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

SYLLABUS

TRAINER KIT BASED EXPERIMENTS

1) Amplitude Modulation & Demodulation
2) Frequency Modulation & Demodulation
3) Balanced Modulator
4) Analog Time Division Multiplexing
5) Base band Sampling
6) Pulse Amplitude Modulation & Demodulation
7) Pulse Time Modulation & Demodulation

8) SSB-SC-AM Modulation
9) Super Hetero dyne Radio Receiver Parameters
10) Spectral Analyses of AM using Spectrum Analyzer
11) Spectral Analyses of FM using Spectrum Analyzer

SIMULATION BASED EXPERIMENTS(Open source/Matlab/Multisim)

1) Amplitude Modulation & Demodulation
2) Frequency Modulation & Demodulation
3) Balanced Modulator
4) SSB-SC-AM Modulation
5) Pulse Time Modulation & Demodulatio
6) Pr-emphasis & De-emphasis
7) Passive Filter Design
8) Attenuator
9) Twin T Network
10) Envelope Detector
11) Frequency Mixer/IF Amplifier/Automatic Gain Control

A student has to perform minimum of 10 experiments.

Text Books

1. B. P. Lathi, "*Modern Digital and Analog Communication Systems*," 2nd Edition, Oxford University Press, 2010.
2. Simon Haykins, "*Communication Systems*," Wiley, Fifth edition, 2009.
3. P.Ramakrishna Rao, "*Analog communications*" Tata McGraw Hill Education Private Limited. 2011.

MICROCONTROLLER & EMBEDDED SYSTEMS LABORATORY	
ECE327	**Credits:2**
Instruction: 3 Lab periods	Sessional Marks:50
End Exam: 3 Hours	End Exam Marks:50

Prerequisites:

Microprocessors and Interfacing, Microcontroller & Embedded Systems

Course Objectives:

- To program both 8051 to meet the requirements of the user.
- To interface various peripherals
- To handle interrupts
- To design a microcomputer to meet the requirement of the user

Course Outcomes:

By the end of the course, the student will be able to:	
1.	Program 8051 microcontroller to meet the requirements of the user.
2.	Interface peripherals like switches, LEDs, stepper motor, Traffic lights controller, etc..,
3.	Handle interrupts
4.	Design a microcontroller development board to meet the requirements of the user

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO	**1**	2	1	2	2	3	-	-	-	2	1	1	1	2	2	2
	2	3	2	2	2	3	-	-	-	2	1	1	1	2	3	2
	3	3	2	2	2	3	-	-	-	2	1	1	1	2	2	2
	4	3	2	3	3	3	-	-	-	2	1	1	1	3	3	3

List of Experiments:

1. Study and familiarization of 8051 Microcontroller trainer kit
2. Assembly Language Program for addition of 8-bit numbers stored in an array
3. Assembly Language Program for Multiplication by successive addition of two 8-bit numbers
4. Assembly Language Program for finding largest no. from a given array of 8-bit numbers
5. Assembly Language program to arrange 8-bit numbers stored in an array in ascending order
6. Stepper motor control by 8051 Microcontroller
7. Interfacing of 8-bit ADC 0809 with 8051 Microcontroller
8. Interfacing of 8-bit DAC 0800 with 8051 Microcontroller and Waveform generation using DAC
9. Implementation of Serial Communication by using 8051 serial ports
10. Assembly Language Program for use of Timer/Counter for various applications
11. Traffic light controller/Real-time clock display
12. Simple test program using ARM 9 mini 2440 kit (Interfacing LED with ARM 9 mini 2440 kit)

NOTE:

1. It is compulsory for each student to Design/Create their own Microcontroller Development Board for personal use
2. A student has to perform a minimum of 10 experiments.

Text Books:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D Mc Kinlay , *The 8051 Microcontroller and Embedded Systems Using Assembly and C*, 2nd Edition, Pearson Education, 2008.
2. Frank Vahid, Tony Givargis, *Embedded System Design*, 2nd Edition, John Wiley.
3. Rajeshwar Singh, Dr.D.K.Singh, *Embedded System Design*, 1st Ed., Dhanpat Rai, 2010

SOFT SKILLS LAB	
ECE328	**Credits : 02**
Instruction: 3Periods/week	Sessional Marks: 100

Prerequisites:

Basic English language skills- LSRW, English theory, English Language Lab.

Course Objectives:

- To inculcate effective communication skills with appropriate body language.
- To produce potent leaders, productive team players and effective individuals with proper professional ethics.
- To enable students to make successful oral presentations using relevant content.
- To train students for Group discussions and job Interviews which improves their employability skills.
- To facilitate students the importance of setting realistic goals and achieving them using time management techniques.

Course Outcomes:

By the end of the course, the student will be able to:	
1	Comprehend the core engineering subjects using effective verbal and nonverbal communication skills.
2	Present accurate and relevant information efficiently, using suitable material aids.
3	Work effectively as an individual as well in teams and emerge as responsible leaders with appropriate professional ethics.
4	Participate in group discussions and interviews using analytical and problem solving abilities, which enhance their employability skills.
5	Set time bound goals and realize them through strategic plans for successful career.

Mapping of Course Outcomes with Program Outcomes & Program Specific Outcomes:

		PO												PSO		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1O**	**11**	**12**	**1**	**2**	**3**
CO	**1**				2			1								2
	2										3					1
	3								2	3		3				3
	4						2									3
	5												3			3

SYLLABUS

UNIT-I : **9 Periods**

Art of communication

1. Definition of Communication
2. Types of Communication
3. Non-verbal Communication
4. Listening skills
5. Feed back

D.A. - Practice of proper hand shake, practice of different postures and gestures and activity on giving feedback

UNIT- II: **6 Periods**

Presentation Skills

Purpose

1. Effective presentation strategies
2. Analysis of audience
3. Preparing an outline of the presentation,
4. Audio –visual aids
5. Body language**.**

D.A. -Group presentation by each team

UNIT- III : **9 Periods**

Group Discussions

Introduction- as a part of selection process-guidelines for GD

1. Types of GD
2. Nature of topics of G.D
3. Roles to be played by participants in a GD
4. Evaluation process

D.A–Group discussions

UNIT – IV: **6 Periods**

Team Building and Leadership

1. Importance of team work
2. Different stages of team formation
3. Good team vs. effective team
4. Team player and Team leader
5. Types of leadership
6. Decision making and negotiating skills

D.A-Decision making for a given situation

UNIT –V: **3 Periods**

Time- Management

1. Importance of time-management
2. Time-Management models
3. Prioritization
4. The art of saying 'No'
5. Identifying Time Wasters

D.A -Time- Bound activities devised by the facilitator

UNIT- VI: **3 Periods**

Goal-Setting

Different type of Goals (Immediate and Short term)

1. 'SMART' Goals
2. Strategies to achieve goals

D.A - Prepare a chart of immediate, short term and long term goals

UNIT- VII: **9 Periods**

Job- Interviews

Preparing Resumes and C.V's

1. Preparing for the interview
2. FAQ's (Integrity, Stress management, Close- Ask questions)

D.A –Mock interviews

REFERENCE BOOKS:

1. Sanjay Kumar and Pushpalata, *Communication Skills* ,Oxford University Press , 2011.
2. Allan Pease, *Body Language***,** Sheldon Press,1997.
3. John A. Kline and BhavnaBhalla, *Speaking Effectively; Achieving Excellence in Presentations*, Pearson publication, 2013.
4. Marc Mancini, *Time Management*, Tata McGraw Hill publishing Comp.Ltd.,2003.
5. Peter Veruki, *The 250 Job Interview Questions,*Adams Media Corporation Avon, Massachusetts,1999.

QUANTITATIVE APTITUDE - II	
ECE 329	**Credits: 2**
Instructions: 4 Periods/week	Sessional Marks: 100

Prerequisites: Nil

Course Objectives:

Quantitative Aptitude –II

- To Categorize, apply and use thought process to distinguish between concepts of reasoning
- To Prepare and explain the fundamentals related to various possibilities and probabilities related to quantitative aptitude.
- To Critically evaluate numerous possibilities related to puzzles.

Verbal Aptitude-II:

- To prepare the students on the various aspects of writing, organizing data, and applying their writing skills in their professional career.
- To demonstrate and recommend the techniques required when interacting in different situations.
- To apply the professional qualities/skills necessary for a productive career and to instill confidence through attitude building.
- To plan activities in order to expose students to the different abilities required for working in a team, encourage them to glean information on current affairs and promote factual reading.
- To illustrate and explain the intricacies/nuances involved in framing responses to the questions asked, reading between lines and reading beyond lines.

Course Outcomes:

Quantitative Aptitude –II

By the end of the course student will be able to :	
1.	Use their logical thinking and analytical abilities to solve reasoning questions from company specific and other competitive tests.
2.	Solve questions related to permutation & combinations and probabilities from company specific and other competitive tests.
3.	Understand and solve puzzle related questions from specific and other competitive tests.

Verbal Aptitude-II:

By the end of the course student will be able to :	
1.	Write paragraphs on a particular topic, essays (issues and arguments), e mails, summaries of group discussions, make notes, statement of purpose (for admission into foreign universities), letters of recommendation (for professional and educational purposes)
2.	Converse with ease during interactive sessions/seminars in their classrooms, compete in literary activities like elocution, debates etc., raise doubts in class, participate in JAM sessions/versant tests with confidence and convey oral information in a professional manner using reason.
3.	Prepare his/her resume, apply the business English concepts learnt in the course, and refine one's overall demeanor which would be very essential to face the corporate world
4.	Respond to their interviewer/employer with a positive mind, customize answers to the

	questions asked during their technical/personal interviews, exhibit skills required for the different kinds of interviews (stress, technical, HR) that they would face during the course of their recruitment process

SYLLABUS

Section –A (Quantitative Aptitude –II)

UNIT I **8 Periods**

Numerical Reasoning:

Problems related to Number series, Analogy of numbers, Classification of numbers, Letter series, Seating arrangements, Directions, blood relations and puzzle test.

UNIT II **4 Periods**

Combinatorics:

Counting techniques, Permutations, Combinations and Probability

UNIT III **4 Periods**

Data sufficiency

Syllogisms

UNIT IV **4 Periods**

Application of Base system:

Clocks (Base 24), Calendars (Base7), Cutting of Cubes and cuboids

UNIT V **4 Periods**

Puzzle Solving & Time Management using various problems solving tools and techniques:

Selective puzzles from previous year placement papers

Selective puzzles from book Puzzles to puzzle you by shakunataladevi

Selective puzzles from book more puzzles by shakunataladevi

Selective puzzles from book puzzles by George summers

Books for practice

1. Quantitative aptitude by RS Agarwal, S Chand Publications
2. Verbal and non verbal Reasoning by RS Agarwal from S Chand publications
3. Puzzles to puzzle you by shakunataladevi orient paper back publication
4. More puzzles by shakunataladevi orient paper back publication
5. Puzzles by George summers orient paper back publication.

References:

1. Barron's by Sharon Welner Green and Ira K Wolf (Galgotia Publications pvt. Ltd.)
2. Material from 'IMS, Career Launcher and Time' institutes for competitive exams.
3. Reasoning by BS Sijwali Arihant publications
4. Reasoning Arun Sharma McGrawhill publications

Websites:

1. www.m4maths.com
2. www.Indiabix.com
3. 800score
4. Official GRE site
5. Official GMAT site

Section –B (Verbal Aptitude –II)

UNIT I **4 Periods**

General Essay writing, writing Issues and Arguments(with emphasis on creativity and analysis of a topic), paragraph

writing, story writing, guidance in framing a 'Statement of purpose', 'Letters of Recommendation', business letter writing, email writing, email and business letter writing etiquette, letters of complaints/responses to complaints. Information transfer is taught with the help of tables, bar diagrams, and pie charts while framing /sending lengthy data where testing is done through Reading comprehension and Critical reasoning. Contextual meanings with regard to inflections of a word, frequently confused words, words often mis-used, words often mis-spelt, multiple meanings of the same word (differentiating between meanings with the help of the given context), foreign phrases. Enhanced difficulty level in spotting errors will be taken up with reference to competitive test based exercises.

UNIT II **4 Periods**

Just a minute sessions, reading news clippings in the class, extempore speech, telephone etiquette, making requests/suggestions/complaints, elocutions, debates, describing incidents and developing positive non verbal communication. Analogies, YES-NO statements (sticking to a particular line of reasoning)

UNIT III **4 Periods**

Corporate readiness, business idioms and expressions, reading newspapers/magazines, brushing up on general awareness, latest trends in their respective branches, resume preparation, understanding business /corporate language, managing emotions, problem solving, importance of team work, goal orientation, professional grooming, positive attitude, assertiveness and inter personal skills.Data sufficiency (answering questions within the ambit of the given text), Fact-Inference-Judgment (to identify statements as FIJ), Syllogisms (with emphasis on fallacies in reasoning), strong and weak arguments.

UNIT IV **6 Periods**

Voice, direct & indirect speech, question tags, one word substitutes, and foreign phrases. An overview on group discussions, preparation for a group discussion, intricacies of a group discussion, topics for GDs (with special focus on controversial topics), structure of participation in a group discussion, roles played by the participants in a group discussion, constructive criticism, standard procedures followed whilst participating in a group discussion, frameworks that can be used for discussion, analysis of the discussion and exposure to case-based group discussions.

UNIT V **6 Periods**

Different types of interviews (with emphasis on personal interview), preparation for an interview, areas of questioning, answering questions on general traits like strengths/weaknesses/hobbies/extracurricular activities, choosing role models, importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews, handling stress, suggestions for responding to tough/unknown questions, preparation on self and personality development.

Note: The concepts learnt in Semester I will be tested in the Mid-term and Semester end exams during the II Semester as well.

Reading/ Listening material:

1. Newspapers like 'The Hindu', 'Times of India', 'Economic Times'.
2. Magazines like Frontline, Outlook and Business India.
3. News channels NDTV, National News, CNN

References:

1. Books written by Stephen Covey and Dale Carnegie-Seven Habits of Highly Effective People etc-Simon & Schuster, Running Press book publishers
2. Books written by Bertrand Russell-Oxford University Press

Suggested General Reading

1. **Who Moved My Cheese?** By Spencer Johnson-GP Putnam's Sons
2. **The art of War**-Sun Tzu by Nabla, Barnes & Noble
3. **The Monk Who Sold Ferrari**-Robin Sharma by Harper Collins, Jaico Publishers
4. **The Hobbit** and other books by JRR Tolkein-Harper Collins

Suggested Authors

1. illiam Dalrymple
2. V.S.Naipaul
3. Kushwanth Singh
4. Ernest Hemingway
5. Charles Dickens
6. Leo Tolstoy
7. R.K. Narayan
8. Amitav Ghosh
9. Oscar Wilde