PANJAB UNIVERSITY, CHANDIGARH-160014(INDIA)
(Estd. under the Panjab University Act VII of 1947-enacted by the Govt. of India)

FACULTY OF ENGINEERING & TECHNOLOGY

SYLLABI

AND THE

REGULATIONS

FOR

Bachelor of Engineering (Electronics & Communication)
Third-Eighth Semesters Examinations,
2018-19

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DEPARTMENT: ELECTRONICS AND COMMUNICATION ENGINEERING

VISION:

Electronics & Communication Engineering will contribute to the ever changing industrial requirements, economic growth and global societal needs by enhancing the technical skills and entrepreneurship abilities.

MISSION:

To produce qualified engineers who are competent in the areas of Electronics & Communication Engineering and able to meet the challenges of ever changing industry requirements at global level.

1. To develop strong theoretical concepts complemented with practical trainings.
2. To inculcate innovative skills, research aptitude, team-work, ethical practices in students so as to meet expectations of the industry as well as society.

PROGRAMME: B. E. ECE (UG PROGRAMME)

PROGRAMME EDUCATIONAL OBJECTIVES:

1. To build a strong foundation in scientific and engineering fundamentals necessary to formulate, solve and analyze engineering problems for successful careers to meet the global demands of the society.
2. To develop the ability among students to synthesize data and technical concepts of Electronics and Communication for application to develop core and multidisciplinary projects.
3. To promote awareness among student for the value of lifelong learning and to introduce them to professional ethics and codes of professional practice.

PROGRAMME OUTCOMES:

1. Graduates will demonstrate basic knowledge in Mathematics, Science and Engineering and the ability to solve the complex problems.
2. Graduates will demonstrate an ability to identify and analyze the basic problems in the field of Mathematics, Science and Engineering.
3. The ability to innovate and design an Electronics or Communication system that meets the desired specifications and requirements.
4. Demonstrate an ability to analyze and interpret data using various research methodologies to solve Electronics or Communication Engineering problems and provide significant conclusions.
5. Graduates will be familiar with the usage of modern engineering software tools for analysis of multidisciplinary Engineering problems and their limitations.
6. Develop the confidence to apply engineering solutions in global and societal context.
7. Ability to understand and demonstrate the impact of Engineering and technological solutions for sustainable development of society and environment.
8. Inculcate the understanding of professional and ethical responsibilities.
9. Demonstrate an ability to understand individual role and leadership qualities to lead diverse groups in multidisciplinary fields.

10. Cultivate the ability to communicate effectively in both verbal and written forms among peers and society.
11. Graduate will possess leadership and managerial skills with best professional, economic and ethical concern for managing team or as an individual in multidisciplinary environment.
12. Capable of self-education and clearly understand the value of lifelong learning.

Scheme of Examination and Syllabi for

B.E. (Electronics & Communication)

3rd to 8th Semester for Academic Year 2018-19

Year: Second **Semester: Third**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	EC301	Electromagnetic Theory	3-1-0	4	3	50	50	100	---
2	EC302	Signals and Systems	3-1-0	4	4	50	50	100	---
3	EC303	Microprocessor and Applications	4-0-2	6	4+1	50	50	100	50
4	EE309	Electrical Science	3-1-3	7	3+1	50	50	100	50
5	EC306	Electronics Measurements & Instrumentation	4-0-2	6	4+1	50	50	100	50
6		Elective (from Humanities and Social Sciences)	3-0-0	3	3	50	50	100	---
Total			**20-3-7**	**30**	**24**	**250**	**250**	**600**	**150**

*Practical marks are for continuous and end semester evaluation

ELECTIVE (from Humanities and Social Sciences)

1. HSS 301: Economics
2. HSS 302: Introduction to Psychology
3. HSS 303: Sociology
4. HSS 304: French Language
5. HSS 305: Russian Language
6. HSS 306: Entrepreneurship and Project Management

Year: Second **Semester: Fourth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	MATHS-401	Linear Algebra & Complex Analysis	4-1-0	5	4	50	50	100	---
2	EC401	Communication Engineering	4-0-2	6	4+1	50	50	100	50
3	EC402	Microcontroller & Interfacing	4-0-2	6	4+1	50	50	100	50
4	EC405	Computer Networks	4-0-0	4	4	50	50	100	---
5	EC406	Analog Electronic Circuits	4-0-3	7	4+1	50	50	100	50
6	EC407	Probability and Random Processes	3-1-0	4	3	50	50	100	---
7	----	Educational Tour	----	**----**	Non-credit	----	----		---
Total			**23-2-7**	**32**	**26**	**300**	**300**	**600**	**150**

*Practical marks are for continuous and end semester evaluation

Year: Third **Semester: Fifth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	EC501	VLSI Design	3-1-2	6	3+1	50	50	100	50
2	EC502	Digital Signal Processing	3-1-2	6	3+1	50	50	100	50
3	EC503	Antennas & Wave Propagation	3-0-0	3	3	50	50	100	---
4	EC506	Advanced Microcontrollers & Applications	4-0-2	6	4+1	50	50	100	50
5	EC505	Digital System Design	3-1-2	6	3+1	50	50	100	50
6		Departmental Elective Course-I	3-0-0	3	3	50	50	100	---
7	EC514	Summer Training	---	---	1	---	---	---	50
Total			**19-3-8**	**30**	**24**	**300**	**300**	**600**	**250**

*Practical marks are for continuous and end semester evaluation

Departmental Elective Course-I (For Fifth Sem)		
Sr No.	**Subject**	**Subject Code**
1	Data Structures and Algorithms	EC507
2	Audio and Visual Systems	EC508
3	Bio-medical Electronics	EC509

Year: Third **Semester: Sixth**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	EC601	Microwave & Radar Engineering	3-0-2	6	3+1	50	50	100	50
2	EC602	Fiber Optic Communication Systems	4-0-2	6	4+1	50	50	100	50
3	EC603	Digital Communication	3-1-2	6	3+1	50	50	100	50
4	EC624	Control Systems	3-1-0	4	3	50	50	100	---
5	EC625	Power Electronics	3-0-2	5	3+1	50	50	100	50
6		Departmental Elective Course-II	3-0-0	3	3	50	50	100	---
	EC627	Project-I	0-0-3	3	2	---	---	---	50
Total			**19-2-11**	**32**	**25**	**250**	**250**	**500**	**250**

*Practical marks are for continuous and end semester evaluation

Departmental Elective Course-II (For Sixth Sem)		
Sr No.	**Subject**	**Subject Code**
1	Information Theory & Coding	EC620
2	Satellite Communications	EC605
3	Data Acquisition and Hardware Interfacing	EC622
4	Speech and Audio Processing	EC626

Year: Fourth **Semester: Seventh**

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1	EC710	Wireless & Mobile Communication	3-1-3	7	4+1	50	50	100	50
2	EC701	Embedded System Design	4-0-2	6	3+1	50	50	100	50
3		Departmental Elective Course-III	4-0-0	4	3	50	50	100	---
4		Departmental Elective Course-IV	4-0-0	4	3	50	50	100	---
5	EC721	Seminar-I	0-0-3	3	2	---	---	---	50
6	EC722	Project-II	0-0-3	3	2	---	---	---	50
7		Summer Training	---	---	1	---	---	---	50
Total			**15-1-11**	**23**	**20**	**200**	**200**	**400**	**250**

*Practical marks are for continuous and end semester evaluation

Departmental Elective Course-III (For Seventh Sem)		
Sr No.	**Subject**	**Subject Code**
1	Operation Research	EC702
2	Operating Systems	EC711
3	Nano Technology	EC703
4	Adaptive Signal Processing	EC723

Departmental Elective Course-IV (For Seventh Sem)		
Sr No.	**Subject**	**Subject Code**
1	Computer Architecture and Organization	EC704
2	Artificial Intelligence	EC705
3	High Speed Semiconductor Devices & Circuits	EC706

Year: Fourth **Semester: Eighth**

OPTION -1

S.No	Course Code	Course Name	Scheme of Teaching			Scheme of Examination			
			L-T-P	Contact hrs/week	Credits	Theory			Practical*
						Internal Assessment	University Assessment	Total	
1		Departmental Elective Course-V	4-0-2	6	4+1	50	50	100	50
2		Departmental Elective Course-VI	4-0-2	6	4+1	50	50	100	50
3		Departmental Elective Course-VII	4-0-0	4	4	50	50	100	---
4		Departmental elective Course-VIII	4-0-0	4	4	50	50	100	---
5	EC816	Seminar-II	0-0-3	3	2	---	---	---	50
Total			**16-0-7**	**23**	**20**	**200**	**200**	**400**	**150**

Departmental Elective Course-V and VI Any two subjects (With Lab) (For Eighth Sem)		
Sr No.	**Subject**	**Subject Code**
1	Digital Image Processing	EC808
2	Advanced Digital Communication	EC809
3	Neural Networks & Fuzzy Logic	EC810
4	HDL based Systems	EC802
5	Wireless Sensor Networks	EC815

Departmental Elective Course- VII and VIII Any two subjects (Without lab) (For Eighth Sem)		
Sr No.	**Subject**	**Subject Code**
1	Optical Networks	EC803
2	MEMS and Microsystems	EC814
3	Imaging and Additive Manufacturing	EC804
4	Advanced Digital Signal Processing	EC801

OPTION – 2

Paper code	Paper title	Duration	Marks Uni. Exam	Int. Marks	Grand Total
EC820	Industrial Training	6 Months	300	250	550
	Total Credits : 20				

In 8th semester, student can exercise **Option 1 or Option 2** according to the following conditions:

A student may opt for one semester training in lieu of subject of 8th semester. The marks for six months training will be equal to the total marks of 8th semester study. A student can opt for six months semester training under following conditions:

a. The student having any pending reappears in any subject (theory as well as practical) will not be allowed to go for training.
b. The students scoring less than 6.5 CGPA upto 6th semester will not be allowed to go for training. However, if a student has been placed through campus placement, he/she may be allowed to go for training at that respective company irrespective of his/her CGPA.
c. The students will only be allowed to pursue training in reputed organizations like MNC, Govt. Organizations, R&D institutions, and PSUs.
d. For pursuing this training, student needs the prior approval from the Coordinator/Chairperson of the respective branch/department.

THIRD SEMESTER

Course Code	**EC 301**
Course Title	**Electromagnetic Theory (Theory)**
Type of Course	Core
L T P	31 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Calculus, Oscillations and Optics
Course Objectives (CO)	1. To understand the relationship between the electricity, magnetism, electric fields, magnetic fields and electromagnetic waves. 2. To study Maxwell equations 3. To deal with the application of electromagnetic waves i.e. reflection and refraction of plane electromagnetic waves 4. To discuss the need of field theory approach of electromagnetic in understanding the waveguides.
Course Outcome	1. Have an understanding of Maxwell's equations and be able to manipulate and apply them to EM problems. 2. Formulate and analyze problems involving lossy media with planar boundaries using uniform plane waves. 3. Able to understand various mode of propagation inside the waveguide.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Electrostatics & Steady Magnetic Field 7

Introduction, Gauss's law, Divergence theorems, Stoke's Theorem, Poisson's equation and Laplace's equation, Electrostatics energy, The Electrostatics uniqueness theorem,

Theories of magnetic field, Faraday's law, Ampere's law, Magnetic vector potential, Analogies between Electric and magnetic fields.

Maxwell's equation 4

Derivation of Maxwell's equations in their integral and differential forms, Maxwell's equations in free space and in harmonically varying fields, Physical Interpretation and Boundary Conditions.

Plane waves in Dielectric and Conducting Media 11

Uniform plane wave: properties, relation between E and H; Conductors and Dielectrics: Wave equations, wave propagation, Intrinsic impedance, skin effect,Poynting Theorem and Electromagnetic vector, application to energy radiation, Velocities of propagation, Electromagnetic wave polarization, Reflection and transmission of the wave at a boundary (Perfect conductor, perfect dielectric, perfect insulator), Poynting Theorem: Application to energy radiation

SECTION-B

Transmission lines 7

Basic principle, Equivalent circuit, Primary constants, Transmission line parameters, Transmission line equations, input impedance, relation between infinite and finite line, standing wave ratio and power.

Guided Waves 6

Waves between parallel planes, TEM waves, Field analysis of T.M. & T.E. wave, Characteristics of T.M. & T.E. Waves.

Wave Guides 10

Rectangular and Circular waveguides: T.M. & T.E. Modes, Impossibility of TEM wave in waveguides, Solution of the Field equations (Rectangular and Circular), Wave impedance and characteristic impedances, Attenuation factor and Q of waveguides, Cavity Resonator.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Electromagnetic Waves & Radiation System	E.C. Jordan & K. G. Balmain,	Prentice Hall India,
RECOMMENDED BOOKS			
1	Electromagnetics	Krauss	McGraw Hill, 5ed.
2	Antennas and Wave Propagation	G S N Raju	Pearson publications
3	Antennas and Radio Wave Propagation	K D Prasad	Satya Prakashan
4	Antenna and Radio Wave Propagation	Collin R.E.	Mc-Graw Hill

Course Code	**EC 302**
Course Title	**Signals & Systems (Theory)**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Differential Equations and Transforms (MATHS 201)
Course Objectives (CO)	1. To understand different types of Signals, Systems and their examples in real life situations. 2. To study solution of differential and difference equations. 3. To study Fourier Series and Fourier Transform of Continuous and Discrete time systems and using these tools to solve systems represented by differential and difference equations. 4. To study Laplace Transform, Z-transform, their properties and their use in finding the output of LTI systems.
Course Outcome	1. Analyze different types of continuous and discrete time systems using different types of system properties. 2. Represent and Analyze real world problems into differential equations and solve them using Continuous time Fourier series, Fourier Transform. 3. Represent and Analyze real world problems into difference equations and solve them using Discrete time Fourier series, Fourier Transform. 4. Use Laplace Transform, Z-Transform, and Hilbert Transform to analyze and solve LTI systems.

SYLLABUS

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SECTION-A

Signals & Systems 6

Classification of Signals, Dirac Delta function and properties, Transformations of independent variable, Elementary Signals, Continuous time and Discrete time systems, System Properties, Examples of Signals and Systems in Electrical, Mechanical, Hydraulic, Thermal, and Biomedical Systems.

Linear Time Invariant Systems 5

Convolution sum and integral, Properties of LTI systems, Systems described by differential equations and difference equations, Singularity functions.

Fourier series Representation 6

Response of LTI systems to complex exponentials, Fourier series representation of continuous time periodic signals, Convergence of fourier series, Properties of continuous time Fourier series, Fourier series representation of discrete time periodic signals, , Properties of discrete time Fourier series, Filtering, examples of filters described by differential and difference equations.

The Continuous Time Fourier Transform 5

Fourier Transform of continuous time Aperiodic signals, The Fourier transform for periodic signals, Properties of Continuous Time Fourier Transform.

SECTION-B

The Discrete time Fourier Transform 6

Fourier transform of discrete time aperiodic signals, The Fourier transform of periodic signals, Properties of Discrete time Fourier Transform, Duality, The magnitude-phase representation of the Fourier Transform, The magnitude-phase representation of the Frequency response of LTI systems.

The Laplace Transform 6

Laplace Transform, ROC of Laplace Transform, The Inverse Laplace Transform, Pole-zero plot, Properties of Laplace transform, Characterization of LTI systems using Laplace Transform, Interconnection of LTI systems, The Unilateral Laplace Transform.

The Z-Transform 5

The Z-Transform, ROC of Z-transform, The Inverse Z-Transform, Pole-Zero plot, Properties of Z-Transform, Characterization of LTI systems using Z-Transform, Interconnection of LTI systems, The Unilateral Z Transform.

State-space Analysis 6

State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**

1	Principles of Linear Systems and Signals	B. P. Lathi	Oxford University Press
RECOMMENDED BOOKS			
1	Signals and Systems	Haykin, S., Van Veen, B.	Wiley; 2003
2	Signals and Systems	Oppenheim, A. V., Willsky , A. S., Nawab ,S.H	Pearson Education
3	Signals and Systems - Continuous and Discrete	R.F. Ziemer, W.H. Tranter and D.R. Fannin,	Prentice Hall, 4th edition, 1998
4	Signals and Systems	T. K. Rawat	Oxford University press
5	Signals and Systems	A. Rajeshwari, V. Krishnaveni	Wiley India

Course Code	EC 303
Course Title	**Microprocessor & Applications (Theory)**
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Design
Course Objectives (CO)	1. To introduce with the basics of microprocessor and its need. 2. To develop the capability to write the assembly language programs. 3. To introduce with the peripheral devices (such as memory and I/O interfaces) and their interfacing with 8085 microprocessors. 4. To learn how the hardware and software components of a microprocessor work together to develop microprocessor based systems 5. To impart practical knowledge on 8085 microprocessor.
Course Outcome	1. Understand the need and the basics of microprocessor 8085. 2. Able to demonstrate their programming proficiency by designing and conducting experiments related to microprocessor based system design and analyze their outcomes. 3. Understand both hardware and software aspects of integrating digital devices (such as memory and I/O interfaces) into microprocessor-based systems and provide solutions to real-world control problems. 4. Recall and relate the historical development of microprocessor technology. Explain the architecture, pin details, addressing modes, instruction set and assembly language programming details of 8086.

SYLLABUS

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SECTION-A

Microprocessor Architecture and Microcomputer Systems 4

Microprocessor Architecture Memory, Input and Output Devices, The 8085 MPU

Interfacing I/O Devices 6

Basic Interfacing Concepts, Interfacing Output Displays, Interfacing Input Devices, Memory- Mapped I/O, I/O Interfacing Circuits.

Programming the 8085 8

Introduction to 8085 Assembly Language Programming, 8085 Programming Model, Instruction Classification, Instruction Format, Data Transfer (Copy) Operations, Arithmetic Operations, Logic Operations, Branch Operations, Writing Assembly Language Programs.

Programming Techniques with Additional Instructions 4

Programming Techniques Looping, Counting and Indexing, Additional Data Transfer and 16-Bit Arithmetic Instructions, Arithmetic Operations Related to Memory, Logic Operations.

SECTION-B

Counters and Time Delays 3

Counters and Time Delays, Hexadecimal Counter, Modulo Ten Counter, Generating Pulse Waveforms.

Stack and Subroutines 3

Stack, Subroutine, Conditional Call and Return Instructions.

Interrupts 3

The 8085 Interrupt, 8085 Vectored interrupts, Multiple Interrupts, interrupts priority.

Architecture of chips 7

The 8255A Programmable Peripheral Interface, 8254 Programmable Interval Timer, 8259 Programmable Interrupt Controller, Direct Memory Access (DMA) and the 8257 DMA Controller, Serial communication

8086 Architecture 7

CPU Architecture, Internal operation, addressing modes, Instruction execution timing, Minimum mode, Maximum mode system bus timing and bus standard.

Virtual Memory, Memory Management Unit(MMU), Numeric Data Processor 8087 and its interfacing to 8086,Architecture of Intel 386 Microprocessor, Intel 486 Microprocessor

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh S. Gaonkar	Penram International, Edition 3rd
2	Microcomputer Systems	Yu Cheng Liu & G. A.	PHI

	8086/8088¸ Family	Gibson	
RECOMMENDED BOOKS			
1	Advanced Microprocessors & Interfacing	Badri Ram	Tata Mc-Graw Hill
2	Microprocessor Principles and Applications	Charles M. Gilmore	TMH , 2nd Edition
3	Microprocessors and Interfacing programming and Hardware	Douglas V. Hall	

Course Title	Microprocessor & Applications (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. Study the 8085 Microprocessor Hardware Kit.
2. Write a program to add 2 numbers.
3. Write a program to dissemble a byte to a nibble.
4. Write a program to reassemble a byte from 2 nibbles.
5. Write a program to add two numbers without carry.
6. Write a program to find the greatest number and smallest number from the given data.
7. Write a program to arrange the given numbers in descending order.
8. Write a program to move a block of data from one section of memory to another section of memory.
9. Write a program to Subtract, Multiply and divide two 8 bit numbers.
10. Write a program to convert a given hexadecimal number to decimal and vice-versa.
11. Write a program to perform the 2 x 2 matrix multiplication.
12. Interface an LED array and 7-segment display through 8255 and display a specified bit pattern/character sequence at an interval of 2 seconds.
13. Program for interfacing between two 8085 kits by using 8255.
14. Interface an ADC chip with microprocessor kit and verify its operation.
15. Interface an external 8253 to the microprocessor kit at the address given. Hence,
    a. generate a pulse train of specified duty cycle at the given output line,
    b. operate as a N counter,
    c. Count a train of pulses for a given duration.
16. Interface the given microprocessor kit to a personal computer through R.S-232C. The band rate is specified. Verify data transfer in both directions (P - PC and PC - P)

Course Code	**EE309**
Course Title	**Electrical Science(Theory)**
Type of Course	Core
L T P	3 1 3
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Basic Electronics, Basic Electrical Engineering
Course Objectives (CO)	1. To acquire knowledge about Circuit components and Network graph. 2. To identify the Network Theorems and Two Port Network Descriptions. 3. To identify response of Network Functions. 4. To identify the characteristics of Attenuators, Filters, and network synthesis. 5. To acquire knowledge about Electrical motors. 6. To impart practical knowledge of Filter Design.
Course Outcome	1. Identify the circuit components and their applications in various circuits. 2. Evaluate RL, RC and RLC circuits by hand. 3. Evaluate and analyze the Norton and Thevenin equivalent circuits. 4. Measure the frequency response of circuits, analyze the two port networks and develop both active and passive filters. 5. Understanding of working of Electrical motors.

SYLLABUS

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SECTION-A

Circuit Concepts 3

Circuit elements, Independent and dependent sources, signals and waveforms, periodic and singularity voltages, Amperes law, Electromagnetic Induction and force, Self and mutual Inductance

Mesh & Nodal Analysis 5

Loop currents and loop equations, node voltages and node equations, mesh and nodal analysis, duality, graphical method of determining the dual of N/Ws, Star Connections,

Delta connections.

Network Theorems: 5

Superposition, Thevenin's, Norton's, Maximum power Transfer, Tellegen's, Reciprocity theorem.

Networks functions 10

Concept of complex frequency, Transform Impedance and transform circuits, Network functions for the one port and two port, Calculation of network functions, Poles and Zeros for Network functions, Restrictions on Poles and Zeros, Locations for Driving Point and Transfer functions, Time domain behavior from Pole and Zero plot, Stability of networks functions.

SECTION-B

Two Port Network 6

Relationship of Two port variables, Short Circuit Admittance and Open circuit Impedance parameters, Transmission and hybrid parameters, Network Topology and Graph Theory.

Filter Synthesis 7

Classification of filters, characteristic impedance and propagation constant of pure reactive network, Ladder network, T–section, Pi–section, terminating half section, Pass bands and stop bands, Design of constant–K, m–derived filters, Composite filters.

Introduction to Electrical Motors 9

Introduction to DC motors: Construction, types, torque and EMF equations, Commutations, Armature reactions, Characteristics and Applications. Principle of single and three-phase induction motors, Rotating field concept, concept of slip, torque-slip characteristics, Starting and speed control methods.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Engineering Circuit Analysis	Milliam H.Hayt., JackE .Kemmerly	
RECOMMENDED BOOKS			
1	Networks and Systems	Ashfaq Hussain	
2	Network Analysis and Synthesis	D.R.Chaudhry	
3	Circuits and Networks (Analysis and Synthesis)	A. Sudhakar& S.P. Shyammohan	Tata McGraw Hill 1994, Edition 2ND
4	Networks, Lines and Fields	John D. Ryder	PHI, Edition 2ND
5	A Course in Electrical Circuits Analysis	Soni-Gupta, Dhanpat Rai& Sons	
6	Theory and Problems of Electric Circuits	Joseph A. Edminister	Tata McGraw Hill, 1991, Edition 2ND.

7	Network Analysis	M.E. Van Valkenburg	PHI
8	Network Analysis	G K Mithal	
9	Basic Electrical and Electronics Engineering	Kothari and Nagrath	Mc-Graw Hill

Course Title	**Electrical Science(Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

Implementation and proof of

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem

Study of transfer characteristics of

Low Pass Filters, High Pass Filters, Band Pass Filters, Band Stop Filters

Design and Implementation of

Constant-k, m-derived, and Composite filters

Course Code	EC306
Course Title	**Electronics Measurements & Instrumentation** (Theory)
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Physics, Basic Electrical Engineering, Analog Electronic Circuits-I, Analog Electronic Circuits - II
Course Objectives (CO)	1. To review the basics of electronic measurement and instrumentation. 2. Explain the design and operation of different types of Electromechanical and Electronic Indicating Instrument. 3. To learn the working principles of Sensors and Transducers. 4. To learn the principles of Virtual Instrumentation and impart practical knowledge of Instrumentation in LabVIEW.
Course Outcome	1. Recall the concept of electronic measurement and instrumentation and demonstrate the working principle of Electronic Instruments. 2. Explain the working principle of different type of Electromechanical and Electronic Instruments. 3. Illustrate the working principle and applications of various Transducers. 4. Do programming in LabVIEW.

SYLLABUS

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SECTION-A

Measurement Systems and Characteristics Of Instruments: 07

Introduction- Measurements, Significance of measurements, Methods of measurements, Instruments and measurement system, Electronic instruments, Classification of instruments, Deflection and Null type instruments, Static Characteristics, Errors in measurements, Types of errors, Accuracy and Precision, Noise, Resolution or discrimination, loading effects, Standards and their classification.

Electromechanical Indicating Instruments: 11

Electromechanical Indicating Instruments: D'Arsonaval Galvanometer, Ballistic Galvanometer, PMMC Instruments, Moving iron instruments: Construction, Torque equation and applications. Dynamic behavior of Galvanometer, Galvanometer shunts, Ammeter shunts, Multirange DC Voltmeter, Ohmmeter: Series and shunt. Bridge Circuits for RLC Measurements: Measurement of R (Medium, High and Low), L, C and frequency, Wheatstone, Kelvin, Maxwell, Anderson, Schering and Wien bridge.

Electronic Instruments: 06

Introduction- Block diagram of CRO, Cathode ray tube, Electrostatic Deflection, Time base generator, Measurement of voltage, phase and frequency using CRO; Digital multimeter, Logic Analyzer, Function generator, Spectrum Analyzer.

SECTION-B

Transducers: 10

Introduction to Sensor Electronics and terminology, Active and Passive Transducers, Strain, Temperature, Pressure, Flow measurement. Instrumentation amplifier, Smart Transducers, optical transducers, light modulating techniques, fiber optic sensors, ECG, EEG, cardiovascular measurements, pacemakers, instrumentation for diagnostic x-rays. Qualitative treatment of Potentiometer, Strain Gauge, LVDT, Thermocouple, IR sensor, Piezo-electric crystal, Accelerometer, and Photoelectric transducers.

Virtual Instrumentation: 11

Virtual Instrumentation in engineering process, Comparison between conventional programming and graphical programming. Introduction to Lab VIEW Front Panel, Block Diagram, Tools And Palettes, Menus, Code Debugging, Creating Sub-Vis, For Loop, While Loop, data types and conversions, operations on numbers, Feedback, Auto indexing, Local Variable, Global Variables, Shift Registers, sub-VI creation, sequence structure, case structure, Formula Node, Arrays and cluster, Inter-conversion of arrays and clusters, charts and graphs and property nodes, strings and string manipulation, output to files and input from files, Introduction to Data acquisition and applications.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Electronic Instrumentation & Measurement Techniques	W.D. Cooper and A.D. Hilfrick	PHI
2	Learning with LabVIEW 7 Express	R.H.Bishop	Pearson Education, Delhi.
3	Electrical and Electronic Measurements and Instrumentation	Sawhney A K	DhanpatRai and Sons
4	Electronic Instrumentation	Kalsi H S	Tata McGraw Hill
5	Transducers and Instrumentation	Murthy D V S	Prentice Hall of India
6	Virtual Instrumentation Using LabVIEW Kindle Edition	Jovitha Jerome	EEE

Course Title	Electronics Measurements & Instrumentation (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. **Create a VI and build a SubVI that converts and**:
   1. Celsius into Fahrenheit (F)
   2. Degree into Radians
   3. Use Case Structure to create a Temperature converter (oC to F and oC to Kelvin)
   4. 4bit BCD to Gray Code
   5. Half Adder (HA)
   6. Use subVI of HA to create a Full Adder
2. **Loops:** Create a VI to find
   7. Factorial of a number using FOR loop and Shift Register
   8. Sum of n natural numbers using WHILE loop and Feedback node
   9. Decimal to binary conversion using FOR loop
   10. Whether a given number is prime or not.
3. **Array**
   11. Create a 1D array. Multiply its elements with a scaling factor and find the resultant array.
   12. Create a 2D array (5X5) and find its transpose
4. **Clusters**
   13. Create a VI to compare cluster elements and switch ON an LED, if nth element is same.
5. **Plotting Data:** Build a VI to
   14. Plot a Circle using FOR Loop and XY graph
   15. Examine the different charts like Strip, Scope, Sweep.
   16. Draw and analyze effect of variation of frequency, phase and amplitude using Lissajous patterns
6. **Formula Node**
   17. Create a VI to find roots of Quadratic equation. Given constants a, b, c. Display roots and type of roots
7. **Strings and File I/O**
   18. Build a VI to replace a particular word in a string with a new word.
   19. Create a VI to read a file and Display the file path and its contents in a numeric and string indicator.
8. **A hardware project to be prepared.**

Course Code	**HSS301**
Course Title	**Economics (Theory)**
Type of Course	Elective
L T P	300
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To make students understand how society manages its scarce resources for achieving maximum satisfaction. 2. To make students learn about economic aspects related to a consumer, firm, market and economy.
Course Outcome	1. The students are expected to apply engineering knowledge to maximize profit, satisfaction and welfare. 2. The students are able to identify the forces that affect the economy.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction to Economics 5

Nature of Economics, Economic Thoughts, Economic Activities, Relationship of Economics with other Social Sciences and Engineering

Theory of Consumer Behaviour 11

Demand: Types, Law of Demand, Determinants of Demand and Change in Demand

Elasticity of Demand: Nature, Degrees, Types, Measurement and Factors Affecting Elasticity of Demand and its Application

Laws of Consumption: Concept and Applicability of Law of Diminishing Marginal Utility and Law of Equi-Marginal Utility

Theory of Production and Cost 7

Cost: Types of Costs, Production: Law of Variable Proportion, Returns to Factor and Returns to Scale, Economies and Diseconomies of Scale

SECTION-B

Theory of Market 8

Nature and Relevance of Perfect Competition, Monopoly and Monopolistic Competition

Basic Concepts of Macro Economics 9

National Income: Concept and Measurement, Determination of Equilibrium of Income

Inflation: Concept, Causes and Effect of Inflation, Measures to Control Inflation

Project Presentations 5

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Modern Economics	Ahuja H. L	S. Chand & Co. Ltd
2	Economics For Engineers	Gupta M. L. & Gupta S. P.	ESS PEE Publications
3	Business Economics	Ahuja H. L.	S. Chand & Co. Ltd
4	Macro Economic Theory	Jhingan M.L.	Konark Publisher Pvt. Ltd.
5	Principles of Microeconomics	Stiglitz J. & Walsh Carl E.,	W. W. Norton & Company
6	Principles of Economics	Mankiw N Gregory	Cengage Learning
7	Course in Micro Economics Theory	Kreps A.	Prentice Hall
8	Economics	Samuelson Paul A. &Nordhaus William D.	Tata McGraw Hill
9	Microeconomics	Gravelle H. & Reiss R.	Pearson Education
10	Macro Economics: Theory and Practice	Ahuja H. L	S. Chand & Co. Ltd

Course Code	**HSS 302**
Course Title	**Introduction to Psychology (Theory)**
Type of Course	Elective
L T P	300
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To provide knowledge and understanding about important concepts in Psychology. 2. To make students learn the application of principles of psychology in working life.
Course Outcome	1. The students will learn the causes and dynamics of human behavior. 2. The students will be able to apply psychological principles to enhance their personal and professional life.

SYLLABUS

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SECTION-A

Understanding Human Behaviour: Definition, methods, branches and application of psychology for engineers (5)

Measuring Human abilities: Intelligence, theories and assessment (6)

The individual working life: Personality, approaches and trait theories (6)

Psychological problems of everyday life: Stress and coping (6)

SECTION-B

Work and mental health, workplace spirituality (4)

Motivation : the concept and theoretical framework, motivating people at work (5)

Group dynamics, Intergroup relations, conflict and negotiation (6)

Leadership and Management (4)

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Psychology	Ciccarelli, S.K., & Meyer, G.E.	Pearson, 2007
2	OrganisationalBehaviour	Parikh, M., & Gupta, R.	Tata McGraw Hill , 2010.
3	Introduction to Psychology	Morgan C. T., King, R.A., Weiss J. R., & Schopler J.	McGraw-Hill, 1986
4	Organizational Behavior	Robbins, S.P.	Prentice Hall of India, 2003.
5	Organizational Behavior	Luthans,F.	McGraw Hill,2010

Course Code	**HSS 303**
Course Title	**Sociology**
Type of Course	Elective
L T P	300
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To make the students understand the role of theory in social sciences. 2. To explain students how social problems interact and react with the larger society. 3. To make students learn whether the problem is evaluated on the macro or micro perspective and their cause and effect patterns.
Course Outcome	1. The students will be able to identify the function and application of sociology theory in social sciences. 2. The students will be able to understand how social class affects individual life chances. 3. The students will learn about social structure and how it shapes and influences social interactions.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Sociology – The Discipline (4)

Sociology as a Science, Impact of Industrial and French Revolution on the Emergence of Sociology, Relevance of Sociology for Engineering

Basic Concepts (5)

Society, Association, Institution, Culture Relativism, Social Structure, Social System, Socialisation, Competition, Conflict, Accommodation, Social Mobility

Pioneering Contributions to Sociology (4)

Seminal Views of Karl Marx, Emile Durkheim, Max Weber, AlwinToeffler

Evolution of Society (5)

Primitive, Agrarian, Industrial and Post-Industrial, Features of Industrial and Post-Industrial Society, Impact of Automation and Industrialization on Society

Economy and Society (4)

Economic Systems of Simple and Complex Societies, Sociological Dimensions of Economic Life, Market (free) Economy and Controlled (planned) Economy

SECTION-B

Industrial Sociology (4)

Nature and Scope of Industrial Sociology, Pre-Conditions and Consequences of Industrialization

Science and Technology (4)

Ethos of Science and Social Responsibility of Science

Social Change (5)

Theories of Change, Factors of Change, Directed Social Change, Social Policy and Social Development, Social Cost Benefit Analysis, Role of Engineers in Development

Understanding Indian Society (7)

Traditional Hindu Social Organization, Caste System, Agrarian Society in India, Social Consequences of Land Reforms and Green Revolution, Working of the Democratic Political System in a Traditional Society, Problem of Education in India, Gender Discrimination, Economic Reforms: Liberalization, Privatization and Globalization, Strategies for Development in India

Social Problems (3)

AIDS, Alcoholism, Drug Addiction, Corruption

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Sociology	VardhanRanjay and Kapila S.	New Academic Publishing.
2	Sociology: Themes and Perspective	Haralambos M.	Collins Educational Publications
3	Sociology of Indian Society	Rao Shankar C.N.	Sultan Chand and Co.
4	Introduction to Sociology	BhushanVidya and Sachdeva D.R.,	KitabMahal Publications
5	Sociological Thought	Abraham Francis and Morgan J.H.	Macmillan India Ltd.

6	An Introduction to Sociology	Dassgupta Samir and SahaPaulomi	Dorling Kindersley (India) Pvt. Ltd.
7	Social Change and Modern India	Srinivas M.N.,	Orient Longman
8	Social Problems	AmitaiEtzioni	Prentice Hall
9	Industrial Sociology	Scheneider	Tata McGraw Hill
10	Society in India	Mandilbaum David	Popular Publications.
11	Sociology	Broom L., Selznick P. and Dorrock D.	Harper International Publishing House

Course Code	**HSS 305**
Course Title	**Russian Language**
Type of Course	Elective
L T P	300
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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Section-A

The Russian Alphabet, consonants, vowel, words, stress, sentence patterns. (4)

Grammar: Noun, gender, personal pronoun, the conjunction conjugation of verbs, number (singular-plural), possessive pronoun, adverbs, translation (Russian to English & vice-versa) (5)

Section-B

Irregular plurals, Imperative mood, demonstrative pronoun, declaration of noun (nominative case, prepositioned case, the past tense, reflexive verbs, adjectives. Translation (Russian in to English & Vice-versa.) (4)

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	"Russian"	Wagner (Part-A-Lesson 1 to n10 and Part-B Lesson 11 to 15)	

Course Code	**HSS 306**
Course Title	**Entrepreneurship and Project Management**
Type of Course	Core
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	The main aim of this course is to make prospective engineers familiar with the concept of entrepreneurship and MSMEs and to provide knowledge about different aspects to be considered while formulating the business plan for a new entrepreneurial venture. This course also intends to create awareness among students about financial and marketing functions that is required for a new venture.
Course Outcome	1. The students will be able to apply engineering knowledge effectively in the field of entrepreneurship development. 2. The students can make effective use of entrepreneurial knowledge to start and manage their venture. 3. The students will learn to check the feasibility of a new project to maintain its long run sustainability.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction to Entrepreneurship

Concept of Entrepreneurship, Characteristics and Functions of Entrepreneur
Forms of Ownership of Business, Factors Affecting Entrepreneurship
Case Studies of Entrepreneurs (8 hours)

Women Entrepreneurship

Nature of Women Entrepreneurship, Problems of Women Entrepreneurs, Institutional Initiatives for Promotion of Women Entrepreneurs (4 hours)

Micro, Small and Medium Enterprises (MSMEs)

Concept of MSMEs, Schemes of MSMEs

Functions of Entrepreneurial Development Programmes (EDPs) (3 hours)

Project Identification

Idea Generation, Project Life Cycle, Concept of SWOT Analysis

SWOT Analysis of Selected Project (3 hours)

SECTION-B

Project Planning and Formulation

Elements of Project Formulation: Product, Technical (Location, Scale, Technology, Production Process, Layout, Manpower, Resources), Market, Finance and Economic Aspects

Feasibility Analysis: Financial Viability and Profitability, and Socio-Economic Desirability (12 hours)

Project Report

Formulation of Business Plan and Project Report, Hypothetical Example of a Real-Life Project (4 hours)

Finance and Marketing Function

Concept of Finance, Finance Related Terminologies, Sources of Finance, Cost Estimations

Marketing Mix: Product, Place, Price, Promotion, People, Process and Physical Evidence

Marketing Segmentation Targeting and Positioning (8 hours)

Discussions on Additional Reading (any one of the following in the semester)

- The New Age Entrepreneurs
- The $100 Startup: Fire your Boss, Do what you Love and Work Better to Live More
- A Guide to Entrepreneurship
- Dhandha: How Gujaratis Do Business
- Rokda: How Baniyas Do Business
- Take Me Home
- Business Families of Ludhiana (3 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	"Dynamics of Entrepreneurial Development & Management"	Desai V	5th Edition, Himalaya Publishing House
2	"Projects: Planning, Analysis, Selection, Financing, Implementation and Review"	Chandra P.	8th Edition, McGraw-Hill Education (India), 2014
RECOMMENDED BOOKS			
1	"Entrepreneur's Toolkit"	Harvard Business School.	Harvard University Press, 2004
2	"Entrepreneurship"	Hisrich R.D., Peters M.P. and Shepherd D.A.	McGraw Hill Education, 2006.
3	"Essentials of Project Management"	Ramakrishna K	PHI Learning
4	"Entrepreneurship"	Roy R.	Oxford University Press, 2e, 2011

5	"Entrepreneurship Development in India"	Gupta C.B. and Srinivasan N.P.	Sultan Chand and Sons, 2013

FOURTH SEMESTER

Course Code	MATHS-401
	(Same as MATHS-301)
Course Title	**Linear Algebra and Complex Analysis** (Theory)
Type of Course	Core
L T P	4 10
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Calculus (MATHS-101)
Course Objectives (CO)	
Course Outcome	

SYLLABUS

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SECTION-A

Systems of Linear equations: 5

Introduction, Linear equations, solutions, Linear equations in two unknowns, Systems of linear equations, equivalent systems, Elementary operations, Systems in Triangular and echelon form, Reduction Algorithm, Matrices, Row equivalence and elementary row operations, Systems of Linear equations and matrices, Homogeneous systems of Linear equations. (Scope as in Chapter 1, Sections 1.1-1.10 of Reference 1).

Vector Spaces: 5

Introduction, Vector spaces, examples of vector spaces, subspaces, Linear combinations, Linear spans, Linear dependence and Independence, Basis and Dimension, Linear equations and vector spaces. (Scope as in Chapter 5, Sections 5.1-5.8 of Reference 1).

Eigenvalues and Eigenvectors, Diagonalization: 4

Introduction, Polynomials in matrices, Characteristic polynomial, Cayley-Hamilton theorem, Eigen-values and Eigen-vectors, computing Eigen-values and Eigen-vectors, Diagonalizing matrices. (Scope as in Chapter 8, Sections 8.1-8.5 of Reference 1).

Linear Transformations: 6

Introduction, Mappings, Linear mappings, Kernal and image of a linear mapping, Rank-Nullity theorem (without proof), singular and non-singular linear mappings,

isomorphisms. (Scope as in Chapter 9, Sections 9.1-9.5 of Reference 1).

Matrices and Linear transformations: 4

Introduction, Matrix representation of a linear operator, Change of basis and Linear operators. (Scope as in Chapter 10, Sections 10.1-10.3 of Reference 1).

SECTION-B

Complex Functions: Definition of a Complex Function, Concept of continuity and differentiability of a complex function, Cauchy – Riemann equations, necessary and sufficient conditions for differentiability (Statement only). Study of complex functions: Exponential function, Trigonometric functions, Hyperbolic functions, real and imaginary part of trigonometric and hyperbolic functions, Logarithmic functions of a complex variable, complex exponents (Scope as in Chapter 12, Sections 12.3 – 12.4, 12.6 – 12.8 of Reference 4). 8

Laurent Series of function of complex variable, Singularities and Zeros, Residues at simple poles and Residue at a pole of any order, Residue Theorem (Statement only) and its simple applications (Scope as in Chapter 15, Sections 15.1 – 15.3 of Reference 4). 6

Conformal Mappings, Linear Fractional Transformations (Scope as in Chapter 12, Sections 12.5, 12.9 of Reference 4). 7

RECOMMENDED BOOKS

S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Shaum's Outline of Theory and Problems of Linear Algebra	Seymour Lipschutz	Second Edition, McGraw-Hill, 1991.
2	Complex Variables and Applications	R. V. Churchill, J. W. Brown	Sixth Edition, McGraw-Hill, Singapore, 1996
3	Linear Algebra	Vivek Sahai, Vikas Bist.	Narosa Publishing House, New Delhi, 2002
4	Advanced Engineering Mathematics	E. Kreyszig	Eighth Edition, John Wiley.
5	Advanced Engineering Mathematics	Michael D. Greenberg	Second Edition, Pearson Education

Course Code	**EC401**
Course Title	**Communication Engineering (Theory)**
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	1. To study the fundamentals, mathematical analysis, generation and reception of Amplitude modulation, Frequency Modulation, and Phase Modulation. 2. To study different types of Pulse modulation techniques and their mathematical analysis. 3. To study noise considerations in AM, FM, and PCM systems 4. To study the mathematical analysis of baseband pulse transmission. 5. To impart practical knowledge of different communication systems.
Course Outcome	1. Explain the fundamentals of Amplitude modulation systems analyze mathematical representation of Amplitude modulation systems. 2. Explain and analyze the theory and mathematical models of Frequency modulation, Phase modulation and pulse modulation systems. 3. Analyze the effects of noise on communication systems and ways to minimize the effects of noise. 4. Analyze the properties of baseband pulse transmission system using mathematical models.

SYLLABUS

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candidate is required to attempt at least two questions from each part.

SECTION-A

Amplitude modulation 8

The need for modulation, mathematical analysis of AM, generation of AM, modulation index and its significance, envelop detector and its analysis, Properties of AM signals, DSB-SC, generation of DSB-SC signals, Coherent reception of AM signals, Costa's receiver, Quadrature carrier multiplexing, single sideband and vestigial sideband modulation, Homodyne and heterodyne receiver structures, characteristics of a super-heterodyne receiver.

Angle Modulation 9

Frequency and phase modulation, narrowband FM, frequency multiplication, Wideband FM, the spectra of FM signals, transmission bandwidth requirement for FM, generation of FM and PM signals, demodulation of FM and PM signals along-with mathematical analysis, The phase locked loop: linear and nonlinear models, The second order PLL, Nonlinear effects in FM systems.

Pulse Modulation 5

The need for sampling, the sampling process, Nyquist sampling theorem, Practical sampling, aperture effect and its analysis, band-pass sampling, PAM, PWM, PPM.

SECTION-B

Digital pulse modulation 8

Quantization Process, midrise and midtread quantizers, PCM, Noise in PCM, quantization noise, companding, A-law and μ-law companding, Delta modulation, analysis of noise specific to delta modulation, adaptive delta modulation, Linear prediction, DPCM, Vocoders and Video Compression.

Noise in communication systems 7

The receiver model and figure of merit of a communication receiver, Noise in baseband systems, Noise in AM, DSB-SC, SSB receivers, threshold effect, Noise in FM systems, capture effect, FM threshold reduction, Pre emphasis and de emphasis, Noise in PCM.

Baseband pulse transmission 8

Line codes, PSD and Bipolar Signaling, Pulse Shaping, ISI, Criterion for zero ISI, Controlled ISI, Differential Encoding, Baseband data transmission in white Gaussian noise, Probability of error, Matched filter and its properties along-with mathematical analysis, the detection problem, Bandlimited nature of channels, baseband M-ary transmission.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Communication Systems	Simon Haykin	Wiley India Ltd

2	Modern Digital and Analog Communication Systems	B P Lathi, Zhi Ding	Oxford University Press
3	Principles of Communication Systems	H. Taub, D. L. Schilling, G. Saha	McGraw Hill, 2011
4	Electronic Communication Systems	G. Kennedy	McGraw Hill, 4th Edition
5	Electronic Communications	Dennis Roddy & John Coolin	PHI, latest Edition
6	Communication Systems: Analog and Digital	R P Singh and S D Sapre	Tata McGraw Hill

Course Title	**Communication Engineering** (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. To measure the modulation index of AM signals using the trapezoidal method
2. To study DSB/ SC AM signal and its demodulation using product Detector Circuit.
3. To study the voltages and waveforms of various stages of super-heterodyne receiver
4. To measure the sensitivity and selectivity of a super heterodyne radio receiver
5. To study the voltages and waveforms of various stages of FM Receiver
6. To study the pulse code modulation and de-modulation circuit
7. To study the Time division multiplexing and de-multiplexing circuits.
8. To study delta modulation and demodulation circuits.
9. To study sigma delta modulation and demodulation circuits.
10. To study Pulse Amplitude Modulation, Pulse Width Modulation, and Pulse Position Modulation.
11. Implementation of modulation techniques in MATLAB.

Course Code	EC402
Course Title	**Microcontrollers and Interfacing** (Theory)
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Microprocessors and Applications
Course Objectives (CO)	1. The course is designed to understand the architecture, instruction sets and various techniques to interface them with different real world I/O devices to accomplish certain tasks. 2. To study the architecture of microcontrollers like 8051 and PIC. 3. To understand the instruction set and programming concepts of the above. 4. To know the techniques of interfacing them to the real world peripheral devices. 5. To use all the above in the design of microcontroller based systems. 6. To impart practical knowledge of 8051, and PIC Microcontrollers
Course Outcome	1. Acquired knowledge about the architecture of microcontrollers. 2. Acquired knowledge about instruction set and programming concepts. 3. To understand peripheral interfacing to microcontrollers. 4. To design the systems /models based on microcontrollers

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the*

candidate is required to attempt at least two questions from each part.

Section-A

INTRODUCTION OF EMBEDDED SYSTEMS

Basic definition and ingredients of embedded system, requirements & challenges in designing of macro and micro embedded systems, different types of microcontrollers: Embedded microcontrollers, external memory microcontrollers etc., processor architectures: Harvard V/S Princeton, CISC V/S RISC. (8 hours)

TOOLS AND SOFTWARE FOR EMBEDDED SYSTEM DESIGN

Development tools/ environments, Assembly language programming style, Interpreters, High level languages, Intel hex format object files, Debugging. (2 hours)

8051 MICRO CONTROLLERS

Architecture, Pin configuration, SFR's, Memory, 8051 Addressing modes. Introduction to 8051 assembly language programming: JUMP, LOOP and CALL instructions, Arithmetic instructions: Unsigned addition and subtraction, unsigned multiplications and Division, signed number concepts and arithmetic operations, Logic And Compare instructions, I/O PORT. Single bit instruction programming, Single bit operations with CY, Reading Input Pins Vs Port latch, Programming 8051 timers, counter programming (10 hours)

Section-B

TIMERS, SERIAL INTERFACE & INTERRUPTS OF 8051 MICROCONTROLLER

Timer: Control Word, mode of timers, simple programming, generation of square wave, Serial interface: Introduction, Control Word, mode of serial interface, simple programming, Interrupts: Introduction, Control word. (8 hours)

APPLICATIONS BASED ON 8051 MICROCONTROLLERS

Interfacing of memory, intelligent LCD, 8255, ADC, DAC, LED display, Bio-metric system, stepper motor, PWM motor control, ultra sonic distance measuring, Temperature Sensor. (9 hours)

PIC18 MICROCONTROLLER

Introduction to PIC18 microcontrollers, features of PIC family microcontrollers, Architecture, Pin diagram and pipelining concept, programming model, addressing modes, CPU registers, Introduction to data copy, arithmetic and branch instructions, logical and bit manipulation instructions and simple programming operations. (8 hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**

1	The 8051 Microcontroller and Embedded System	Muhammad Ali Mazidi, Janice Gillespie Mazidi	Pearson Education
2	PIC Microcontroller and Embedded Systems	Muhammad AliMazidi, Rolin D. McKinlay, Danny Causey	
3	Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family)	Ramesh Gaonkar	Penram International, 2007
RECOMMENDED BOOKS			
1	The 8051 Microcontrollers	Ayala	Penram Publications
2	The 8051 Microcontroller	Mackenzie	Pearson education
3	Designing with PIC Microcontrollers	John B Peatman	Pearson Education, 2004
4	Embedded C Programming and the Microchip PIC	Barnett Cox &O'Cull	Thomson, 2006.

Course Code	
Course Title	**Microcontrollers and Interfacing** (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. Programming examples of 8051 and PIC.
2. Interfacing using 8051 & PIC
3. Interfacing of LED, seven segment display, keypad, LCD etc.
4. Microcontroller based project.

Course Code	EC407
Course Title	**Probability and Random Processes**
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	1. To provide the student with an appreciation to implement the concepts of Signals and Systems to understand Communication Theory. 2. To promote understanding of probability theory and use of random-process models to characterize random signals and noise. 3. To develop the understanding of noise and interferences and how these issues can be addressed to design a communication system. 4. To analyze the response of optimum filter and understand how the system with minimum probability of error can be designed. 5. To appraise student with concept of information theory, entropy and coding techniques. 6. To help students obtain a necessary background for further study in Digital Communication.
Course Outcome	1. Recall and apply the concepts of Signals and Systems to Communication Theory. 2. Make use of probability theory and concepts of random-process (or stochastic-process) to characterize random signals and noise. 3. Analyze the response of optimum filter and explain concept of minimum probability of error. 4. Estimate the performance of Digital communication systems using the concept of Information Theory,entropy and coding techniques.

SYLLABUS

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SECTION-A

Introduction 3

The communication process, The layered approach, block diagram of a general communication system, A brief history of communications

Representations of signals 5

Review of low pass and band pass filters, The communication channel as a filter, Low pass and band pass signals, Hilbert transform, Complex baseband representation of band pass signals, Band pass systems, phase and group delay, sources of information.

Random variables and processes 15

Probability theory, classical and axiomatic definition of probability, Bayes theorem, conditional and joint probability, Random variables, PDF,CDF and their properties, conditional and joint PDFs for several random variables, Standard distributions(Binomial, Poisson, Uniform, Gaussian, Rayleigh), Derivation of the Poisson distribution, statistical averages, moments and characteristic functions, Random processes, Ergodicity and stationarity, mean, correlation and covariance functions, PSD of a random process and its properties, Transmission of a random process through an LTI system, Gaussian process, Central limit theorem.

SECTION-B

Noise 9

Noise, classification and characterization of noise, Noise temperature, noise figure, narrowband noise and its representations, stochastic model of radio link channel, The requirement of a minimum working SNR, Link budgeting, FRIIS equation and system design for given SNR requirements.

Elements of Information Theory 13

Information, Measure of Information, Entropy, source encoding theorems, fixed length and variable length codes, Coding efficiency, Huffman coding, lossless and lossy coding, Discrete memoryless channels, Mutual information and channel capacity, Channel coding theorem, Capacity of a Gaussian channel and Shanon's channel capacity theorem.

TEXT BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Modern Digital and Analog Communication Systems	B P Lathi, Zhi Ding	Oxford University Press
RECOMMENDED BOOKS			
1	Communication Systems	Simon Haykin	Wiley India Limited, 5th Edition
2	Principles of Communication Systems	H. Taub, D. L. Schilling, G. Saha	McGraw Hill, 2011
3	Principles of Digital communication	J. Das, S. K. Mullick, P. K. Chatterjee	New Age International
4	Communication Systems: Analog and Digital	R P Singh and S D Sapre	TMH
5	An Introduction to Information Theory	F M Reza	

Course Code	EC405
Course Title	**Computer Networks (Theory)**
Type of Course	Core
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To build an understanding of the fundamental concepts and basic taxonomy of computer networking area. 2. To study layers of OSI model and TCP/IP model. 3. To explain the need and significance of different types of networks, topologies and protocols. 4. To study and understand how computer and rest of the world do actually communicates with each other.
Course Outcome	1. Explain the basics and taxonomy of computer networking area. 2. Describe the functions performed by different layers and their significance. 3. Identify the different types of network devices, networks, topologies and their functions within a network 4. Familiarity with the basic protocols of computer networks and how they can be used to assist in network design and implementation.

SYLLABUS

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SECTION-A

Introduction: 05

Computer Networks, Network Hardware, Network Software, OSI & TCP/IP Reference models, ARPANET, Frame Relay, Introduction to Internet, ATM, Network devices: Hub, Bridge, Switch (Layer 2 & Layer 3), Router & Gateway, Addressing: Physical addresses, Logical addresses, Port Addresses.

Physical Layer: 05

Data Communication concepts, Wired and Wireless transmission media, Transmission Impairments and Performance, Parallel and Serial Transmission, Switching, Circuit Switching, Packet Switching, and Virtual Circuit Switching.

Data Link Layer: 06

Data link layer Design Issues, Framing, Error Detection and Correction, Flow Control, Sliding Window Protocols, HDLC, SLIP, and PPP.

Medium Access Control Sublayer: 06

Channel Allocation, Description and Analysis of ALOHA, Slotted ALOHA, CSMA, CSMA/CD, IEEE LAN Standards: Ethernet (802.3), Gigabit Ethernet, Wireless LAN (802.11), Broadband Wireless (802.16), Bluetooth.

SECTION-B

Network Layer: 12

Network layer Design Issues, IPv4 and IPv6 Structure and addresses, Routing algorithms– Shortest path, Flooding, Distance Vector Routing and Link State Routing; General principles of Congestion Control, Congestion Control in Datagram and Virtual Circuit Subnets, Brief idea of Quality of Service, Internetworking, IP protocol, IP Addresses, Internet Control Protocols, Subnetting and Supernetting, ARP, NAT, DHCP.

Transport Layer: 05

The Transport Service, Elements of Transport Protocols, TCP & UDP Protocols

Application Layer: 06

Domain Name System, SMTP, FTP, HTTP, WWW, SNMP, Multimedia, and Cryptography.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Data Communications and Networking	B. A. Forouzan	TMH, 1st ed, 2000.
2	Computer Networks	A. S. Tanenbaum	4th Edition, PHI
RECOMMENDED BOOKS			
1	Data & Computer Communication	William Stallings	PHI, 6ed, 2002
2	An Engineering approach to Computer Networking	S. Keshav	Addison Wesley, 1999

Course Code	**EC406**
Course Title	**Analog Electronic Circuits** (Theory)
Type of Course	Core
L T P	40 3
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Introduction to Electronics, Analog Electronics Circuits-I
Course Objectives (CO)	1. To introduce Op Amp as an important device that finds applications in a variety of electronic systems. 2. To study various essential properties of an ideal op-amp. 3. To make students aware of how to apply simple rules to analyze and realize op amp circuits. 4. To make students aware of the use of feedback in the construction of many op amp circuits. 5. To make students aware of the concepts of active filters, oscillators and power devices. 6. To make students high frequency model of a Transistor.
Course Outcome	1. The student will have complete understanding of the working of op-amp. 2. The students will be able to calculate gain, input and output impedances for different configurations of op-amp. 3. The student will have complete understanding of the concepts of feedback in terms of basic gain, (open loop gain), closed loop gain, loop gain, feedback factor. 4. The students will be able to design clippers, clampers, filters, oscillators through hands-on laboratory experiments. 5. The students will be able to validate their designs through SPICE simulation program.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole*

syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.

SECTION-A

Multistage or Cascaded Amplifiers 6

Classification of Multi-stage Amplifier, Types of coupling, Effect of cascading on voltage gain, Current gain, Phase, Input and output impedances and bandwidth Analog of cascaded or multistage amplifiers, Miller Theorem, Darlington pair, Bootstrap Circuits. Transistor at high frequency and it hybrid pi CE model

Feedback Amplifiers 6

Concept of feedback, Positive and negative feedback, Voltage and current feedback, Series and shunt feedback, Effect of feedback on performance characteristics of an amplifier.

Differential amplifiers 6

Differential Amplifiers Basic of Differential Amplifier, Transistorized differential Amplifier, Configurations of Differential Amplifier, Analysis of Dual Input Balanced Output Differential Amplifier, Constant Current Bias, Current Mirror Circuit.

Operational Amplifier 4

Block diagram of a typical Op-Amp, Schematic symbol, Characteristics and performance parameters of ideal Op-Amp, Open loop configurations: Differential, Inverting & Non-Inverting.

SECTION-B

Practical Op-Amp: offset voltage analysis and compensation, input bias and offsetcurrent analysis and compensation, Change in Input offset voltage and Input offset current withtime, Temperature and supply voltage, Common mode configuration and Common mode rejection Ratio, Frequency response, slew rate. 4

Op-amp Applications 7

DC and AC amplifiers, Peaking amplifiers, Summing, Scaling and Averaging amplifiers, Differential amplifier, Instrumentation amplifiers, V to I and I to V converters, Differentiator and integrator, A to D and D to A converters, Log and antilog amplifiers, Sample and hold circuits.

Active Filter, Oscillators 6

Active filters, Essentials of Oscillator, Types of Oscillator, Sinusoidal Oscillator, Schmitt Trigger Circuits

Non-Linear Wave Shaping 6

Clipping circuits (diode & transistor), Diode comparators, Transistor differential comparator, Operational amplifier comparator, clamping circuits, Practical clamping circuit, clamping circuit.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Electronics Circuit Analysis and Design	Donald A. Neamen	Tata McGraw Hill
RECOMMENDED BOOKS			
1	Op-Amps and Liner integrated Circuits	Ramakant A. Gayakward	Pearson Education, 4th edition
2	Integrated electronics	Millman&Halkias	Tata McGraw Hill
3	Electronic devices and Circuit Theory	Boylstead	PHI

Course Title	**Analog Electronic Circuits** (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. To study the Pspice Simulation software
2. Design fabrication & testing of Differentiator Circuits using Op-Amp & simulate using P-spice
3. Design fabrication & testing of Integrator Circuits using Op-Amp & simulate using P-spice
4. Design fabrication & testing of adder/Subtractor Circuits using Op-Amp & simulate using P-spice
5. Design fabrication & testing of Clippers and Clampers Circuits using Op-Amp & simulate using P-spice
6. Design fabrication & testing of Universal Active filter & simulate using P-spice
7. To study the frequency response of OP-Amp & simulate using P-spice
8. To design Butter worth Low pass filter & simulate using P-spice
9. To design Butter worth High pass filter & simulate using P-spice
10. To design Butter worth Band pass filter & simulate using P-spice
11. Hartley and Colpitts Oscillator.
12. RC Phase shift oscillator.

FIFTH SEMESTER

Course Code	EC501
Course Title	**VLSI Design** (Theory)
Type of Course	Core
L T P	3 1 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Introduction to Electronics, AEC-I, AEC-II
Course Objectives (CO)	1. To understand theoreticaland practical aspects of all the basic processes involved in Integrated circuit fabrication technology. 2. To develop the understanding of MOSFET physics, its design parameters and Scaling rules. 3. To study the static characteristics, dynamic characteristics and layout design of nMOS, CMOS Logic, and Transmission Gate. 4. To develop the capability to analyzeCMOS logic circuit based on Power dissipation, Speed and Noise Margin.
Course Outcome	Student will be able to: 1. Describe theoretical and practical basic processes involved in Integrated Circuit fabrication technology 2. Derive and interpret MOSFET Characteristics, its design parameters and scaling rules. 3. Explain the static characteristics and dynamic characteristics of nMOS, CMOS Logic, and Transmission Gate. 4. Analyze and design nMOS, CMOS, and Transmission gate circuits that meet desired specifications.

SYLLABUS

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SECTION-A

Monolithic IC Processes:

General classification of Integrated Circuits, advantages of ICs over Discrete Components, Refining, and growth of silicon crystals, Si-Wafer preparation, Diffusion of dopant impurities, Defication systems, Ion implantation, Thermal oxidation, Photolithography, Fine Line lithography, Relative Plasma etching, Chemical Vapour Deposition (CVD), Metallization, Packaging. (10hours)

Monolithic Components:

Epitaxial devices and their characteristics, Bipolar IC process, P-N junction Isolation, Monolithic Bipolar transistor constructions, Dielectric isolation, Monolithic Diodes, Monolithic Junction FETS, Monolithic resistors and Monolithic capacitors. Fabrication of MOSFET, CMOSn-well process, Lambda based Design rules,Short channel MOS structures, MOS layers, stick Diagramsand layout design for nMOS and CMOS technology. (10hours)

SECTION-B

Introduction to MOS Technology:

MOSFET Structure and operation, Characteristics – Threshold Voltage, Body Bias concept, Square-Law Current-Voltage Model. Geometric Scaling Theory – Full-Voltage Scaling, Constant-Voltage Scaling. Challenges of MOSFET Scaling – Short Channel Effects. (8hours)

MOS Inverter Design:

Resistive Load inverter Design, Comparison of depletion and enhance type MOS load.CMOS inverter Static Characteristics: Basic Circuit Operation, static characteristics and switching characteristics, Noise Margins.CMOS Inverter Switching Characteristics – Delay time definition and calculation of delay time, rise time and fall time.Static Power Dissipationand Dynamic Power Dissipation. (10hours)

CMOS Logic Design:

CMOS NAND and NOR Gate, XOR, combinational circuit, Full Adder Circuit.Basic principal of nMOS Pass transistor, CMOS Transmission gate Logic design, Clocked-CMOS, Pre-Charge/ Evaluate Logic and Domino Logic. (7hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Integrated circuits	K.R. Botkar	Khanna Publishers
2.	CMOS Digital Integrated Circuits	Sung- Mo (Steve) Kang and Yusuf Leblebici	Tata McGraw Hill
RECOMMENDED BOOKS			
S.	**NAME**	**AUTHOR(S)**	**PUBLISHER**

No.			
1.	Principles of Microelectronics Technology	D. Nagchoudhuri, A H Wheele	PHI
2.	VLSI Technology	Simon Sze	Tata McGraw Hill
3.	Principles of CMOS VLSI Design	Neil H.E. Weste and Kamran Eshraghian	AddisonWesley
4.	Basic VLSI Design	Douglas- A. Pucknell	PHI
5.	Digital Integrated Circuit Design	Ken Martin	OXFORD University

Course Title	**VLSI Design(Practical)**
Type of Course	**Core**
Credits	**1**
Course Assessment Methods **Continuous Assessment**	 **50**

LIST OF EXPERIMENTS

1. Introduction to Tanner EDA Tool.
2. To study the effect of variation of Threshold voltage, Transconductance parameter, Lambda on I-V characteristics of n-MOSFET using SPICE Level 1 MOSFET model.
3. To implement CMOS logic NANDGate, NOR Gate, XOR Gate and Full adder.
4. To study the Voltage Transfer Characteristics an nMOS inverter with resistive load and to observe changes in the characteristics with change in value of load Resistor.
5. To study the Voltage Transfer Characteristics of CMOS inverter.
6. To compare Transient Characteristics of:
   (a) nMOS Pass Transistor
   (b) CMOS Pass Transistor
7. To implement Multiplexer and EXOR Gate using Pass Transistor.
8. To determine the Propagation Delay (high to low and low to high) in CMOS Logic.
9. To compare and analyze static and dynamic Power Dissipation in nMOS and CMOS logic.
10. To implement a give Boolean expression using Dynamic CMOS Logic.

Course Code	**EC502**
Course Title	**Digital Signal Processing (Theory)**
Type of Course	**Core**
L T P	**3 1 2**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments,Quiz)	 50 50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations Convolution and correlation. 2. To Study the basics, mathematical analysis and applications of DTFT, DFT, FFT, DCT, and wavelet transforms. 3. To study the design and implementation of Digital Filters. 4. To study the analysis of multirate systems. 5. To study the architecture of DSP processors. 6. To impart practical knowledge of signal processing operations in MATLAB.
Course Outcome	1. Explain the properties of discrete time systems 2. Analyze Continuous and Discrete time systems using different types of Transforms. 3. Design and Implement FIR and IIR Digital filters. 4. Explain multi-rate systems and DSP processors.

SYLLABUS

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SECTION-A

Introduction:

Classification of Discrete-time Signals & Systems, The Sampling Theorem, Reconstruction using Interpolation filter, Aliasing, Stability and Causality, Convolution of discrete time signals, Correlation of Discrete time signals, Solution of Linear constant coefficient difference equations, Review of Z-transform. (7hours)

Frequency Domain Representation of Signals & Systems:

Review of DTFT, Discrete Fourier Transform and its properties, Filtering of long data sequences, Goertzel Algorithm, Divide and Conquer approach to computation of DFT, Fast Fourier Transform, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Discrete Cosine Transform, Audio & Video Coding, JPEG coding, Time-Frequency Analysis, Wavelet Transform. (15hours)

SECTION-B

Digital Filters:

Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling technique, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation. . (9hours)

Implementation of Discrete Time Systems:

Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Arithmetic operations. (5hours)

Multirate Signal Processing:

Basic Sampling rate alteration devices, Time domain and frequency domain representation, Multirate structures, Multistage design, Polyphase decomposition. (7hours)

Processors:

Architecture of TMS320CXX series, Addressing modes, Memory management. (2hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Digital Signal Processing: Principles, Algorithms and Applications	Proakis & Manolakis	Pearson Education Ltd . 4th edition
RECOMMENDED BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**

1.	Digital Signal Processing	E C Ifeacher and B W Jervis	Pearson
2.	Digital Signal Processing	A.V Oppenheim and R.W.Schafer	Pearson Education Ltd
3.	Digital Signal Processing	Sanjit and Mitra	Tata Mcgraw Hill
4.	Digital Signal Processing	S Salivahanan, A Vallavraj, C Gnanapriya	Tata Mcgraw Hill
5.	Digital Signal Processing	E C Ifeacher and B W Jervis	Pearson

Course Title	**Digital Signal Processing (Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. Introduction to MATLAB.
2. Effect of noise on signals in MATLAB
3. Z-Transform.
4. Convolution of sequences in MATLAB
5. Correlation of sequences in MATLAB
6. Detection of Signals buried in Noise.
7. System Response to Arbitrary Inputs
8. DFT & IDFT of two sequences
9. FFT of two Sequences
10. Circular Convolution
11. Overlap-add method and overlap-save methods
12. FIR Filter Design in MATLAB
13. IIR Filter Design in MATLAB
14. Interpolation and Decimation of sequences
15. Implementation of digital filter banks
16. System Design based on DSP kits

Course Code	EC503
Course Title	**Antennas & Wave Propagation(Theory)**
Type of Course	Core
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Physics, Electromagnetic Theory
Course Objectives (CO)	1. To provide an in depth understanding of basic antenna parameters. 2. To provide in depth study for the analysis and design of antenna arrays. 3. To provide in depth study of Yagi-Uda array, log periodic array, and Dolph-Techebysheff arrays. 4. To provide in depth study of Practical Antennas such as rhombic antennas, ferrite rod, whip antennas. 5. To provide in depth study of special antennas such as frequency independent antennas and receiving antennas. 6. To study the effect of propagation of radio waves in actual environment.
Course Outcome	1. Explain basic Antenna parameters. 2. and special Analyze and design of antenna arrays. 3. Describe and analyze design parameters related to practical antennas antennas. 4. Explain the concept of propagation of radio waves.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Antenna Radiation:

Antenna Parameters: Antenna impedance, Directional patterns, Effective length, Radiation

Intensity, Directivity, Power gain, Efficiency, Effective area, Equivalent circuit, Front to back ratio, polarization and antenna temperature, Radiation field, Radiation power, Radiation resistance, Directivity and gain of an alternating current element, half wave dipole and quarter wave monopole, Effect of earth on patterns. (15hours)

Antenna Arrays:

Multiplication of patterns, one dimensional broadside and endfire arrays, Feed network for arrays: series, shunt, delta matching, Impedance matching: Folded dipole, BALUNS and stubs, Yagi Uda array, log-periodic arrays, Dolph-Techebysheff arrays (10hours)

SECTION-B

Practical Antennas:

Top loading and tuning, rhombic antennas, ferrite rod, whip antennas, Receiving antennas, frequency independent antennas.(08hours)

Wave Propagation:

Modes of Propagation: Surface Wave Propagation, Sky Wave (Ionospheric) Propagation- Virtual height, Maximum usable Frequency, Skip Distance, Optimum working frequency, Space Wave (Tropospheric) Propagation- line of sight distance.(12hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR**	**PUBLISHER**
1	Antennas and Radio Wave Propagation	K D Prasad	Satya Prakashan
RECOMMENDED BOOKS			
1	Antennas and Wave Propagation	G S N Raju	Pearson
2	Antenna and Radio Wave Propagation	Collin R.E	Mc-Graw Hill.
3	Antenna and Radio Wave Propagation	Krauss	TMH
4	Antenna and Radio Wave Propagation	Ballanis	John Wiley & Sons

Course Code	EC506
Course Title	**Advanced Microcontrollers & Applications** (Theory)
Type of Course	**Core**
L T P	**4 0 2**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 **50** **50**
Course Prerequisites	**Microprocessor**
Course Objectives (CO)	
Course Outcome	

Note for Examiner- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt any two questions from each part.

Section A

Introduction to Embedded System:
Define basic concept of embedded system, Explain Characteristics of embedded system, Operating System (OS): Types of OS, Types of Mobile OS, Characteristics of Real Time Operating System, Compare different Operating Systems used for embedded system designing.

8-bit Microcontrollers Architecture (Atmega 8, AVR):
Microcontroller Types: PIC, AVR, ARM: features and applications, Compare different micro controllers used for embedded system designing, AVR microcontroller: Types , Architecture and functional diagram, Internal Architectural, Block diagram of controller (Atmega 8), pin diagram, Configuration of Two 8-bit and One 16-bit Timers and Counters, channel ADC Working, Essential Peripheral circuits: Crystal Circuit, Power supply, Oscillator Circuit, Initial programming configurations of Atmega8: port, counter, timer, Bootloader Circuit, ISP of Atmega 8 and Tmega8 and ATmea328

Section B

Open Source Embedded Development Board (Arduino):
Overview of open source embedded development board (Arduino), Explain working of open source embedded development board using block diagram, Identify pins of embedded development board, circuit diagram of open source embedded Hardware, features of open source tool used for programming a development board, programming of embedded

development board, Interface Serial Port with embedded development board, Basic Circuit of embedded development Board

Interface Digital and Analog I/O Devices (Arduino Interfacing): Concept of input and output port of embedded development board (Arduino Interfacing Concept), Interfacing of Digital I/O devices with program (Digital I/O Interfacing), Interfacing of Analog I/O devices program (Analog I/O Interfacing), Interfacing of Keypad with programming (Keypad Interfacing). Interfacing of Serial port with programming (Serial Port Interfacing), Interfacing of DC motor with programming, Interfacing of 16x2 LCD with programming

Embedded system Applications (Arduino): functional blocks of Line follower Robot using Arduino, functional blocks of accelerometer based gesture control robot, functional blocks of home automation using RF control.

TEXT BOOKS			
S. No.	Title	Author(s)	Publisher
1.	Exploring Arduino	Jeremy Blum.	Wiley
2.	30 Arduino Projects for Evil Genius	Simon Monk	McGraw-Hill Professional
RECOMMENDED BOOKS			
3	Make: Arduino Bots and Gadgets	Kimmo and Tero Karvine	O'REILLY
4	Arduino Cookbook	Michael Margolis	O'REILLY
5	Arduino Internas	Dale Wheat	Technology in Action

Course Title	**Advanced Microcontrollers & Applications** (Practical)
Type of Course	**Core**
Course Assessment Methods Continuous Assessment	50

List of Experiments:

1. Test AVR Micro-Controller Architecture.
2. Identify each block of ATmega8 with Pins.
3. Use Arduino Architectural diagram .
4. Test the different Arduino Boards, Open-Source and Arduino Shields.
5. Install Arduino IDE and its development tool.
6. Design an embedded development Board.(arduino)
7. Develop a program to Blink LED for 1second.
8. Develop a program to interface Input Switches and output LEDs with development board (arduino).

9. Interface 7 seg display with development board(arduino) and Write a program to count and display 0 to 9 on it.
10. Develop a program to generate led pattern using computer serial control.
11. Interface potentiometer with development board (arduino) and write a program to generate Led pattern on it.
12. Interface LM35 temperature sensor with arduino and monitor temp. on serial monitor.
13. Interface DC motor using L293D Motor Driver.
14. Interface RF Tx/RF Rx with Arduino
15. Interface 16x2 LCD and Display “HELLO WORLD”.
16. Make Line-Follower Robot using Arduino.
17. Build Digital thermometer using LM35 and LCD 16x2.
18. Build Gesture Control Robot using Accelerometer.

Course Code	EC505
Course Title	**Digital System Design (Theory)**
Type of Course	Core
L T P	3 1 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Basic Electronics, Digital Electronics
Course Objectives (CO)	1. To familiarize with basics of switching algebra using theorems and devise various minimization techniques for single and multi-output combinational functions. 2. To understand the need for error correction and error detection techniques. 3. To use and analyze various fault detection and correction techniques for combinational and sequential circuits. 4. To introduce the concept of Finite state machine and use it for minimization of completely and incompletely specified synchronous and asynchronous sequential circuits. 5. To draw and analyze ASM charts and learn the concept of races, cycles and hazards. 6. To impart practical knowledge of digital system design.
Course Outcome	1. Recall and explain the concepts about combinational and sequential circuits. 2. Experiment with various minimization techniques (like K-maps, Q-M methods, Iterative method, Variable-entered mapping) to design optimal combinational circuits. 3. Construct and analyze Finite State Machines for synchronous and asynchronous sequential circuits. 4. Identify and discuss the methods to find faults and errors for detection and location in combinational and sequential circuits.

SYLLABUS

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SECTION-A

Combinational Circuits:

Review of switching algebra: Definitions, Theorems, Functions of n variable, Logic Detailed Diagram and Symbols minimization, Minimization Techniques: optimal combinations with K-map and tabular methods, simplification & minimization, complimentary approach with map method, map method for multi-output functions, Tabular and Iterative consensus method for obtaining prime implicants for single and multi-output functions.

Error Correction and Detection:

Error detection and correction techniques, Single error detection, Single error correction with double error

Fault detection and Location in combinational circuits:

Different methods of detecting and locating Faults in combinational circuits.

(20hours)

SECTION-B

Sequential Circuits: Synchronous circuits: Concept of state diagram and state table, state assignment, Analysis and synthesis of sequential circuits, designs of Next state decoder and output decoder, state reduction, Machine minimization of completely and incompletely specified machines.

Asynchronous Circuits: Analysis and Synthesis of Asynchronous circuits, Races and Cycles, hazards in asynchronous circuits. Sequential Machine Flow Charts, synthesis using sequential machine flow charts.

Fault detection and Location in sequential circuits.

(25hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Switching and Finite Automata Theory	Kohavi	TMH
2.	Digital circuits and Logic Design	Lee	PHI

Course Title	**Digital System Design (Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. To Design and test the minimized circuit of Full Adder.
2. To Design and test the minimized circuit of BCD to Binary Converter
3. Implement decade counter using minimum number of gates
4. To test the minimized circuit of Decimal to BCD Encoder
5. Design and test hexadecimal to binary Encoder
6. Implement and test BCD to 7-Segment decoder
7. Design a sequence detector to detect a given sequence
8. Design and test twisted type ring counter
9. Implement the minimized circuit of Modulo-6 counter
10. To design, implement and test a 16:4 multiplexer using logic gates.
11. To design, implement and test a 4:16 demultiplexer using logic gates.
12. Design & test Johnson Counter.

Course Code	EC507
Course Title	**Data Structures & Algorithms (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Object Oriented Programming
Course Objectives (CO)	1. To develop an in depth understanding of various Data Structures such as stacks, queues, linked lists, trees and graphs. 2. To help students select an appropriate data structure for a particular application and design the algorithm to manipulate the data structure. 3. To analyze the complexity of various algorithms.
Course Outcome	1. Describe the usage of various data structures and explain algorithm's complexity. 2. Recognize basic operations and design algorithms for arrays, stacks and queues. 3. Describe basic operations and design algorithms for various types of linked lists. 4. Explain operations on various types of trees and their applications. 5. Examine graphs, their applications and various sorting and searching algorithms.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction

Introduction to data structures, Introduction to Algorithms Complexity. (02hours)

Arrays, Stacks & Queues

Concepts; Basic operations & their algorithms: Transverse, Insert, Delete, Sorting of data in these data structures; Prefix, Infix, Postfix Notations. (08hours)

Lists

Concepts of Link List and their representation; Two way lists; Circular link list; Basic operations & their algorithms: Transverse, Insert, Delete, Searching and Sorting of data in List; Storage Allocation & Garbage Collection; Linked stack and queues; Generalized List; sparse matrix representation using generalized list structure. (11hours)

SECTION-B

Trees

Binary Trees and their representation using arrays and linked lists, Trees and their applications, Binary tree transversal, Inserting, deleting and searching in binary trees, Heap & Heap Sort, General Trees, Thread binary tree, Height balance Tree (AVL), B-Tree. (08hours)

Graphs and their applications

Graphs, Linked Representation of Graphs, Graph Traversal and spanning forests, Depth first search, Breadth first search. (08hours)

Sorting & Searching

Insertion sort, Selection sort, Merging, Merge sort, Radix sort, Sequential & Binary Search, Indexed Search, Hashing schemes, Binary search Tree. (08hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Theory and problems of Data Structures	Seymour Lipschutz	McGraw Hill
RECOMMENDED BOOKS			
1.	Data Structure Using C and C++	A. Tenenbaum, Y. Langsam, M. J. Augenstein	PHI, Edition 2nd
2.	Data Structures & Program Design	Robert L. Kruse	PHI , Edition 3rd

Course Code	EC508
Course Title	**Audio and Visual Systems**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Design
Course Objectives (CO)	1. To Understand Television Transmitter and Receiver. 2. To Understand Audio devices and applications. 3. To Understand digital video and standards. 4. To Understand advanced television technologies.
Course Outcome	1. Illustrate knowledge of Television Transmitter and Receiver. 2. Ability to analyze Audio devices and applications. 3. Analyze digital video and standards. 4. Illustrate knowledge of advanced television technologies.

SYLLABUS

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SECTION-A

Fundamentals Of Television

Introduction of television, General concepts-interlaced scanning, Geometric form and aspect ratio, Image continuity, No. of scanning lines, Resolution, Brightness, Contrast, Composite video signal, Television Transmitter, Monochrome television receiver, compatibility between Monochrome and colour television, three color theory, PAL transmitter and receiver.
(09hours)

Audio Devices And Applications

Microphone Sensitivity, Nature of Response and Directional Characteristics, Measurement Microphones, Various Types of Microphones, Various Types of Loudspeakers, Characteristic Impedance of Loud Speakers, Headphone Types, The basics of Magnetic Recording, Sound Cards, Sound Mixers, PA Systems & Installations, Digital Consoles, modern audio recording techniques. (08hours)

Digital Audio

Digital Audio Fundamentals, review of Sampling and Quantizing, PCM, Audio Compression, Disk-Based Recording, Rotary Head Digital Recorders, Digital Audio Broadcasting, Digital Filtering, Stereophony and Multichannel Sound. (06hours)

SECTION-B

Digital Video & Standards

Digitizing Video, Chroma Subsampling, Basics of Video Compression (MPEG-x, H.26x), Digital VTR, Non-Linear Editing, 4:3 Vs 16:9 for Digital Video. (11hours)

Advanced Television Concepts

HDTV, Display Technologies (CRT, LCD, Plasma, LED, Projection), Video Interfaces (Composite, Component, S-Video, DV, SDI, HDMI television DVI),Digital television, Digital video disc, Flatron picture tube, Video on demand, video on internet, cable television, closed circuit television, Dish TV. (11hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Modern Television Practice	R.R. Gulati	New Age publication, 3rd edition, 2007
2	Audio Video Systems	R.G. Gupta	Technical Education , TMH, 2010
RECOMMENDED BOOKS			
1	Essential Guide to Digital Video	John Watkinson	Snell & Wilcox Inc Publication 1996
2	Digital Television Fundamentals	Robin, Poulin	McGraw -Hill 2nd ed, 2000
3	Audio Video Systems Principles Practices and Troubleshooting	Bali & Bali	Khanna Publishing Company. 2010

Course Code	**EC509**
Course Title	**Bio-Medical Electronics**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To provide an acquaintance of the physiology of the heart, lung, blood circulation and circulation respiration. Biomedical applications of different transducers used. 2. To introduce the student to the various sensing and measurement devices of electrical origin. To provide awareness of electrical safety of medical equipments 3. To provide the latest ideas on devices of non-electrical devices. 4. To bring out the important and modern methods of imaging techniques. 5. To provide latest knowledge of medical assistance / techniques and therapeutic equipments.
Course Outcome	At the end of the course, students will demonstrate the ability to: 1. Understand the application of the electronic systems in biological and medical applications. 2. Understand the practical limitations on the electronic components while handling bio-substances. 3. Understand and analyze the biological processes like other electronic processes.

SYLLABUS

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SECTION-A

PHYSIOLOGY AND TRANSDUCERS (12)

Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organisation of the nervous system ; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system.

Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors;

ELECTRO – PHYSIOLOGICAL MEASUREMENTS (10)

Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes; floating electrodes; pregelled disposable electrodes ;Micro, needle and surface electrodes; Preamplifiers, differential amplifiers, chopper amplifiers ;Isolation amplifier. ECG; EEG; EMG; ERG; Lead systems and recording methods

SECTION-B

NON-ELECTRICAL PARAMETER MEASUREMENTS (9)

Measurement of blood temperature, pressure and flow; ; Cardiac output ; Heart rate ; Heart sound ;Pulmonary function measurements ; spirometer ; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

MEDICAL IMAGING (7)

Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computer tomography; MRI; Ultrasonography

ASSISTING AND THERAPEUTIC EQUIPMENTS (7)

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

RECOMMENDED BOOKS

S. No.	Title	Author(s)	Publisher
1	Review of Medical Physiology	W.F. Ganong	8thAsian Ed, Medical Publishers, 1977
2	Medical Instrumentation	J.G. Websster	Houghton Mifflin, 1978
3	Therapeutic Medical Devices	A.M. Cook and J.G. Webster	Prentice-Hall, 1982.
4	Hand Book of Bio-Medical instrumentation	R.S.Khandpur	Tata McGraw Hill, 2003
5	Bio-Medical Instrumentation and Measurements	Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer	Pearson Education 2nd edition

SIXTH SEMESTER

Course Code	EC601
Course Title	**Microwave & Radar Engineering (Theory)**
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Physics, Electromagnetic Theory, Antenna and Wave Propagation.
Course Objectives (CO)	1. To study and design the microwave circuits, components, and systems. 2. To study the special techniques that applies to circuits and devices operating at very high frequencies. 3. To impart practical knowledge of Microwave components. 4. To familiarize with the working of radar and derive its radar equation for different types of radar systems.
Course Outcome	1. Discovered about microwave frequencies and their applications. 2. Demonstrate knowledge about waveguide components, and microwave based solid state sources. 3. Ability to identify functioning of microwave tubes and transmission lines 4. Illustrate the working principle of a radar system

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Waveguide Components:

Transitions, Discontinuities, Matched loads, Shorts, Flanges, Bends & Twists, Attenuator & phase

shifters, Microwave Hybrid Circuits: Waveguide Tees, Magic (Hybrid) Tees, Scattering matrix of tees, Hybrid Rings (Rat-Race Circuits), Directional Couplers: Two Hole Directional Couplers, Scattering matrix of a directional coupler, Hybrid Couplers, Multi-hole couplers. Propagation in ferrites, Faraday rotation, Microwave Circulators: 3 port circulators and Isolators. (10hours)

Measurements: Slotted waveguide, Swept Frequency Technique Detectors, Power & Impedance measurement. (06hours)

Solid State Sources:

Tunnel Diodes, Transferred Electron Devices (TEDs): GUNN Diode, LSA Diodes. Avalanche Transit Time Devices: IMPATT Diodes, TRAPATT, BARITT Diodes and Parametric Devices.

(06hours)

SECTION-B

Microwave Tubes: Microwave Linear Beam Tubes: Klystron, Multicavity Klystron, Reflex Klystron, Helix Traveling-Wave Tubes (TWT), Coupled Cavity Travelling-Wave Tubes, Microwave Crossed-Field Tubes: Cylindrical Magnetron. (09hours)

Radar:

Radar Principles, Radar Equation, Types of Radars & Radar Functions, Doppler & Moving Target Indicator(MTI) Fundamentals, MTI Principles & Methods, CW Radar. (04hours)

The Radar Equation:

Radar Equation Introduction, Points Targets in Noise, Radar Equation with Pulse Compression, Search Radars, Tracking Radars, CW & Pulse Doppler Radar, Area Targets & Clutter, Volume Targets & Clutter, Augmentation, Bistatic Radar Equation, including Missile Illumination, Losses in Radar Equation.Introduction to Radar cross-section (RCS) (10hours)

TEXT BOOKS		
NAME	**AUTHOR(S)**	**PUBLISHER**
1.Elements of Microwave Engineering	R. Chatterjee	East-West Press
RECOMMENDED BOOKS		
1. Microwave Devices & Circuits	S Y LIAO	Prentice Hall, 3rd Edition
2. Microwave	K. C. Gupta	New Age , Edition 2nd
3.Microwave Engineering---Special topics	R. Chatterjee	East-West Press
4.Foundations of Microwave Engineering	R.E. Collin	Wiley, 2nd Edition
5.Introduction to Radar Systems	Skolnik	McGraw Hill

6.Radar: Principles, Technology, Applications	Byron Edde	Pearson Education

Course Title	**Microwave & Radar Engineering(Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. Measurement of impedance.
2. Measurement of (i) Insertion loss & (ii) Isolation of a circulator.
3. Measurement of S parameters of a Hybrid Tee.
4. Measurement of SWR.
5. Reflex klystron mode curves.
6. Antenna radiation pattern.
7. Verification of Diode law.
8. Gunn Oscillator characteristics.
9. Directivity & Coupling of a directional coupler.
10. To verify the waveguide law.

Course Code	EC602
Course Title	**Fiber Optic Communication Systems (Theory)**
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments,Quiz)	 50 50
Course Prerequisites	Electromagnetic Theory, Communication Engineering, Digital Communication
Course Objectives (CO)	1. To explain the need and significance of Optical Communication System 2. To impart knowledge of types, basic laws, and transmission characteristics of optical fibers. 3. To study various types of losses and non-linear effects. 4. To study and compare various types of basic components of optical communication i.e. sources, detectors and optical amplifiers. 5. To explain the characteristics of Digital and Analog Transmission System and study of advanced system techniques. 6. To impart practical knowledge of Fiber optic systems
Course Outcome	1. Understanding the need, fundamentals and advances in Optical Communication System. 2. Apply knowledge of basic properties, characteristics of Optical Communication in various applications related to research or telecomm industry. 3. Understand the working and analysis of important components of Optical Communication System like sources (LEDs/Lasers, detectors (PIN/APD) and Amplifiers (SOA/EDFA). 4. Imparting ability to judge the various budgeting aspects (rise time/power) in the optical link.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the*

candidate is required to attempt at least two questions from each part.

SECTION-A

Overview of Optical Fiber Communication:

Elements of basic communication system, communication system architecture, advantages of optical communication, Definition of dB and dBm. (03hours)

Optical Fiber Wave Guides:

Ray Theory of Transmission: Total Internal reflection, Acceptance Angle, Numerical Aperture, Electromagnetic mode theory for optical communication of both types of fibers viz step index fiber and graded index fibers, Fiber materials, fiber fabrication, fiber to fiber joints, fiber splicing, optical fiber connectors. (09hours)

Signal Degradation in Optical Fibers:

Attenuation, Material absorption losses, linear and non linear scattering losses, fiber bend loss, dispersion viz intermodal dispersion and intramodal dispersion, overall fiber dispersion and polarization mode dispersion, Introduction to nonlinear effects: Self phase modulation, cross phase modulation, Stimulated Brillion and Raman scattering, Four Wave Mixing. (03hours)

SECTION-B

Optical Sources and Detectors:

Sources:Basic Concepts: emission & absorption, p-n junctions, non-radiative recombination, semiconductor materials. LED: power-current characteristics, internal quantum efficiency, LED spectrum, modulation Response, LED structures. LASER Diode: optical gain, feedback and Laser threshold, internal quantum efficiency and Laser characteristics.

Detectors:Basic Concepts: Detector responsivity, rise time bandwidth. common photodetectors: p-n photodiodes, p-i-n photodiodes, avalanche photodiode, MSM photodetector. (08hours)

Lightwave systems:

System architectures: point to point links, Distribution networks, local area networks. Design guidelines: loss-limited lightwave systems, dispersion-limited lightwave systems, power budget, rise time budget. Multichannel systems: WDM lightwave systems; system performance parameters: Bit Error Rate (BER), Eye Diagrams, optical signal to noise ratio. (07hours)

Optical components and sensors:

Coupler/splitter, optical switches, optical add/drop multiplexers, fiber grating, Basic applications & types of optical amplifiers. Introduction to fiber-optic sensors, Intensity modulated sensors. (08hours)

Advances in Optical Communication:

Introduction to Free Space Optics, Photonics Microwave, DWDM (03hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Fiber optic communication systems,2E	Govind P. Agrawal	Wiley India
2.	Optical Fiber Communications Designs,3rd Edition	Gerd Keiser	McGraw Hill
3.	Fundamentals of Fibre Optics in Telecommunication and sensor systems	Bishnu P. Pal	New Age International
RECOMMENDED BOOKS			
1.	Fiber optic communication technology	D. F. Mynbaev and L. Scheiner	Pearson Education
2.	Fiber-Optic Communication	Vivekanand Mishra, Sunita P. Ugale	Wiley India

Course Title	**Fiber-optic Communication systems (Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods **Continuous Assessment**	 50

LIST OF EXPERIMENTS

1. Demonstration and study of different types of Optical Fibers and connectors.
2. To establish and Study a 650nm fiber optic analog link.
3. To establish and Study a 650nm fiber optic digital link.
4. Study of Intensity Modulation Technique using Analog input signal. To obtain intensity modulation of the analog signal, transmit it over a fiber optic cable and demodulate the same at the receiver and to get back the original signal.
5. Study of Intensity Modulation Technique using digital Input signal. The objective of this experiment is to obtain intensity modulation of digital signal, transmit it over fiber optic cable and demodulate the same at the receiver end to get back the original signal.
6. To measure propagation or attenuation loss in optical fiber.
7. To measure propagation loss in optical fiber using optical power meter.
8. To measurement of the Numerical Aperture (NA) of the fiber.

Course Code	EC603
Course Title	**Digital Communication (Theory)**
Type of Course	Core
L T P	3 1 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Communication Theory, Communication Engineering
Course Objectives (CO)	1. Understand basic components of digital communication systems. 2. Design and analyze convolution coding schemes for digital communication systems. 3. Analyze the error performance of digital modulation techniques. 4. Design digital communication systems under given power, spectral and error performance constrains. 5. Signal design for band -limited channels for No Inter Symbol Interference. 6. Study of multiple access algorithms and spread spectrum techniques. 7. To impart practical knowledge of digital communication systems.
Course Outcome	1. Explain about basics of digital communication, design of various modulation schemes. 2. Illustrate block coding, convolution coding and Entropy. 3. Explain multiple access techniques, band limited design for no Inter Symbol Interference. 4. Explain spread spectrum systems.

SYLLABUS

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SECTION-A

Signal Space Analysis:

Geometric Representation of Signals, Gram-Schmidt Orthogonalization Procedure. (04hours)

Digital Modulation Techniques:

PSK, FSK, MSK, QAM. Error calculations for PSK, FSK, MSK, QAM, Shannon's limit. (08hours)

Information theory and coding: Entropy, Capacity of a Gaussian Channel. Block codes, Convolution coding and decoding, Soft and Hard decision decoding, State & Trellis diagrams, Viterbi Algorithm, Trellis decoded modulation.
(10hours)

SECTION-B

Multiplexing and Multiple Access: Allocation of communication Resources, FDM/FDMA, TDM/TDMA, CDMA, SDMA, Multiple Access Communications and Architecture, Access Algorithms. (08hours)

Spread Spectrum Techniques: Spread Spectrum Overview, Pseudo-noise Sequences, Direct Sequence and Frequency Hopped Systems, Synchronization of DS and FH systems, Jamming Considerations, Commercial Applications. (08hours)

Signal design for band-limited channels for No Inter Symbol Interference: Pulse shaping to Reduce ISI, types of error-performance degradation, demodulation/ detection of shaped pulses. (07hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Digital Communications	Bernard Sklar	PHI
2.	Principles of Communication Systems	Taub and Schilling	Tata McGraw Hill
RECOMMENDED BOOK			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Communication Signals and Systems	S. Haykins	Wiley
2.	Principles of Digital Communication	J. Das, S.K. Mullick, P.K. Chatterjee	New Age International Ltd
3.	Digital Communications	J.G. Proakis	Tata McGraw Hill

Course Title	**Digital Communication (Practical)**
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. Design and practical implementation of ASK systems
2. Design and practical implementation of PSK systems
3. Design and practical implementation of QPSK systems
4. Design and practical implementation of FSK systems
5. To study the application of CDMA in voice communications
6. To practically compare the noise in PCM and DM systems
7. To practically study Frequency Division Multiplexing.
8. To practically study Time Division Multiplexing.
9. Implementation of Viterbi algorithm using C-language

Course Code	EC624
Course Title	**Control Systems** (Theory)
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Basics of Electrical Engineering, Signals & Systems
Course Objectives (CO)	1. To familiarize with the basics of control systems, using suitable examples. 2. To devise mathematical models and perform time-domain analysis for different types of first and higher order systems. 3. To analyze various methods to find the stability for a control system and draw Bode and Polar plots using it. 4. To introduce the concept of compensators and design lead and lag compensators. 5. To acquire knowledge about modeling and analyzing state space equations for continuous and discrete time systems.
Course Outcome	1. List different types of control systems and discuss their applications in real world. 2. Experiment with various methods to perform stability analysis to design various control systems. 3. Illustrate the need for compensators and construct lead, lag and lead-lag compensators. 4. Choose and compare methods to perform state space analysis, to test the controllability and observability of a control system.

SYLLABUS

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SECTION-A

Introduction:

History of automatic control, servomechanism, regulating systems, open loop , closed loop control systems, feedback, effect of feedback, linear and non linear control systems, block diagrams, Examples: speed control system, robot control system., temperature controls system traffic control system , business control systems etc. (06hours)

Modeling:

Differential equations of physical systems, electrical, mechanical, translational, rational, gear systems, thermal systems. Electrical, mechanical analogies, Laplace transforms, transfer function. Block diagram algebra, signal flow graphs, characteristic equation, Control system components: Error detectors potentiometer, synchros, stepper motor, ac and dc techo-generators. (07hours)

Time Domain Analysis:

Typical test input signals, Transient response of the first order, second order system, Time domain specifications Dominant closed loop poles of higher order systems, Steady state error and error coefficients. (04hours)

Stability:

Concepts of absolute and relative stability pole zero location, Routh-Hurwitz criteria. (02hours)

Root Locus Technique:

Introduction, Root Locus Concept, Construction Root Loci, Stability analysis. (04hours)

SECTION-B

Frequency Response:

Introduction, Bode diagram, polar plots, log magnitude vs. phase plot, nyquist stability criterion, stability analysis, relative stability, Gain margin & Phase margin close loop frequency response. (04hours)

Introduction To Design:

Necessity of compensation, lag and lead compensation, design of PID Controller. (05hours)

State Space Analysis:

Concept of State, state variable and state vector, state space modeling of continuous time and discrete time systems, solution of state equation, concepts of controllability and observability, pole-placement design. (09hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Control Systems Engineering	I.J. Nagrath and M. Gopal	Wiley Easter
RECOMMENDED BOOKS			
1	Design of feedback Control Systems	R. T. Stefani et al	Oxford University Press
2	Modern Control Engineering	K. Ogata	PHI

Course Code	**EC625**
Course Title	**Power Electronics**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Analog Electronic Circuits
Course Objectives (CO)	
Course Outcome	At the end of this course students will demonstrate the ability to 1. Build and test circuits using power devices such as SCR 2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters, 3. Learn how to analyze these inverters and some basic applications. 4. Design SMPS.

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt any two questions from each part.*

SECTION-A

Semiconductor Power Devices (9)

Characteristics of Semiconductor Power Devices: Thyristor, power MOSFET and IGBT Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Controlled Rectifiers (7)

Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of

source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Choppers (7)

Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

SECTION-B

Single-phase inverters (9)

Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter

Switching Power Supplies (6)

Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

Applications (7)

Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

TEXT BOOKS			
S. No.	**Title**	**Author(s)**	**Publisher**
1	Power electronics	Muhammad H. Rashid	Prentice Hall of India
RECOMMENDED BOOKS			
1	Power electronics	Ned Mohan, Robbins	John Wiley and sons. 3rd edition
2	Modern Power Electronics	P.C. Sen	Chand & Co. 2nd edition
3	Power Electronics	V.R.Moorthi	Oxford University Press.
4	Power Electronics	Cyril W., Lander	McGraw Hill. 3rd edition
5	Thyristorised Power Controllers	G K Dubey, S R Doradla	New Age International Publishers

Course Code	EC605
Course Title	**Satellite Communications (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Communication Engineering, Antennas & Wave Propagation
Course Objectives (CO)	1. To gain knowledge of key issues in satellite communication. 2. Satellite Communication is one of the most important spin-offs from space programs and has made major contribution to the pattern of international communication 3. The engineering aspect of satellite communication combines such diverse topics as antennas, radio wave propagation signal processing, data communication, modulation, detection, coding, filtering orbital mechanics, and electronics. Each is a major field of study and each has its own extensive literature. 4. Satellite Communication Engineering emphasizes the relevant material from various areas and help the students to compete with the growing needs.
Course Outcome	1. Illustrate knowledge of communication satellites and sub systems. 2. Ability to describe satellite link design. 3. Analyze GPS principles and applications 4. Able to interpret effects of propagation on the satellite performance.

SYLLABUS

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SECTION-A

Communication Satellite: Orbit and Description

A Brief history of satellite Communication, Satellite Frequency Bands, Satellite Systems,Applications, Orbital Period and Velocity, effects of Orbital Inclination, Azimuth and Elevation, Coverage angle and slant Range, Eclipse, Orbital Perturbations, Placement of a Satellite in a Geo-Stationary orbit. (08hours)

Satellite Sub-Systems

Attitude and Orbit Control system, TT&C subsystem, Attitude Control subsystem, Power systems, Communication subsystems, Satellite Antenna Equipment. (07hours)

Satellite Link

Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic Link Analysis, Interference Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use). (08hours)

SECTION-B

Propagation effects

Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionospeheric Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference. (11hours)

GPS Principles:

History of Navigation, GPS Constellation, Principle of operation, GPS Orbits, Orbital mechanics and Satellite position determination, Time reference, Various DOPs, signal structure, Code and carrier phase measurements, position estimation with pseudorage measurements. GPS applications

(11hours)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1.	Satellite Communications	Timothy Pratt, Charles Bostian, Jeremy Allnutt	John Wiley & Sons
2.	Satellite Communications	D. C.Agrawal	Khanna Publishers
RECOMMENDED BOOKS			
1.	Satellite Communications	Dennis Roddy	Mc-Graw Hill
2.	Digital Satellite Communications	Tri.T.Ha	Mc.Graw Hill

Course Code	EC620
Course Title	**Information Theory & Coding**
Type of Course	Departmental Elective Course
L T P	4 00
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Communication
Course Objectives (CO)	1. To explain the principles and applications of information theory in digital communication systems. 2. Calculation of the capacity of a communication channel in noiseless and noisy channels. 3. Understanding of different coding schemes.
Course Outcome	1. Describe the concepts of information theory and digital communication. 2. Construct efficient codes for data on imperfect communication channels. 3. Explain the concepts of coding schemes.

SYLLABUS

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SECTION-A

Modulation & Detection :

Overview of Shannon's contributions to Information Theory and the digital communication system. Digital modulation: Modulation classification, Signal space representation & the symbol constellation, Linear memory less modulation scheme examples Optimum detection: Correlation demodulator & matched filter, Optimum symbol detectors, Detector performance for several modulation schemes. (08hours)

Source Coding & Channel Coding :

Lossless coding for discrete-valued sources, Discrete memory less source (DMS) Discrete stationary source, Lossy coding for discrete-time sources. Channel models, Channel capacity, The noisy channel coding theorem. (07hours)

Block Codes:
Introduction to block codes, A Galios field primer, Linear block codes, Initial comments on Performance & implementation, Important binary linear block codes, Binary linear block code decoding & performance analysis, Non-binary block codes - Reed-Solomon (RS) codes, Techniques for constructing more complex block codes: product codes, interleaving, concatenated block codes, Space-time block codes. (07hours)

SECTION-B

Convolutional Codes:
Linear convolutional codes & their descriptions, Transfer function representation & distance properties, Decoding convolutional codes, Soft-decision MLSE, Hard-decision MLSE, The Viterbi algorithm for MLSE, Performance of convolutional code decoders, Viterbi algorithm implementation issues: RSSE, trellis truncation, cost normalization, Sequential decoding: Stack, Fano, feedback decision decoding, Techniques for constructing more complex convolutional codes. (09hours)

Turbo & Low Density Parity Check (LDPC) Codes:
Decoding algorithms which generate extrinsic information Turbo codes, Turbo product codes, Turbo equalization, Low Density Parity Check (LDPC) coding & decoding-Basic graph theory concepts, Graph representation of LDPC codes, Decoding LDPC codes. (08hours)

Trellis Coded Modulation (TCM):
Introduction, Trellis coding with higher order modulation, Set partitioning, Trellis coded modulation (TCM), TCM decoding and performance. (06hours)

TEXT BOOKS			
S. No.	**Name**	**AUTHOR(S)**	**PUBLISHER**
1.	Digital Communications	John Proakis&MasoudSalehi	McGraw-Hill, 5th edition, 2008
2.	Digital Communication	Amitabha Bhattacharya,	Tata McgrawHill,2006

Course Code	EC622
Course Title	**Data Acquisition and Hardware Interfacing**
Type of Course	Departmental Elective Course
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	This course will introduce various data acquisition systems and techniques and their application using different hardware interfacing mechanisms.
Course Outcome	1. To understand the principles of operation and limitations of the data acquisition system (single and Multiple channels). 2. To use Labview for analyzing and generating reports of various acquired signals. 3. To use different interface mechanism of devices for communication.

SYLLABUS

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SECTION-A

Signal Conditioning and Data Acquisition:

Analog-to-digital and digital-to-analog converters; sampling rate, multiplexing, resolution, range, and code width; grounding, isolation and noise; single-ended and differential measurements; attenuation, amplification, and filtering; excitation and linearization; impedance mismatch and loading; digital signal conditioning; signal transmission (voltage vs. current loop); and hardware architecture of a modern multi-function data acquisition card. Various DAS Configurations, Single Channel DAS, Multi-Channel DAS, IC Based DAS, Data Acquisition, Data Acquisition in PLC.

(10hours)

Fundamentals of programming logic - Lab View:

Virtual instruments; indicators and controls; front panel and block diagram; data types and data flow programming; case and sequence structures; arrays, loops, and clusters;graphs and charts; sub VIs; and file I/O. (08hours)

Instrument control:
Components of an instrument control system (GPIB and RS-232); detecting and configuring instruments; and instrument drivers. (04hours)

SECTION-B

Instrumentation system design:
Design specifications; functional block representation; design, debugging, and testing; interpretation and presentation of data; user interface; temperature control system design; motor speed control system design; and instrumentation project incorporating multiple sensors, signal interfacing electronics, data-acquisition hardware, instrument control. (09hours)

Buses:
Industry standard architecture (ISA), peripheral component Interconnect (PCI) – Instrumentation Buses: Serial (RS232C, USB) and Parallel (GPIB) Accelerated Graphics port (AGP) – plug-and-play devices – SCSI concepts – USB architecture. (07hours)

Project Work (Using LABVIEW):
Generation of signal (different function generators) on PC and acquiring the signal from sensor at PC again with different sampling rate and quantization level. Representations of different characteristics of acquired signals and their analysis and reporting. (07hours)

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Instrumentation Devices And Systems	Rangan C. S., Sarma G. R. and Mani V. S. V.	Tata McGraw-Hill
2	Modern Electronic Instrumentation and Measurement Techniques	Helfrick Albert D. and Cooper W. D.,	Prentice Hall India
3	Digital Instrumentation	A. J. Bouvens	McGraw-Hill
4	Process Control Instrumentation Technology	Johnson Curtis D.,	Prentice Hall
5	A Course In Electrical And Electronics Measurements And Instrumentation	Shawhney A. K.	DhanpatRai& Sons
6	Data acquisition technique using personal computers	Howard Austurlitz.	

Course Code	EC626
Course Title	**Speech and Audio Processing**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	
Course Outcome	1. Mathematically model the speech signal 2. Analyze the quality and properties of speech signal. 3. Modify and enhance the speech and audio signals.

SYLLABUS

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SECTION-A

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. (6 hours)

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation. (3 hours)

Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction. (7 hours)

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types. (6 hours)

SECTION-B

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection

coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF. (6 hours)

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model. (6 hours)

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zerostate method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP (8 hours)

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards (3 hours)

TEXT BOOKS			
S. No.	**Title**	**Author(s)**	**Publisher**
1	Digital Speech	A.M.Kondoz	Wiley Students Edition
2	Speech Coding Algorithms: Foundation and Evolution of Standardized Coders	W.C. Chu	WileyInter science, 2003.

Course Code	**EC627**
Course Title	**Project-I**
Credits	2
Course Assessment Methods Continuous Assessment	 50
Course Outcomes:	At the end of the course, students will demonstrate the ability to: 1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis. 2. Design, implement and test the prototype/algorithm in order to solve the conceived problem. 3. Write comprehensive report on project work.

Guidelines:

1. The project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The project may be a complete hardware or a combination of hardware and software. The software part in project should be less than 50% of the total work.
3. Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with assigned supervisor and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and objectives of project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed project and documentation in the form of project report is to be submitted at the end of semester.
10. The lab sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

SEVENTH SEMESTER

Course Code	EC710
Course Title	**Wireless & Mobile Communication** (Theory)
Type of Course	Core
L T P	3 1 3
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments,Quiz)	 50 50
Course Prerequisites	Digital Communication
Course Objectives (CO)	1. To gain an understanding of the principles behind the design of wireless communication systems and technologies 2. To impart practical knowledge of wireless systems.
Course Outcome	1. Explain the concept of frequency reuse, capacity enhancement techniques, introduction to 2G & 3G cellular networks and Personal area networks. 2. Explain concept of capacity enhancement techniques, system interference, mobility management and small scale fading. 3. Explain diversity, equalization, different modulation schemes and multiple access techniques used in wireless communications. 4. llustrate wireless networking, GSM architecture and CDMA digital cellular standard.

SYLLABUS

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SECTION-A

Introduction : 12

Evolution of Mobile Communication Systems, cellular telephone systems, comparison of common wireless communication systems, 2G cellular networks, 2.5 G wireless network, HSCSD, GPRS, EDGE technology, 3G wireless network, UMTS, 3G CDMA2000, 3G TD-SCDMA, Wireless Local Loop, Blue tooth and Personal Area Networks.

System Design Fundamentals 10

Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, parameters for

mobile multipath channel.

SECTION-B

Modulation Techniques 10

spread spectrum modulation techniques, Equalization, Equalizers in communication receiver, Diversity techniques, RAKE receiver, Fundamentals of channel coding , Small scale fading, Fading Channels (Rayleigh, Rician)

Multiple Access Techniques 2

FDMA, TDMA, CDMA, SDMA

Wireless Networking 3

Difference between wireless and fixed telephone networks, development of wireless networks, ISDN, VOIP, IP based telephony

Wireless Systems 8

GSM, GSM Architecture, CDMA digital cellular standard, IS-95 system, LTE, LTE Advanced, MIMO systems

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Wireless Communications	Andrea Goldsmith	Cambridge University Press
2	Wireless Communications Principles and practice	Theodore S. Rappaport	Prentice Hall India
RECOMMENDED BOOKS			
3	Modern Wireless Communications	Simon Haykin , Michael Moher	PHI
4	Wireless Communication and Networking	Jon W Mark	PHI

Course Title	Wireless & Mobile Communication (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	 50

LIST OF EXPERIMENTS

1. Equipment orientation
    a. Familiarisation with spectrum analyser , simulation softwares, various kits to be used in the laboratory.
    b. Review of working of function generator , CRO , multimeter& other instruments.
2. Simulation and implementation of baseband digital signals
    a. Types of baseband signals: unipolar, polar, bipolar, RZ, NRZ, etc.
    b. Distortion and noise. Eye diagram.
3. Simulation and implementation of modulated digital signals
    a. PSK, ASK and FSK modulations.
    b. Demodulation with envelope detection and synchronous.
    c. PSK differential modulation.
    d. Quadrature modulations (QASK and QPSK).
    e. QAM modulation.
4. Global System for Mobiles (GSM)
    a. Cellular telephony. GSM Architecture.
    b. Radiofrequency. Traffic and control channels. Frames.
    c. AT Commands
    d. Working of GSM mobile station.
5. Multiple Access
    a. Time division multiple Access
    b. Frequency division multiple access
6. Spread Spectrum communication systems
    a. Pseudo-noise coders
    b. Direct sequence spread spectrum communication systems
    c. Frequency hopped spread spectrum communication systems
    d. CDMA wireless computer communication systems
7. Channel Characteristics
    c. Multipath channel propagation characteristics
    a. Bit-error rate measurement
8. Wireless Networks
    a. Bluetooth wireless network.
    b. Wi-Fi
    c. Wi-Max

Course Code	EC701
Course Title	**Embedded System Design (Theory)**
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Microprocessors, Microcontrollers & Interfacing, Advanced Microprocessors
Course Objectives (CO)	1. To familiarize with the basic hardware of Embedded System, PIC Microcontroller its register file structure, Instruction set,programming& interfacing methods. 2. To understand the concept of software structures, scheduling architecture, IDE , Linker , Locator, Simulators. 3. To know how to get Embedded software into target system debugging strategies. 4. To familiarize with RTOS and RTOS Services.
Course Outcome	1. Deciding which ARM is best for the job in hand. 2. Understand the concept and apply the methodologies employed in designing an embedded system. 3. Develop the applications based on ARM and Thumb Programming model. 4. Analyze and compare the latest ARM including strong ARM, ARM7, ARM8, ARM9 series components.

SYLLABUS

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SECTION-A

Embedded system concepts: 5

Introduction to embedded systems, Difference between embedded and general purpose computing, Embedded system architecture, Embedded system model, RISC, CISC, VLIW, superscalar architecture.

The ARM Architecture 10

The ARM Family History, The Acorn RISC' Machine, Architectural inheritance, The ARM programmer's model, ARM development tools

ARM Assembly Language Programming 6

Data processing instructions, Data transfer instructions, Control flow instructions, Writing simple assembly language programs

The ARM Instruction Set 8

Introduction, Exceptions, Conditional execution, Branch and Branch with Link (B, BL) Branch, Branch with Link and exchange (BX, BLX), Software Interrupt (SWI), Data processing instructions, Multiply instructions, Count leading zeros (CLZ - architecture v5T only), Single word and unsigned byte data transfer instructions, Half-word and signed byte data transfer instructions, Multiple register transfer instructions, Swap memory and register instructions (SWP), Status register to general register transfer instructions, General register to status register transfer instructions

SECTION-B

ARM Organization and Implementation 6

3-stage pipeline ARM organization, 5-stage pipeline ARM organization, ARM instruction execution, ARM implementation, interfacing with various external hardware devices like LED,7 segment , LCD, Keypad.

The Thumb Instruction Set 6

The Thumb bit in the CPSR, The Thumb programmer's model, Thumb branch instructions, Thumb software interrupt instruction, Thumb data processing instructions, thumb single register data transfer instructions, Thumb multiple register data transfer instructions, Thumb implementation, Thumb

Architectural Support for System Development 4

The ARM memory interface, The Advanced Microcontroller Bus Architecture (AMBA)

ARM Processor Cores 5

ARM7TDMI, ARM8, introduction to ARM 9 architecture, Difference between ARM7 & ARM9 architecture, Introduction to RTOS

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	ARM System-on-Chip Architecture	Steve Furber	
2	ARM assembly language: Fundamentals and Techniques	William Hohl	CRC Press
3	ARM Assembly Language Programming & Architecture	Mazidi&Naimi	ARM Books
4	ARM System Developer's Guide: Designing and Optimizing System Software	The Morgan Kaufmann	
5	An Embedded Software Primer	David E. Simon	

Course Title	**Embedded System Design (Practical)**
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
LIST OF EXPERIMENTS	
Programming examples of ARM Processor, Interfacing using ARM: Interfacing of LED, Seven segment display, keypad, LCD etc	

Course Code	EC702
Course Title	**Operations Research** (Theory)
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Linear Algebra and Complex Analysis
Course Objectives (CO)	1. To give the student experience in modeling, solving and analyzing problems using linear programming. Emphasis is stressed on theory, applications, and computer usage. 2. Optimization, i.e., "to do things best under the given circumstances." 3. To improve a quantitative decision making procedure. 4. To help the decision-maker to select the key decision variables that will influence the overall quality of decisions. 5. To make them understand how to transport goods from one place to another at minimum cost. 6. To be able to form networks and find project completion time. 7. To derive formulas to obtain solutions of various models of Dynamic programming.
Course Outcome	1. Identify and develop operational research models from the verbal description of the real system. 2. Understand the mathematical tools that are needed to solve optimization problems. 3. Use mathematical software to solve the proposed models. 4. Learn about the Alternate method to look at linear programming problem. 5. Learn about the methods to minimize the transportation cost. 6. Learn about how to assign jobs to the workers so that cost of assignment can be minimized. 7. Learn about forming networks, critical paths involved in projects, floats and probability of completing a project in a prescribed time. 8. Learn about methods to solve various models such as

	knapsack model, shortest route problem, workforce size models etc. of Dynamic programming. 9. Learn about the serving schedules, arrival rates of customers and time to be spent in a queue at a se4rvice center. 10. Learn about the strategy that a salesman should follow so that he can travel in all the destinations in minimum amount of time. 11. Learn to solve problems in which decision variables cannot take fractional values, using Branch and Bound method and cutting plane algorithm etc.

SYLLABUS

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SECTION-A

Optimization Problems 12

Linear Programming: Graphical Method (Scope as in Chapter 1 of Reference 1), Solution of simultaneous linear equations: An overview (Scope as in Chapter 2, Sections 2.15 – 2.16 of Reference 1), Basic solutions, lines and hyperplanes, convex sets, extreme points, convex sets and hyperplanes (Scope as in Chapter 2, Sections 2.19 – 2.21 of Reference 1), Reduction of any feasible solution to a system of equations to a basic feasible solution, Simplex Method: The simplex algorithm (Scope as in Chapter 3, 4 of Reference 1), Tableau format for simplex computations, Charne's M-method, Two phase method (Scope as in Chapter 5 of Reference 1), The revised simplex method (Scope as in Chapter 7 of Reference 1).

Duality theory: 6

Formulation of the dual problem, Theorems on duality: Weak Duality Theorem, Strong Duality Theorem, Complementary Slackness Theorem, Dual Simplex Algorithm (Scope as in Chapter 8, Sections 8.1 – 8.12 of Reference 1).

Integer Linear Programming: 4

Branch and Bound Algorithm, Cutting Plane Algorithm (Scope as in Chapter 9, Section 9.1 – 9.2 of Reference 2).

SECTION-B

Transportation Problem: 6

Initial solution by North-West corner rule, Row minima method, Column minima method, Matrix minima method, Vogel's method. Tableau of transportation problem, u-v algorithm for solving transportation problem. Degeneracy in transportation problem. (Scope as in Chapter 9 of Reference 1).

The Assignment Problem: 2

Hungarian Method

(Scope as in Chapter 5, Section 5.4 of Reference 2)

Traveling Salesman Problem 2

(Scope as in Chapter 9, Section 9.3 of Reference 2)

Dynamic Programming: 6

Shortest route problem, Knapsack Model, Workforce size model, Equipment replacement model, Investment model, Game of chance (Scope as in Chapter 10, Sections 10.1 – 10.3, Chapter 15, Section 15.1 – 15.2 of Reference 2

CPM and PERT: 2

Network representation, Critical path computations, Construction of time schedule, Linear programming formulation of CPM, PERT networks (Scope as in Chapter 6, Section 6.6 of Reference 2).

Basic Queuing Systems: 5

Elements of a queuing model, Pure birth and pure death model, Generalized Poisson queuing model (Scope as in Chapter 17, Section 17.1 to 17.5 of Reference 2).

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Linear Programming	G. Hadley	Narosa Publishing House
2	Operations Research, An Introduction	Hamdy A. Taha	Pearson Education
3	Operations Research	Kanti Swaroop, P. K. Gupta, Man Mohan	Sultan Chand and Sons
4	Operations Research	A. M. Natarajan, P. Balasubramani, A. Tamilarasi	Pearson Education

Course Code	EC 711
Course Title	**Operating Systems (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Computer Networks
Course Objectives (CO)	1. To introduce design and implementation issues of various Operating Systems: batch, multi-programmed, time sharing, real time, distributed, parallel Operating System structural Components, layered structure, functions 2. To understand concept of processes, CPU Scheduling Algorithms, Inter Process Communication, Process Synchronization, Deadlocks Detection , Recovery, Avoidance and Prevention 3. To familiarize with Memory Management using contiguous memory allocation, paging, segmentation, Virtual Memory, Thrashing. File Systems, directory structure, allocation methods, free-space management,andProtection mechanisms. 4. To understand Disk Structure & Management, Swap Space Management , Android, IOS,Windows Operating system in Mobile phone
Course Outcome	1. Implement various process management concepts including scheduling, synchronization and deadlocks,Implementation of multithreading. 2. Understand concepts of memory management including virtual memory, secondary storage management like disk management, disk scheduling, free space management and swap space management. 3. Understand issues related to file system interface and implementation, protection and security mechanisms 4. Be familiar with various types of operating systems including Android , IOS ,Windows Operating system in Mobile phone

SYLLABUS

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SECTION-A

Introduction: 5

What is an O.S., O.S. Functions; Different types of O.S.: batch, multi-programmed, time sharing, real time, distributed, parallel; General structure of operating system, O/S services, system calls.

Process Management: 10

Introduction to processes - Concept of processes, process scheduling, operations on processes; Inter Process Communication, Critical Sections, Mutual Exclusion with Busy Waiting, Sleep and Wakeup, Semaphores, Message passing; CPU scheduling-scheduling criteria, pre-emptive & non-pre-emptive scheduling, Scheduling Algorithms: FCFS, SJF, RR and priority, Circuit Switching & Packet Switching.

Memory Management: 6

Background, logical vs. physical address space, memory management without swapping; swapping; contiguous memory allocation, paging, segmentation, segmentation with paging; Virtual Memory, demand paging, performance, page replacement, page replacement algorithms (FIFO, Optimal ,LRU); Thrashing.

SECTION-B

File Systems: 6

Files - file concept, file structure, file types, access methods, File attributes, file operations; directory structure, allocation methods (contiguous, linked, indexed), free-space management (bit vector, linked list, grouping), Protection mechanisms.

Secondary Storage: 6

Disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN, LOOK), Disk Management (Disk Formatting, Boot Blocks, Bad Blocks), Swap Space Management (Swap Space use, Swap Space Location, Swap Space Management)

Deadlocks: 6

Introduction to deadlocks, Conditions for deadlock, Resource allocation graphs, Deadlock Detection and Recovery, Deadlock Avoidance, Deadlock Prevention

Latest Operating Systems: 6

Introduction of Android, IOS, Windows Operating system in Mobile phone

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Operating Systems	Galvin &Silberschatz Addison	Wesley Publishing Ltd,5E
2	An Introduction to Operating System	Harvey M. Deitel,	Narosa Publishing House
3	Operating Systems: Design and implementation	Andrew S. Tanenbaum	PHI, 2 E
4.	Operating system	Millan Milankovic	McGraw Hill, 2E

Course Code	EC 703
Course Title	**Nano Technology (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Integrated Circuits, VLSI Design
Course Objectives (CO)	1. To understand what nanotechnology is about and how to use it. 2. To gain knowledge of structure, properties, manufacturing, and applications of silicon and carbon materials. 3. To understand various fabrication methods in nanotechnology (top down & bottom up) 4. To analyse and discuss various characterization methods in nanotechnology (optical, electrical, AFM, SEM, TEM, and nanoindentation)
Course Outcome	1. Students will be able to understand nanotechnology and its scope in modern technology. 2. Students will be able to understand the basic chemistry and physics of the bulk solid state. 3. Students will be able to understand various challenges for development of large scale inexpensive methods of fabrication in Nano science. 4. Students will be able to study various Biological materials used in nanotechnology.

SYLLABUS

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SECTION-A

Introduction to Physics of the Solid State: 10

Structure, Size dependence of properties, Crystal structures, Face-Centered cubic nanoparticles, Tetrahedrally Bonded semiconductor structures, Lattice Vibrations, Energy Bands, Insulators, Semiconductors and conductors, Resiprocal Space, Energy Bands and Gaps of Semiconductors, Effective masses, Fermi surfaces, Localized particles, Donors, Acceptors and Deep Traps, Mobility, Excitons.

Properties of Individual Nanoparticles: 9

Introduction to Semiconducting Nanoparticles, Introduction to Quantum Dots, wells, wires, Preparation of Quantum Nanostructures, Introduction to Carbon Nanotubes, Fabrication, Structure, Electrical properties, Vibrational properties, Mechanical properties.

Biological Materials: 4

Biological Building Blocks, Nucleic Acids, Biological Nanostructures.

SECTION-B

Tools: 11

TEM, Infrared and Raman Spectroscopy, Photoemission and X-RAY spectroscopy, Electron microscopy, SPMs, AFMs, Electrostatic force Microscope, Magnetic force microscope

Nanoscale Devices: 11

Introduction, Nanoscale MOSFET-planer and non planer, Resonant-tunneling diodes, Single electron transistor, Quantum-Dot, Nano-electrochemical systems, Molecular/Bimolecular electron devices

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Nanotechnology	G.Timp; Bell Labs	NJ(Ed.)
2	Inroduction to Nanotechnology	Charless P. Poole	Wiley International
3	Nano Systems: Molecular machinery, manufactureing and computation	Eric Drexler	John wiley and sons

Course Code	**EC723**
Course Title	**Adaptive Signal Processing**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Signal Processing
Course Objectives (CO)	
Course Outcome	1. Understand the non-linear control and the need and significance of changing the control parameters w.r.t. real-time situation. 2. Mathematically represent the 'adaptability requirement'. 3. Understand the mathematical treatment for the modeling and design of the signal processing systems.

SYLLABUS

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SECTION-A

General concept of adaptive filtering and estimation (12)

Applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices. Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error, correlation matrix, excess mean square error and mis-adjustment

Variants of the LMS algorithm (11)

The sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.

SECTION-B

Vector space of random variables (11)

Correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Introduction to recursive least squares (RLS) (11)

Vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.

RECOMMENDED BOOKS			
S. No.	**Title**	**Author(s)**	**Publisher**
1	Adaptive filter theory	Simon Haykin	Prentice Hall, 1986.
2	Adaptive signal processing	C. Widrow and S.D. Stearns	Prentice Hall, 1984.

Course Code	EC704
Course Title	**Computer Architecture & Organization** (Theory)
Type of Course	Core
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Electronics, Digital System Design
Course Objectives (CO)	1. To impart study of the structure and behaviour of various functional modules of a computer. 2. To study how hardware is to be designed given a set of specifications. 3. To gain an understanding of the detailed steps required to design an elementary basic computer.
Course Outcome	1. Acquire knowledge about Register transfer language, various micro-operations, and the design of a basic digital computer. 2. Illustrate understanding of computer software by learning about programming and assembly languages. 3. Analyze general register organization and architecture of a CPU, and micro-programmed control organization using microinstruction formats. 4. Classify various arithmetic algorithms and explain their implementation using digital hardware. 5. Illustrate the techniques that computers use to communicate with input and output devices, and the organization and operation of memories

SYLLABUS

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SECTION-A

Register Transfer and Micro-Operations: Register Transfer Language, Inter Register Transfer Arithmetic, Complements, fixed and floating point Representation, Micro-Operations, Shift Micro-Operations and Control Operations. 06

Basic Computer Origination and design: Instruction Codes, Computer Instructions, Timing and Control, Execution of Instructions, Input, Output and interrupt, Design of Computer. 06

Computer Software: Programming Language, Assembly Language, The Assembler, Program Loops, Programming Arithmetic and Logic Operations, Subroutines, Input-Output Programming. 07

Control Processor Organization: Processor Bus Organization, ALU stack Organization, General Register Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Microprocessor Organization, Pipelining, Parallel Processing. 07

SECTION-B

Micro program Control Organization: Control Memory, Address Sequencing, Micro program Sequences, Microinstruction Formats, and Software Aids. 06

Arithmetic Processor Design: Comparison and Subtraction of unsigned Binary Numbers, Addition, Subtraction, Multiplication, Division Algorithm, Processor configuration and control 06

Input-Output & Memory Organization: Input-Output interface, Asynchronous Data Transfer, DMA, Priority Interrupt, I/O Processor, Virtual Memory, Cache Memory, Associative memory, Memory Management Hardware. 07

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Computer system & Architecture	M. Morris Mano,	Pearson Education
2	Computer architecture and organization	Hayes .J.P	Narosa Publications
3	Logic and computer design Fundamentals	M. Morris and Charles R. Kinre	Pearson Education

Course Code	EC 705
Course Title	**Artificial Intelligence (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Data Structures & Algorithms
Course Objectives (CO)	1. To introduce the AI techniques to solve problems and search strategies to find optimal solution paths from start to goal state. 2. To introduces different knowledge representation methods in AI Programs. 3. To introduce different design techniques for Game Playing Programs. 4. To introduce the AI Agents, their design and planning techniques. 5. To introduce the natural language processing and expert systems.
Course Outcome	1. Provide introduction to AI and explain various techniques and agents. 2. Analyze various problem solving techniques. 3. Describe the different types of planning techniques. 4. Distinguish the different approaches to knowledge representation.

SYLLABUS

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SECTION-A

Introduction: 6

Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents.

Planning: 6

The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning

Problem solving techniques: 5

State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening.

SECTION-B

Knowledge representation: 16

Mapping between facts and representations, Approaches to knowledge representation, Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm, procedural vs declarative knowledge, Forward vs Backward reasoning, Matching, conflict resolution, Non-monotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts.

Introduction to Natural Language processing and expert system: 6

Basic Tasks of Natural Language processing, Expert systems, Expert system examples, Expert System Architectures, Rule base Expert systems, Non Monotonic Expert Systems, Decision tree base Expert Systems.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Artificial Intelligence	Elaine Rich	McGraw Hill
2	Artificial Intelligence	Partick Henry Winston	Addison Wesley
3	AI: A Modern Approach	Stuart J.Russel	Pearson Education
4	Artificial Intelligence	George Luger	Pearson Education
5	Introduction to AI and Expert Systems	DAN, W. Patterson	PHI
6	Principles of AI	A.J. Nillson	Narosa publications

Course Code	EC 706
Course Title	**High Speed Semiconductor Devices & Circuits (Theory)**
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	VLSI
Course Objectives (CO)	
Course Outcome	

SYLLABUS

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SECTION-A 22

High speed Semiconductor Devices and Circuits: Quantum Physics: Quantum theory, Quantum mechanics, Schrodinger equation.Solution of Schrodinger Equation: Free Particle, Particle in Infinite Potential Well, Finite Potential Well, Linear Harmonic oscillator, Energy Band Theory: Culomb Field, Bloch Theorem, Kronig - Penney Analysis, Eigen value equationEnergy in Brilloun Zone representation, Motion of electrons in Energy Bands: Block parameter 'k', Energy-Momentum Relations, Effect of External forces: Concept of Holes, Mobility: Introduction, Lattice vibrations, Carrier Density: Density of States, Finite Drac Statistic, Maxwell-Bottzman approximation, Variation with energy carrier concentration

SECTION-B 23

Extensive doping, Position of intrinsic Energy, Generation -Recombination process in semiconductors, Introduction, Band to Band generation, Band to Band recombination, Generation-Recombination Centimes/Traps. Diffusion and Continuity Equation: Diffusion Current, Eiustem Relation, Continuity Equations. Diodes:Introduction, P-N junction diodes, Diode Currents. Diffusion Capacitance, Transient response of Diode. Schottky Diode Schottky effect learning of the barrier Current transport in Metal-SemiconducterSchottky

Diodes,MultivalleySemiconductors, MESFET (Metal Semiconductor Field Effect Transistor) Introduction Basic FET Operation, Drain Current Field dependent mobility, Saturated velocity model, Semiconductor Heterojunction: Introduction, Energy Alignment Current transport, Bipolar Junction Transister: Introduction, BJT as a Variable current carrier storage, 1st order model of BJT, Current model, Heterojunciton Bipolar Transistor: Introduction, Components of base currents.

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Device Electronics for Integrated circuits	Richard S.Muller Theodore I. Kamins	John Wiley and Sons, 1986.
RECOMMENDED BOOKS			
1	Fundamentals of Semi-Conductor Devices	Edward S. Yang	McGraw Hill, 1988
2	Physics of Semi Conductor Devices	S.M. Sze,1981	
3	MOS Field Effect Transistor and Integrated Circuits	Paul Richaman	John Wiley and Sons

Course Code	**EC722**
Course Title	**Project-II**
Credits	2
Course Assessment Methods Continuous Assessment	 50
Course Outcomes:	At the end of the course, students will demonstrate the ability to: 1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis. 2. Design, implement and test the prototype/algorithm in order to solve the conceived problem. 3. Write comprehensive report on project work.

Guidelines:

1. The project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The project may be a complete hardware or a combination of hardware and software. The software part in project should be less than 50% of the total work.
3. Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with assigned supervisor and based on comprehensive literature survey/need analysis, the student shall identify the title and define the aim and objectives of project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed project and documentation in the form of project report is to be submitted at the end of semester.
10. The lab sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

EIGHTH SEMESTER

Course Code	EC808
Course Title	**Digital Image Processing (Theory)**
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Digital Signal Processing
Course Objectives (CO)	1. To provide the student with the fundamentals knowledge of the concepts of visual perception and image acquisition, basic techniques of image manipulation, segmentation and compression. 2. To impart knowledge of spatial and frequency domains image processing techniques. 3. To familiarize with MATLAB Image Processing Toolbox 4. To introduce the students to a preliminary understanding of Computer Vision. 5. To impart practical knowledge of Image processing operations in MATLAB.
Course Outcome	1. Explain the fundamentals of Image processing system. 2. Explain and implement image enhancement in spatial and transform domain. 3. Explain and implement image compression.

SYLLABUS

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SECTION-A

Introduction 4

Fundamental Steps in Image Processing, Elements of Digital Image Processing, Image Acquisition, Storage, Processing.

Image Perception 8

Structure of the human eye, light, luminance, brightness, contrast, image model, sampling and quantization-uniform and non uniform, basic relationships between pixels, Imaging geometry, Camera model, Perspective Transformation, stereo imaging.

Image Enhancement 10

Spatial domain methods, Enhancement by point processing, histogram processing, image subtraction, image averaging, spatial filtering, smoothing filters, sharpening filters, Enhancement in the frequency domain, Color image processing.

SECTION-B

Image Transforms 11

Fourier Transform, Discrete Fourier Transform, Properties of the Two-Dimensional Fourier Transform, Fast Fourier Transform, Inverse FFT, Walsh Transform, Discrete Cosine Transform, Haar Transform, Slant Transform.

Image Compression 12

Fundamentals, Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria, Image Compression Models, Source Encoder and Decoder, Channel Encoder and Decoder, Elements of Information Theory, Measuring Information, Information Channel, Fundamental Coding Theorems, Using Information Theory, Error-Free Compression, Variable-Length Coding, Bit-Plane Coding, Lossless Predictive Coding, Lossy Compression,Lossy Predictive Coding, Transform Coding, Image Compression Standards.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Image processing	R.C. Gonzalez and R. F. Woods	Pearson Education
2	Digital Image Processing	W.K.Pratt	Tata McGraw Hill
3	Fundamentals of Digital Image Processing	A.K Jain	
4	Digital Image Processing and Analysis	B. Chandra and D. Dutta Majumder	
5	Algorithms for image Processing and Computer Vision	James R.Parker	
7	Digital Image Processing using MATLAB	Woods & Gonzalez	Pearson Education

Course Title	**Digital Image Processing** (Practical)
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS **(Using MATLAB)**	
1.	Intensity transformation
2	Histogram Processing.
3	Spatial Filtering.
4	Frequency Domain Processing
5	Image Restoration.
6	Image Denoising
7	Color Image Processing
8	Wavelet Transform
9	Image Compression

Course Code	EC 809
Course Title	**Advanced Digital Communication (Theory)**
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Communication Engineering, Digital Communication
Course Objectives (CO)	1. Understand basic components of digital communication systems. 2. Design optimum receivers for digital modulation techniques. 3. Analyze the error performance of digital modulation techniques. 4. Design digital communication systems under given power, spectral and error performance constrains. 5. Understand Multichannel and Multicarrier systems. 6. To impart practical training in Advanced Digital communication systems
Course Outcome	1. Identify the major blocks of a digital communication system and explain various forms of signal representation. 2. Represent QAM, PSK, FSK, and other modulation formats using a signal space representation

SYLLABUS

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SECTION-A

Elements of a Digital communication system: 5

Communication channels and their characteristics, mathematical models for communication channels, recent trends in digital communication, Deterministic and Random Signal Analysis, Band pass and Low pass Signal Representation, Signal space representation of waveforms.

Digital modulation Schemes: 9

Representations of digitally modulated signals, memory less modulation methods, PAM, PM, QAM, multidimensional signaling, Signaling schemes with memory, CPFSK,

CPM, Power spectrum of Digitally modulated signals, PSD of a digitally modulated signal with memory, PSD of linearly modulated signals.

Optimum Receivers for Additive White Gaussian Noise Channels: 9

Waveforms and vector channel models, waveforms and Vector AWGN channels, Optimum detection for the Vector AWGN channel, Implementation of the optimal receiver for AWGN channels, the correlation receiver, matched filter receiver, frequency domain interpretation of the matched filter, Performance analysis of wire line and radio communication systems.

SECTION-B

Digital Communication through Band-Limited Channels: 11

Characterization of band-limited channels, Signal Design for band-limited channels, The nyquist criterion, Controlled ISI, Optimum receiver for channels with ISI and AWGN, Optimum MLR, MLSE for Discrete time white noise filter model, Linear equalization, Decision feedback equalization.

Multichannel and Multicarrier System: 11

Multichannel Digital Communication in AWGN channels, binary signals, M-ary orthogonal signals, Multicarrier communication, single-carrier versus multicarrier modulation, Capacity of a Non-ideal linear filter channel, orthogonal frequency division multiplexing (OFDM), modulation and demodulation in an OFDM system, Spectral characteristics of multicarrier signals, Bit and Power allocation in multicarrier modulation.

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Communications	J. G. Proakis	McGraw-Hill
2	Digital Communication	Haykins	McGraw Hill Int Edition
3	Modern Digital & Analog Communication	B P Lathi	Oxford University Press
4	Communication. Systems	A B Carlson	Tata McGraw Hill
5	Digital Communications	Ian A Glover& Peter M Grant	Pearson Education

Course Title	Advanced Digital Communication (Practical)
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
LIST OF EXPERIMENTS:	
	Experiments are based on Theory

Course Code	EC 810
Course Title	**Neural Networks and Fuzzy Logic (Theory)**
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Programming Fundamentals, Digital Electronics
Course Objectives (CO)	1. To explain the need and significance of soft computing concepts 2. To correlate the biological neural system with the artificial neural system 3. To study various artificial neural network architecture and implement the same using MATLAB. 4. To study the various basic concepts of Fuzzy Logic.
Course Outcome	1. Explain the need of Artificial Neural Network and compare this with Biological Neural Network 2. Classify and explain various Supervised learning algorithms 3. Classify and explain various Unsupervised learning algorithms 4. Understand the significance of Fuzzy logic and the basis of its classification

SYLLABUS

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SECTION-A

Fundamentals of Neural Networks 7

Classical AI and Neural Networks, characteristics of neural networks, Historical perspective, The biological inspiration, models of artificial neuron & activation functions, Artificial neural networks & architectures, Training of artificial neural networks.

Supervised Learning 10

Learning and memory, Representation of perceptron, Linear separability, Perceptron Learning, Training of single layer and multi-layer, back propagation training algorithm, Applications of back propagation, Universal function approximation.

Attractors Neural Networks 8

Introduction, Associative memory, Hopfield networks, Content addressable memory, Bidirectional associative memories.

SECTION-B

ART Networks 7

Vector quantization & simplified ART architecture, Architectures & algorithms of ART1 & ART2 networks, Applications.

Self-organizing Feature Map 6

Introduction, Competitive learning, Maxican Hat networks, SOFM algorithm, Applications.

Fuzzy Logic 7

Basic concepts of Fuzzy Logic, Fuzzy vs Crisp set, Fuzzy uncertainty & Linguistic variables, membership functions, operations on fuzzy sets, fuzzy rules for approximate reasoning, variable inference techniques, defuzzification techniques, Applications of fuzzy logic, Fuzzy system design.

RECOMMENDED BOOKS

S. No	NAME	AUTHOR(S)	PUBLISHER
1	Neural Networks – A Classroom Approach	Satish Kumar	TMH
2	Neural Networks, fuzzy Logic, and Genetic Algorithms	Rajasekaran&VijayalakhmiPai	PHI
3	Principles of Soft Computing	Sivanandam, Deepa	Wiley India
4	Fuzzy Logic with engineering applications	Ross	Mc-GrawHil
5	Introduction to Neural Network using MATLAB 6.0	Sivanandam, Sumathi, Deepa	Wiley India

Course Title	**Neural Networks and Fuzzy Logic** (Practical)
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
Course Prerequisites	
LIST OF EXPERIMENTS	
	Experiments are based on Theory

Course Code	**EC 801**
Course Title	**ADVANCED DIGITAL SIGNAL PROCESSING**
Type of Course	Elective Course
L T P	4-0-0
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50

SYLLABUS

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SECTION-A

Transform Theory:

Review of Z-Transform, Solution of Linear Difference Equations, Fourier series and Fourier Transform, Discrete Fourier Transform, Radix-2 FFT.

Introduction to Radix-4 and Split Radix FFT, Discrete Cosine Transform, DCT as Orthogonal Transform, Walsh Transform, Hadamard Transform, Wavelet Transform. (6)

Digital Filters:

FIR Filter Design: Filter Specifications, Coefficient Calculation Methods- Window method, Optimal method, Frequency Sampling method. Realization Structures, Finite Word Length Effects.

IIR Filter Design: Specifications, Coefficient Calculation methods- Pole-Zero Placement method, Impulse Invariant method, Matched Z-Transform method, Bilinear Z-Transformation method, Use of BZT and Classical Analog Filters to design IIR Filters. Realization Structures, Finite Word Length Effects. (8)

Multirate Digital Signal Processing:

Sampling Rate Alteration Devices, Multirate Structures for sampling rate conversion, Multistage design of Decimator and Interpolator, The Polyphase Decomposition, Arbitrary Rate Sampling Rate Converter, Filter Banks, QMF banks, Multilevel Filter Banks, Sub-band Coding, Discrete Wavelet Transform. (7)

SECTION-B

Linear Prediction and Optimum Linear Filters:

Forward and Backward Linear Prediction, Properties of Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction. (5)

Adaptive Digital Filters:

Concepts of Adaptive Filtering, LMS Adaptive Algorithm, Recursive Least Squares Algorithm, Applications, Introduction to Active Noise Control (5)

Power Spectrum Estimation:

Nonparametric methods for Power Spectrum Estimation, Bartlett method, Welch method, Blackman and Tukey method, Parametric methods for Power Spectrum Estimation, Yule-Walker method, Burg method, Unconstrained Least-Squares method, Sequential Estimation methods, Selection of AR

Model Order, MA model for Power Spectrum Estimation, ARMA model for Power Spectrum Estimation. (7)

DSP Chips:
Introduction to fixed point and floating point processors, TMS320C6x series: Architecture, Instruction set, Memory, Addressing Modes, Interrupts, Applications. (6)

TEXT BOOKS			
S. No.	**NAME**	**AUTHOR(S)**	**PUBLISHER**
1	Digital Signal Processing: Principles, Algorithms and Applications	Proakis & Manolakis	Pearson Education
RECOMMENDED BOOKS			
1	Digital Signal Processing	S.K.Mitra	Tata-Mcgraw Hill
2	Discrete Time Signal Processing	Oppenheim & Schafer	PHI
3	Digital Signal Processing: A Practical Approach	Ifeacher& Jervis	Pearson Education
4	Fundamentals of Digital Signal Processing using MATLAB	Robert J. Schilling & Sndra L. Harris	CENGAGE Learning
5	Modern Digital Signal Processing	Roberto Cristi	Nelson Engineering
6	Digital SignalProcessing	Salivahanan, Vallavaraj & Gnanapriya	Tata-Mcgraw Hill
7	Digital Signal Processing and Applications with the TMS320C6713 and TMS320C6416 DSK	R Chassaing, and D Reay	Wiley India

Course Code	EC802
Course Title	**HDL based Systems** (Theory)
Type of Course	Elective
L T P	4 0 2
Credits	4
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	1. To review basic logic design fundamentals. 2. To understand the modelling & simulation & its role in digital evaluation. 3. To learn basic concepts of VHDL language, its different architecture, designing of various combinational & sequential circuits. 4. To study various PLDs & detail study of FPGAs and implementation of various combinational & sequential logic circuits on FPGAs.
Course Outcome	1. Understand the need & application of hardware description language. 2. Modelling & simulations of various basic & advanced digital systems using VHDL. 3. Implementation of various basic & advanced digital systems using FPGAs. 4. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.
SYLLABUS	
***Note for Examiner**- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*	
SECTION-A	

Review of Logic Design Fundamentals Combinational Logic, Boolean Algebra & algebra simplifications, Karnaugh map, Designing with NAND and NOR gates, Hazards in combinational circuits, Flip-Flop & latches, Mealy Sequential circuits design, Moore sequential circuit design, equivalent states and reduction of states tables, sequential circuit timing, tristate logic and busses.	10
Introduction to VHDL Computer-aided design, Hardware description languages, VHDL description of combinational circuits, VHDL modules, sequential statement and VHDL processes, Modeling flip-flops using VHDL processes, Processing using wait statements, two types of VHDL delays: Transport & Inertial delays, compilation, simulation & synthesis of VHDL code, VHDL data types & operators, simple synthesis example, VHDL models for multiplexers, VHDL libraries, Modeling Register & counters using VHDL processes, Behavioral & structural VHDL, Variables, signals & constants, arrays, loop in VHDL, assert & report statements.	12
SECTION-B	
Introduction to programmable logic devices Brief overview of PLDs, Simple PLDs, Complex PLDs, Field Programmable Gate Arrays (FPGAs)	5
Design examples BCD to 7-segemnts display decoder, ABCD adder, 32-bit adder, Traffic light controller, State graphs of control circuits, A shift & add multiplier, Array multiplier.	7
Designing with FPGAs Implementation functions in FPGAs, Implementation function using Shannon's decomposition, Carry chains in FPGAs, Cascade chains in FPGAs, Examples of logic blocks in commercial FPGAs, Dedicate memory in FPGAs, Dedicate multiplier in FPGAs, cost of programmability, FPGAs and on-hot state assignment, FPGA capacity: maximum gates versus usable gates, Design translation (synthesis), mapping, placement & routing.	11

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital System Design Using VHDL	Lizy Kurian John, Charles H. Roth Jr.	Cengage learning, 2nd Edition
2	Introduction to Digital Systems: Modeling, Synthesis, and Simulation Using VHDL	Mohammed Ferdjallah	Wiley Publication
3	Digital Systems Design with VHDL and Synthesis: An Integrated Approach	K. C. Chang	Wiley-IEEE Computer Society Press

Course Title	**HDL based Systems**(Practical)
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
Course Prerequisites	

LIST OF EXPERIMENTS	
1	To design 4:1 multiplexer using concurrent statements
2	To design J-K and S-R Flip flops using process statements
3	To design excess 3 code converter
4	To design BCD to 7-segemnt display decoder
5	To design a traffic light controller
6	Implementation of combinational circuits on FPGAs
7	Implementation of sequential circuits on FPGAs
8	To design a 4-bit ALU

Course Code	EC 803
Course Title	**Optical Networks (Theory)**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Fiber Optic Communication Systems, computer Networks
Course Objectives (CO)	1. To explain the need and significance of optical networks. 2. To study the components and basic building blocks of an optical network. 3. To study various types of optical networks and optical switching. 4. To study various issues related to the management of optical networks and applications of optical networks.
Course Outcome	1. Understanding the need, advantages & applications of optical networks 2. Apply knowledge of basic concepts, working of components of optical networks in research and telecomm industry 3. Understand the working of optical access and metro optical networks 4. Understand the working of optical switching and wavelength routed optical networks

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Optical Networking-Introduction Advantages of optical network, telecom network overview and architecture, WDM optical networks, WDM network evolution, WDM network construction, broadcast and select optical WDM network, wavelength routed optical WDM network, Challenges of optical WDM network.	7

Optical Networking - Components Optical transmitters, semiconductor laser diode, laser characteristics, photo-detectors, tunable and fixed optical filters, channel equalizers, optical amplifiers and its characteristics, semiconductor laser amplifier, Raman amplifier, doped fiber amplifier, various switching elements, OADM, OXC, wavelength convertors.	9
Single and Multi-hop Networks Introduction to single and multi-hop networks, Characteristics of single and multi-hop networks.	4
SECTION-B	
Optical switching Optical packet switching basics, slotted and unslotted networks, header and packet format, contention resolution in OPS networks, self routing, examples on OPS node architecture, optical burst switching, signaling and routing protocols for OBS networks, contention resolution in OPS networks, multicasting, implementation and application. MEMs based switching, switching with SOAs.	9
Optical Access Network Introduction to access network, PON, EPON and WDM EPON: overview & principal of operation, Gigabit Ethernet, radio over fiber network.	4
Optical Metro Networks Introduction to metro network, overview of traffic grooming in SONET ring, traffic grooming in WDM ring, Interconnected WDM networks.	5
Routing and wavelength assignment Issues in wavelength routed networks: Routing wavelength Assignment, Classification of RWA algorithms, RWA algorithms: Fixed Routing, Fixed Alternate Routing, Exhaust Routing, Least Congested Path Routing, Joint Wavelength -Route Selection.	7

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Optical Network Series	Biswanath Mukherjee,	Springer, 2006.
2	Optical Networks	R.Ramaswami and K.Sivarajan,	Â Morgan Kaufmann Publishers, 2nd ed., 2002.
3	Optical Switching Networks	Mayer & Martin	Cambridge University Press, 2008.

Course Code	EC 814
Course Title	**MEMS & Microsystems (Theory)**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	Physics, Integrated Circuits, VLSI Design
Course Objectives (CO)	1. To understand the importance and advantages of Micro fabricating some electrical and mechanical components on micro-scale. 2. To learn the working principle of micro-sensors and micro-actuators. 3. To learn different micro-machining techniques to design micro-sensors and micro-actuators.
Course Outcome	1. Understand the need and advantages of micro fabrication of mechanical and electrical components. 2. Apply knowledge of various disciplines of engineering and sciences to learn the interdisciplinary aspects of MEMS and Microsystems

SYLLABUS

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SECTION-A

Overview of MEMS and Microsystems MEMS and Microsystems, MEMS and Microsystems Products, Evolution of Microfabrication, Multidisciplinary Nature, Microsystems and Miniaturization, Application of Microsystems.	6
Working Principles of Microsystems Microsensors: Acoustic Wave Sensors, Biomedical sensors & Biosensors, Chemical Sensors, Optical Sensors, Pressure Sensors, Thermal Sensors. Microactuation: Actuation using Thermal forces, Actuation using shape-memory alloy, Actuation using Piezoelectric crystal, Actuation using Electrostatic Forces.	6

Scaling Laws in miniaturization Introduction to scaling, Scaling in Geometry, scaling in rigid body dynamics, scaling in electrostatic forces, scaling in electromagnetic forces, scaling in electricity.	6
Materials for MEMS & Microsystems Substrate & wafer, active substrate material, silicon as substrate, gallium arsenide, quartz, piezoelectric materials, polymers, packaging material.	5
SECTION-B	
Microsystems Fabrication Processes Photolithography, Ion implantation, Diffusion, Oxidation, Chemical Vapor Deposition, Physical vapor deposition, epitaxy, etching.	7
Overview of Micromachining Bulk micromachining, surface micromachining, LGA process.	8
Microsystems Design Design Consideration, Process Design, Design of silicon die for micro manufacturing, Computer Aided Design, Introduction to Microsystems Packaging.	7

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	MEMS & Microsystems: Design and Manufacture	Tai-Ran Hsu	McGraw Hill
2	MEMS	N Mahalik	McGraw Hill
3	MEMS and MOEMS Technology and Applications	P.Rai Choudhury	PHI
4	Microsensors MEMS & Smart Devices	Gardner	CBS Publishers

Course Code	EC 804
Course Title	**Imaging and Additive Manufacturing (Theory)**
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 50 50
Course Prerequisites	
Course Objectives (CO)	To understand the complete process of image capturing and developing complex high precision structures through additive manufacturing
Course Outcome	

SYLLABUS

Note for Examiner*- Examiner will set 7 questions of equal marks. First question will cover whole syllabus, having 10 conceptual questions of 1 mark each or 5 questions of 2 mark each and is compulsory. Rest of the paper will be divided into two parts having three questions each and the candidate is required to attempt at least two questions from each part.*

SECTION-A

Introduction And Digital Image Fundamentals: The origins of Digital Image Processing Examples of Fields that Use Digital Image Processing Fundamentals Steps in Image Processing Elements of Digital Image Processing Systems. Elements of digital image processing, Image model, Sampling and quantization, Relationships between pixels	8
Converting Between data classes and Image Types Introduction to M Function Programming using MATLAB • Image Enhancement in the Spatial Domain: Some basic Gray Level Transformations Histogram Processing, o Discrete Fourier Transform, Discrete Cosine Transform, Haar Transform, Hadamard Transform, Enhancement by point processing, Spatial filtering, Enhancement in the frequency domain, Color Image Processing	9
Image Segmentation, Discontinuity detection, Edge linking and boundary detection, Thresholding, Region oriented segmentation, Use of motion for segmentation	6

SECTION-B

Multispectral Image Analysis - Color Image Processing Three Dimensional Image Processing-Computerized Axial Tomography-Stereometry-Stereoscopic Image Display-Shaded Surface Display Image Restoration: A model of The Image Degradation / Restoration Process Project: Part 2 Digital Image Page 6 of 7 Noise Models Restoration in the presence of Noise Only Spatial Filtering Processing Application Some basic morphological algorithms, Extensions to	8

gray level images	
2D & 3D Transformations of geometry: Translations, Scaling, Reflection, Rotation, Homogeneous representation of transformation, Concatenation of transformations, Perspective, Axonometric projections, Orthographic and Oblique projections. Polymer and Photopolymerization, (SLS), LCVD, DMD,	6
Design of Surfaces: Differential geometry, Parametric representation, Curves on surface, Classification of points, Curvatures, Developable surfaces, Surfaces of revolution, Intersection of surfaces, Surface modelling, 16-point form, Coons patch, B-spline surfaces. Design of Solids: Solid entities, Boolean operations, B-rep of Solid Modelling, CSG approach of solid modelling, Advanced modelling methods. Data Exchange Formats and CAD Applications: Data exchange formats, Finite element analysis, reverse engineering, modelling with point cloud data, Rapid prototyping. 3D Scanning and Digitizing Devices CAD Model Construction from Point Clouds, Data handling & Reduction Methods, AM Software (Magics, Mimics, 3Matic, Rhino) Tessellated Models, STL File Problems, STL File Manipulation and Repair Algorithms, Role of Rapid Solidification	8

RECOMMENDED BOOKS

S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Image Processing	Kenneth R Castleman	Pearson Education, 1995
2	Digital Image Procesing	S. Jayaraman, S. Esakkirajan, T. Veerakumar	McGraw Hill Education, 2009
3	Geometric Modeling	Michael E. Mortenson	Wiley, NY, 1997
4	Computer Aided Engineering Design	AnupamSaxena, BirendraSahay	Springer, 2005

Course Code	**EC815**
Course Title	**Wireless Sensor Networks**
Type of Course	**Elective**
L T P	**4 0 2**
Credits	**4**
Course Assessment Methods End Semester Assessment (University Exam.) Continuous Assessment (Sessional, Assignments, Quiz)	 **50** **50**
Course Prerequisites	**Computer networks**
Course Objectives (CO)	
Course Outcome	1. Design wireless sensor networks for a given application 2. Understand emerging research areas in the field of sensor networks 3. Understand MAC protocols used for different communication standards used in WSN **4.** Explore new protocols for WSN

SYLLABUS

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SECTION-A

Introduction:

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc NETworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks (8 hours)

Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts. (7 hours)

Deployment and Configuration: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self configuring localization systems, sensor management Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee,Dissemination protocol for large sensor network. (7 hours)

SECTION-B

Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing. (8 hours)

Data Storage and Manipulation: Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Operating systems and execution environments, introduction to TinyOS and nesC. (7hours)

Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring. Home Control, Building Automation ,Industrial Automation, Medical Applications - Reconfigurable Sensor Networks ,Highway Monitoring ,Military Applications ,Civil and Environmental Engineering Applications, Wildfire Instrumentation ,Habitat Monitoring, Nanoscopic Sensor Applications , Case Study: IEEE 802.15.4 (8 hours)

TEXT BOOKS			
S. No.	Title	Author(s)	Publisher
1	Wireless Sensor Network: Technology, Protocols and Application	Kazem, Sohraby, Daniel Minoli, Taieb Zanti	John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2).
2	"Protocols and Architectures for Wireless Sensor Networks	Holger Karl and Andreas Willig	John Wiley & Sons, Ltd, 2005.
RECOMMENDED BOOKS			
1	A survey of routing protocols in wireless sensor networks	K. Akkaya and M. Younis,	Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349
2	"Wireless Sensor Network Designs",	Anna Ha´c,	John Wiley & Sons Ltd,

Practical :

Experiments related to Wireless Sensor networks and motes