



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,
2017-18

-:O:-

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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:

1. 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.
2. To develop strong theoretical concepts complemented with practical trainings.
3. 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 2017-18

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	EE309	Electrical Science	3-0-2	5	3+1	50	50	100	50
2	EC301	Electromagnetic Theory	3-1-0	4	4	50	50	100	---
3	EC302	Signals and Systems	3-1-0	4	4	50	50	100	---
4	EC303	Microprocessor and Applications	4-0-2	6	4+1	50	50	100	50
5	EC304	Analog Electronic Circuits -II	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			20-2-6	28	25	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

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	MATH S-405	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	EC403	Communication Theory	3-1-0	4	4	50	50	100	---
5	EC404	Engineering Analysis and Design: Virtual Instrumentation	4-0-2	6	4+1	50	50	100	50
6	EC405	Computer Networks	4-0-0	4	4	50	50	100	---
7	----	Educational Tour	----	----	Non-credit	----	----		---
Total			23-2-6	31	27	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	3-0-2	5	3+1	50	50	100	50
2	EC502	Digital Signal Processing	3-1-2	6	4+1	50	50	100	50
3	EC503	Antennas & Wave Propagation	3-0-0	3	3	50	50	100	---
4	EC504	Advanced Microprocessors	3-0-2	5	3+1	50	50	100	50
5	EC505	Digital System Design	3-1-2	6	4+1	50	50	100	50
6	EC513	Control Systems	3-1-0	4	4	50	50	100	---
7	EC514	Summer Training	---	---	1	---	---	---	50
Total			18-3-8	30	26	300	300	600	250

*Practical marks are for continuous and end semester evaluation

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	3-1-2	6	4+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	4+1	50	50	100	50
4		Departmental Elective Course-I	4-0-0	4	4	50	50	100	---
5		Open Elective	4-0-0	4	4	50	50	100	---
6		Minor Specialization Course-I Departmental Honors Course-I	4-0-0	4	4	50	50	100	---
7		Minor Specialization Course-II Departmental Honors Course-II	4-0-0	4	4	50	50	100	---
Total				26/34	23/31	250/350	250/350	500/700	150

*Practical marks are for continuous and end semester evaluation

Total Marks: 650/850

Total Credits: 23/31

Departmental Elective Course-I		
Sr No.	Subject	Subject Code
1	Data Structures and Algorithms	EC604
2	Satellite Communications	EC605
3	Audio and Visual Systems	EC606
4	Data Acquisition and Hardware Interfacing	EC622

Open Elective (Offered to students of other branches by ECE Deptt)		
Sr No.	Subject	Subject Code
1	Engineering Analysis and Design: Virtual Instrumentation	EC613
2	Neural Network and Fuzzy Logic	EC614
3	Microcontroller & Applications	EC615
4	Digital Image Processing	EC616
5	Analog & Digital Communication	EC617
6	Electronics Circuit Design	EC618

Open Elective (Management subject offered to ECE students)		
Sr No.	Subject	Subject Code
1	Managing Innovation and Change	HSS 601

Minor Specialization in ECE (Offered to students of other branches by ECE Deptt) Course- I & II (For Sixth sem) Any two courses		
Sr No.	Subject	Subject Code
1	Microcontroller & Applications	EC615
2	Electronics Circuit Design	EC618
3	VLSI Design	EC619

Minor Specialization in Management (Offered to ECE students) Course- I & II (For Sixth sem)		
Sr No.	Subject	Subject Code
1	Principles of Management	HSS-602
2	Marketing Management	HSS-603

Departmental Honors Courses- I & II (For Sixth sem) (For ECE students) Any two courses		
Sr No.	Subject	Subject Code
1	Information Theory & Coding	EC620
2	Low Power VLSI Design	EC621
3	Data Acquisition and Hardware Interfacing	EC622
4	Smart System Technologies	EC623

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	3-1-2	6	4+1	50	50	100	50
2	EC701	Embedded System Design	4-0-2	6	4+1	50	50	100	50
3		Departmental Elective Course-II	4-0-0	4	4	50	50	100	---
4		Departmental Elective Course-III	4-0-0	4	4	50	50	100	---
5		Seminar-I	0-0-3	3	2	---	---	---	50
6		Project-I	0-0-3	3	2	---	---	---	50
7		Summer Training	---	---	1	---	---	---	50
		Minor Specialization Course-III /Departmental Honors Course-III	4-0-0	4	4	50	50	100	---
		Minor Specialization Course-IV /Departmental Honors Course-IV	4-0-0	4	4	50	50	100	---
		Minor Specialization Course-V /Departmental Honors Course-V	4-0-0	4	4	50	50	100	---
Total				26/38	23/35	200/350	200/350	400/700	250

*Practical marks are for continuous and end semester evaluation

Total Marks: 650/950**Total Credits: 23/35**

Departmental Elective Course-II		
Sr No.	Subject	Subject Code
1	Operation Research	EC702
2	Operating Systems	EC711
3	Nano Technology	EC703

Departmental Elective Course-III		
Sr No.	Subject	Subject Code
1	Computer Architecture and Organization	EC704
2	Artificial Intelligence	EC705
3	High Speed Semiconductor Devices & Circuits	EC706

Minor Specialization in ECE (Offered to students of other branches by ECE Deptt) Course- III, IV and V (For Seventh sem) Any three courses		
Sr No.	Subject	Subject Code
1	Mobile Communication	EC719
2	Embedded Systems	EC720
3	Digital Signal Processing	EC709
4	Analog & Digital Communication	EC714

Minor Specialization in Management (Offered to ECE students) Course- III, IV and V (For Seventh sem) Any three courses		
Sr No.	Subject	Subject Code
1	Financial Management	HSS-701
2	Business Laws	HSS- 702
3	Human Resource Management	HSS-703
4	Business Research	HSS-704

Departmental Honors Courses- III, IV & V (For Seventhsem) Any three courses		
Sr No.	Subject	Subject Code
1	Advanced Digital Signal Processing	EC715
2	Advanced Digital Communication	EC716
3	Sensor Based Application Systems	EC 717
4	Principles of Design Engineering and Product Development	EC 718

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-IV	3-0-2	5	3+1	50	50	100	50
2		Departmental Elective Course-V	3-0-2	5	3+1	50	50	100	50
3		Departmental Elective Course-VI	3-0-0	3	3	50	50	100	---
4		Management Elective	3-0-0	3	3	50	50	100	---
5		Seminar-II	0-0-3	3	2	---	---	---	50
6		Project-II	0-0-3	3	2	---	---	---	50
Total				22	18	200	200	400	200

Departmental Elective Course-IV and V Any two subjects (With Lab)		
Sr No.	Subject	Subject Code
1	Digital Image Processing	EC808
2	Advanced Digital Communication	EC809
3	Neural Networks & Fuzzy Logic	EC810
4	Advanced Digital Signal Processing	EC801
5	HDL based Systems	EC802

Departmental Elective Course- VI		
Sr No.	Subject	Subject Code
1	Optical Networks	EC803
2	MEMS and Microsystems	EC814
3	Imaging and Additive Manufacturing	EC804

Management Elective		
Sr No.	Subject	Subject Code
1	Entrepreneurship and Project Management	HSS801

OPTION - 2

Paper code	Paper title	Duration	Marks Uni. Exam	Int. Marks	Grand Total
EC820	Industrial Training	6 Months	300	300	600
	Total Credits : 18				

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	EE309
Course Title	Electrical Science(Theory)
Type of Course	Core
L T P	3 0 2
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Basic Electronics, Basic Electrical Engineering
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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., Jack E. 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	Joseph A. Edminister	Tata McGraw Hill,

	Circuits		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	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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Calculus, Oscillations and Optics
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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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	SatyaPrakashan
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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Differential Equations and Transforms (MATHS 201)
Course Objectives (CO)	<ol style="list-style-type: none"> 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. 5. To study Hilbert Transform.
Course Outcome	<ol style="list-style-type: none"> 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	5
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.	
Sampling	2
The sampling Theorem, Reconstruction using Interpolation, Aliasing	

SECTION-B

The Discrete time Fourier Transform	7
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	6
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.	
Hilbert Transform	3
Introduction to continuous-time and discrete-time Hilbert Transform	

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	A. Rajeshwari, V. Krishnaveni	Wiley India
3	Signals and Systems	Oppenheim, A. V., Willsky, A. S., Nawab, S.H	Pearson Education
4	Signals and Systems	T. K. Rawat	Oxford University press

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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Digital Design
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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. Ability to engage in self-learning and to function as an effective team member.

SYLLABUS

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SECTION-A

Microprocessor Architecture and Microcomputer Systems	4
Microprocessor Architecture Memory, Input and Output Devices, The 8085 MPU, Example of an 8085-Based Microcomputer, Memory Interfacing	
Interfacing I/O Devices	6
Basic Interfacing Concepts, Interfacing Output Displays, Interfacing Input Devices,	
	20

Memory- Mapped I/O, I/O Interfacing Circuits. 8
Programming the 8085

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 5

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 4

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.

Interfacing Data Converters 4

Interfacing for 8 bit: Digital- to- Analog (D/A) Converters, Analog- to-Digital (A/D) Converters.

General –Purpose Programmable Peripheral Devices 8

The 8255A Programmable Peripheral Interface, Illustration: Interfacing Keyboard and Seven- Segment Display, Illustration: Bi- directional Data Transfer between Two Microcomputers, Block Diagram and pin description of 8254 Programmable Interval Timer, 8259 Programmable Interrupt Controller, Direct Memory Access (DMA) and the 8257 DMA Controller, serial communication, Programmable communications interface 8251

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh S. Gaonkar	Penram International, Edition 3 rd
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 disassemble 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	EC 304
Course Title	Analog Electronic Circuits-II (Theory)
Type of Course	Core
L T P	40 2
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Introduction to Electronics, Analog Electronics Circuits-I
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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.

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 its 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 offset current analysis and compensation, Change in Input offset voltage and Input offset current with time, 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-II(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.

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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

- 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	Organisational Behaviour	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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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, Alwin Toeffler	
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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	
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

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)	

FOURTH SEMESTER

Course Code	MATHS-405
	(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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Calculus (MATHS-101)
Course Objectives (CO)	
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

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, Kernel 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	VivekSahai, VikasBist.	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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	<ol style="list-style-type: none"> 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 study the working of different communications systems in Lab. 6. To impart practical knowledge of different communication systems.
Course Outcome	<ol style="list-style-type: none"> 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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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 midtredquantizers, 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
7	Principles of Digital communication	J. Das, S. K. Mullick, P. K. Chatterjee	New Age International
8	An Introduction to Information Theory	F M Reza	

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. Study 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)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

8051 Micro Controllers: Architecture, Pin configuration, SFR's, Memory, 8051 Addressing modes.	04
8051 Instructions: 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.	06
Input Output Programming: Single bit instruction programming, Single bit operations with CY, Reading Input Pins Vs Port latch, Programming 8051 timers, counter programming.	05
8051 Serial Communication: 8051 connection to RS 232, 8051 serial communications Programming.	02
8051 Interrupts: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Interrupt Priority in the 8051.	04
Interfacing: Interfacing LCD and keyboard interfacing.	03

SECTION-B

Programming model (08) PIC18F programming model, instruction set, instruction format. Data copy, arithmetic, branch, logical, bit manipulation and multiply-divide operations, Stacks, subroutines and macros, Role of Assembler.	08
PIC18F Family: The Architecture of PIC family of devices, PIC18F instructions and assembly language.	03
Interrupts and Timers of PIC: Concepts of Interrupts and Timers, Interrupts and their implementation in PIC18, The PIC18 timers, The CCP, Use of Interrupts in applications.	05
Serial I/O: Concept of serial I/O, SPI protocol, RTC interfacing.	03
Interfacing: Stepper motor, ADC and DAC interfacing using PIC 18.	02

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	
<ol style="list-style-type: none"> 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	EC403
Course Title	Communication Theory
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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 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	Communication Systems: Analog and Digital	R P Singh and S D Sapre	TMH
RECOMMENDED BOOKS			
1	Modern Digital and Analog Communication Systems	B P Lathi, Zhi Ding	Oxford University Press

2	Communication Systems	SimonHaykin	Wiley Limited, Edition	India 5 th
3	Principles of Communication Systems	H. Taub, D. L. Schilling, G. Saha	McGraw 2011	Hill,
4	Principles of Digital communication	J. Das, S. K. Mullick, P. K. Chatterjee	New International	Age
5	An Introduction to Information Theory	F M Reza		

Course Code	EC404
Course Title	Engineering Analysis and Design: Virtual Instrumentation(Theory)
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Physics, Basic Electrical Engineering, Analog Electronic Circuits-I, Analog Electronic Circuits - II
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

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'Arsonval 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, 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; Digitalmultimeter, 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	<i>Electrical and Electronic Measurements and Instrumentation</i>	Sawhney A K	DhanpatRai and Sons
4	<i>Electronic Instrumentation</i>	Kalsi H S	Tata McGraw Hill
5	<i>Transducers and Instrumentation</i>	Murthy D V S	Prentice Hall of India
6	<i>Virtual Instrumentation Using LabVIEW Kindle Edition</i>	Jovitha Jerome	EEE

Course Title	Engineering Analysis and Design: Virtual 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.

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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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, 1 st ed, 2000.
2	Data & Computer Communication	William Stallings	PHI, 6ed, 2002
RECOMMENDED BOOKS			
1	Computer Networks	A. S. Tanenbaum	4 th Edition, PHI
2	An Engineering approach to Computer Networking	S. Keshav	Addison Wesley, 1999

FIFTH SEMESTER

Course Code	EC501
Course Title	VLSI Design (Theory)
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Introduction to Electronics, AEC-I, AEC-II
Course Objectives (CO)	<ol style="list-style-type: none"> 1. To understand theoretical and 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 analyze CMOS logic circuit based on Power dissipation, Speed and Noise Margin.
Course Outcome	<p>Student will be able to:</p> <ol style="list-style-type: none"> 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. No.	NAME	AUTHOR(S)	PUBLISHER

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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 4-E	Proakis&Manolakis	Pearson Education Ltd
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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Physics, Electromagnetic Theory
Course Objectives (CO)	<ol style="list-style-type: none"> 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-Tschebysheff 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	<ol style="list-style-type: none"> 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

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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-Tschebysheff 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	SatyaPrakashan
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	EC504
Course Title	Advanced Microprocessors (Theory)
Type of Course	Core
L T P	3 0 2
Credits	3
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Microprocessors, Microcontrollers and Interfacing
Course Objectives (CO)	<ol style="list-style-type: none"> 1. The course is designed to understand the architecture and instruction sets of different microprocessors and to design systems using them. 2. To study the architecture of microprocessors like 8086, 80386, 80486. 3. To understand the instruction set of the above. 4. To know the methods of connecting them to the peripheral devices. 5. To use all the above in the design of microprocessor/microcontroller based systems. 6. To impart practical knowledge of 8086 microprocessors.
Course Outcome	<ol style="list-style-type: none"> 1. 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. 2. Classify the interrupts of 8086 and data transfer techniques between 8086 and I/O's (DMA in detail). 3. Outline issues related to multiprocessor based systems, architecture, pin details and interfacing of 8087 Math co-processor. 4. Explain advanced microprocessors of 80X86 family like 80486 in terms of architecture, addressing modes, multitasking capability, concept of virtual memory, segmentation and paging scheme

SYLLABUS

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SECTION-A

8086 Architecture:

CPU Architecture, Internal operation, addressing modes, instructions formats, Instruction execution timing. (04hours)

Assembly Language Programming:

Assembler Instruction formats, Data Transfer, Arithmetic, Branch, loop, machine control, logical, Shift and rotate instructions, Directives and operators. (07hours)

Modular Programming:

Linking & relocation, stacks, procedures, Interrupt and routines. (04hours)

Byte And String Manipulation:

String instruction, prefix, text editor, number format conversion. (04hours)

I/O Programming:

Fundamental I/O consideration programmed I/O, Interrupt I/O, Block Transfer and DMA. (03hours)

SECTION-B**System Bus Structure:**

Minimum mode, Maximum mode system bus timing and bus standard. (05hours)

Numeric Data Processor:

8087, NOP data types, Processor architecture (08hours)

Intel 386 And 486 Microprocessors:

Intel 386 Microprocessor, Intel 486 Microprocessor, 486DX Architecture, Register Organization of 486 Microprocessor, memory organization, Virtual Memory, Memory Management Unit(MMU), Interrupts and Exceptions, Addressing Modes of 80486. (10hours)

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Microcomputer Systems 8086/8088, Family	Yu Cheng Liu &G.A.Gibson	PHI
RECOMMENDED BOOKS			
1	Intel's Microcontroller Handbook		

Course Title	Advanced Microprocessors (Practical)
Type of Course	Core
Credits	1
Course Assessment Methods Continuous Assessment	50

LIST OF EXPERIMENTS

1. Write a program to load register A, B, C and D with same constant (e.g.A1). Try to optimize your program in such a way that you use the smallest number of program bytes. Test your program in single step mode.
2. Assume that 4 bytes of data restored at consecutive locations of the data memory starting at location X. Write a program that loads register E with(X) i.e. With data contained at memory location X, D with (X+1), C with (X+2) and B with (X+3+0)
 - a. Use direct addressing mode (LDA)
 - b. User register indirect addressing mode (M)
Test your program in single step mode.
3. (a) Write a program which tests the zero condition of data byte specified at data memory location X. If it is zero, a 00 should be stored at location X+1, otherwise FF.
(b) Write a program which tests the all–one–condition of data byte specified at date memory location X. If all the bytes are 1, store 01 at location X+1, otherwise 00.
4. Four bytes of data are specified at consecutive data memory locations starting X. Write a program which increments the value of 4 bytes by 1.
5. Two unsigned binary numbers are stored at consecutive data memory locations, X+1. Write a program for computing (X+1)-(X). The magnitude of the result should be stored at Y and the sign 00 if positive and 01 if negative at Y+1.
6. (a) A double precision number, i.e. a 16 bit unsigned number, is stored X and X+1, with low order byte at X. Another double precision number is stored at Y and Y+1. Add the two numbers and store the result a W and W+1.
(b) Same as (a). Subtract the two numbers and store the result at W and W+1.
7. A code word is stored at memory location X. Write a program fro testing whether the code word belongs to 2/5 code, and set the location Y to FF if yes 00 if no. The code word is valid if three MSBs are zero and if the number if 1's in the remaining 5 bits is 2 (2/5 Code).
8. A counter is defined as register (e.g. B) which gets decremented till zero. Define such a counter as subroutine. Write a program, which consist of two counters, You must implement the following steps
 - a. Set initial value of counter to 1.
 - b. Call counter subroutine.
 - c. Set initial value of counter to 2.
 - d. Call counter subroutine.
 - e. Go back to step 1.
9. (a) N binary numbers are stored at consecutive data memory locations, starting at x, where N is defined at data member location "NUMBER". Find the largest number and display it in the data field.
(b) N binary numbers are started consecutive data member locations starting at X.

Rearrange the numbers in ascending order.

10. A binary number is stored at data memory locations X. Multiply the number by 10 and display the result in the address field (Hint: $bx10 = bx2 + bx8$, a multiplication by 2 corresponds to a shift left on a bit).
11. An 8 bit binary number is stored at data memory locations. Y. Convert the decimal (BCD) and display the result in the address field.
12. Given 2 digit decimal number at data memory location X and X+1. Find the product using binary multiplications and display the result in address field.
13. Write a program for moving a data block starting address X to address Y. The addresses X, Y, as well as the block length are specified at some suitable data memory locations.
14. A two digit BCD number is stored at memory location X. Convert the number into binary and display the result in data field.
15. Divide a 16 bit number by a 8 bit number and display the result in data field.
16. Write a program for display of decimal numbers 00-99 in sequence with a delay of 15 seconds between any two consecutive numbers.

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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Basic Electronics, Digital Electronics
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

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	EC513
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)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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, rotational, 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

SIXTH SEMESTER

Course Code	EC601
Course Title	Microwave & Radar Engineering (Theory)
Type of Course	Core
L T P	3 1 2
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Physics, Electromagnetic Theory, Antenna and Wave Propagation.
Course Objectives (CO)	<ol style="list-style-type: none">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	<ol style="list-style-type: none">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 lines4. 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, 3 rd Edition
2. Microwave	K. C. Gupta	New Age , Edition 2 nd
3.Microwave Engineering---Special topics	R. Chatterjee	East-West Press
4.Foundations of Microwave Engineering	R.E. Collin	Wiley, 2 nd 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)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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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 Brillouin 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)

7

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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Communication Theory, Communication Engineering
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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)
08

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)

10

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)

08

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 (Practicals)
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	EC604
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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Object Oriented Programming
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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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 3 rd

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)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 Ionospheric 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 pseudorange 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	EC606
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)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

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

	EC 613 (same as EC404)
Course Title	Engineering Analysis and Design: Virtual Instrumentation (Theory)
Type of Course	Open Elective
L T P	4 0 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Physics, Basic Electrical Engineering, Analog Electronic Circuits-I, Analog Electronic Circuits -II
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

Measurement Systems and Characteristics Of Instruments:

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. (07hours)

Electromechanical Indicating Instruments:

Electromechanical Indicating Instruments: D'Arsonval 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, and frequency, Wheatstone, Kelvin, Maxwell, Anderson, Schering and Wien bridge. (11hours)

Electronic Instruments:

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. (06hours)

SECTION-B**Transducers:**

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. (10hours)

Virtual Instrumentation:

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. (11hours)

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

Course Code	EC614
Course Title	Neural Networks and Fuzzy Logic (Theory)
Type of Course	Open 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	Programming Fundamentals, Digital Design
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

Fundamentals of Neural Networks

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. (07hours)

Supervised Learning

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. (10hours)

Attractors Neural Networks

Introduction, Associative memory, Hopfield networks, Content addressable memory, Bidirectional associative memories. (08hours)

SECTION-B

ART Networks

Vector quantization & simplified ART architecture, Architectures & algorithms of ART1 & ART2 networks, Applications. (07hours)

Self-organizing Feature Map

Introduction, Competitive learning, Mexican Hat networks, SOFM algorithm, Applications. (07hours)

Fuzzy Logic

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. (07hours)

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

Course Code	EC615
Course Title	Microcontrollers and Application (Theory)
Type of Course	Minor Specialization Course, Open Elective
L T P	4 0 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Microprocessors
Course Objectives (CO)	<ol style="list-style-type: none"> 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 AVR. 3. To know the techniques of interfacing them to the real world peripheral devices. 4. To use them in the design of microcontroller based systems.
Course Outcome	<ol style="list-style-type: none"> 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 to Embedded System :

A brief history of microcontrollers ,8051, Difference Between MP and MC, Development Board Drivers & Software Installation, Different Compilers Information ,USB ASP Programmer and Burner Software, overview of the AVR family. (04hours)

8051 Instructions:

Architecture, Pin configuration, SFR's, Memory, 8051 Addressing modes. Introduction to 8051 embedded C: 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. (06hours)

Input Output Programming:

Single bit instruction programming, Single bit operations with CY, Reading Input Pins Vs Port latch, Programming 8051 timers, counter programming. (06hours)

8051 Interrupts: Programming Timer Interrupts, Programming External Hardware Interrupts. (04hours)

SECTION-B

AVR PROGRAMMING IN C:

Data types and time delays, i/o programming, logic operations, data conversion programs, data serialization memory allocation, AVR hardware connection, hex file, and flash loaders, ATMEGA32 pin connection, AVR fuse bits , explaining the hex file for AVR, AVR programming and trainer board. (08hours)

Interfacing:

LED Interfacing, LCD Interfacing, Motor Interfacing, Digital IR Sensors, Keypad Interfacing, Interfacing of Temperature Sensor, Buzzer interfacing, Speaker (Monotone) Interfacing & PWM Matrix Keypad Interfacing, Interfacing Relays, RF Module (Wireless Technology), Interfacing USART Protocol. (07hours)

Project Work using KEIL & AVR STUDIO :

Glowing LEDs in a pattern, Seven Segment, LCD interfacing, Detecting White and Black surface with Digital IR Sensors. Learning Interfacing of Motor using LEDs & LCD, Controlling Direction of Rotation of a Motor, Controlling Motor with Digital IR Sensor. Measuring Distance of object using Analog IR Sensors etc. (10hours)

TEXT BOOKS			
S. No	NAME	AUTHOR(S)	PUBLISHER
1.	The 8051 Microcontroller and Embedded System	Muhammad Ali Mazidi, Janice Gillespie Mazidi	Pearson Education
2.	The AVR Microcontroller and Embedded Systems using Assembly and C	Muhammad Ali Mazidi, SarmadNaimi, SepehrNaimi	Prentice Hall
RECOMMENDED BOOKS			
1.	The 8051 Microcontrollers	Ayala	Penram Publications
2.	Fundamentals of Microcontrollers and Applications in Embedded Systems (with the PIC18 Microcontroller Family)	Ramesh Gaonkar	Penram International, 2007
3.	The 8051 Microcontroller	Mackenzie	Pearson Education
4.	Embedded C Programming and the Microchip PIC	Barnett Cox &O’Cull	Thomson, 2006.

Course Code	EC616
Course Title	Digital Image Processing (Theory)
Type of Course	Open 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)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

Fundamental Steps in Image Processing, Elements of Digital Image Processing, Image Acquisition, Storage, Processing. (04hours)

Image Perception

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. (08hours)

Image Enhancement

Spatial domain methods, Enhancement by point processing, histogram processing, image subtraction, image averaging, spatial filtering, smoothing filters, sharpening filters, Enhancement 90

in the frequency domain, Color image processing.

(10hours)

SECTION-B

Image Transforms

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. (11hours)

Image Compression

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. (12hours)

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

Course Code	EC617
Course Title	Analog & Digital Communication(Theory)
Type of Course	Open Elective
L T P	4 0 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Signals & Systems
Course Objectives (CO)	<ol style="list-style-type: none"> 1. To study the analysis of Amplitude modulation, Frequency Modulation, and Phase Modulation. 2. To study Pulse modulation techniques and their mathematical analysis. 3. To study noise considerations in AM, FM, and Pulse modulation systems 4. To study different Digital Modulation and multiple access techniques.
Course Outcome	<ol style="list-style-type: none"> 1. Explain the concepts and mathematical analysis of AM, FM, and phase modulation systems. 2. Explain and analyze the theory and mathematical models of pulse modulation systems. 3. Analyze the effects of noise on different modulation techniques. 4. Explain and analyze digital modulation techniques and multiple access techniques.

SYLLABUS

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SECTION-A

Amplitude modulation

The need for modulation, mathematical analysis of AM, generation and demodulation of AM, Properties of AM signals, DSB-SC, generation of DSB-SC signals, Coherent reception of AM signals, Quadrature carrier multiplexing, single sideband and vestigial sideband modulation, Super-heterodyne receiver. (7hours)

Angle Modulation

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. (08hours)

Pulse Modulation

The need for sampling, the sampling process, Nyquist sampling theorem, Practical sampling, PAM, PWM, PPM, PCM, quantization noise, companding, Delta modulation, Differential PCM. (08hours)

SECTION-B

Noise in communication systems

The receiver model and figure of merit of a communication receiver, Noise in AM receivers, threshold effect, Noise in FM systems, Pre emphasis and de-emphasis, Noise in PCM. (08hours)

Digital modulation techniques:

PSK, FSK, MSK, QAM. Error calculations for PSK, FSK, MSK, QAM, Shannon’s limit. (07hours)

Multiplexing and Multiple Access:

Allocation of communication Resources, FDM/FDMA, TDM/TDMA, CDMA, SDMA, Multiple Access Communications and Architecture, Access Algorithms. (07hours)

TEXT 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
RECOMMENDED BOOKS			
1.	Digital Communications	Bernard Sklar	PHI
2.	Principles of Communication Systems	H. Taub, D. L. Schilling, G. Saha	McGraw Hill, 2011
3.	Communication Systems: Analog and Digital	R P Singh and S D Sapre	Tata McGraw Hill
4.	Principles of Digital communication	J. Das, S. K. Mullick, P. K. Chatterjee	New Age International
5.	Digital Communications	J.G. Proakis	Tata McGraw Hill
6.	Electronic Communication Systems	G. Kennedy	McGraw Hill, 4th Edition

Course Code	EC618
Course Title	Electronics Circuit Design
Type of Course	Minor Specialization Course
L T P	4-0-0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Physics
Course Objectives (CO)	<ol style="list-style-type: none"> 1. Develop the capability to analyze and design simple electronic circuits. 2. Gain knowledge about working and applications of various electronic components such as Diode, Transistor, Op-amp. 3. Understand the concept of sensors and signal conditioning
Course Outcome	<ol style="list-style-type: none"> 1. Become adept at using methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers. 2. Learn working of elementary electronic components, e.g., resistors, capacitors, diodes, transistors and op-amp. 3. Apply the concept of electronic devices, sensors and signal conditioning to observe physical signals.

SYLLABUS

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SECTION-A

Semiconductor Devices: Ohm's Law, KVL and KCL, Series and parallel Resistance, Capacitance, Voltage and Current divider rule, active and passive devices, Intrinsic and Extrinsic Semiconductors. Structure, working, and applications: PN-Junction (Rectifier, Clipper and Clamper), LED, Zener Diode and Photo Diode. BJT, Current Components in BJT. Diode and transistor as an electronic switch, Common Emitter Amplifier with Voltage divider, Impedance matching, Multi-stage Amplifier, Types of coupling, Effect of cascading on voltage gain, Current gain, Phase, Input and output impedances and bandwidth. (10hours)

Operational Amplifier: Block diagram of a typical op-amp, symbol, characteristics and performance parameters of ideal Op-Amp, Concept of feedback in electronics, Positive and

negative feedback, Voltage and Current feedback, Series and Shunt feedback, Effect of feedback on performance characteristics of an amplifier. (10hours)

Section B

Op-Amp Applications: Differential, Inverting & Non-Inverting. Practical op-amp, Common mode configuration, DC and AC amplifiers, Peaking amplifiers, Summing, Scaling and Averaging amplifiers, Differential amplifier, Differentiator and Integrator, Clipping circuits (diode), Operational amplifier as comparator, clamping circuit ADC and DAC. (10hours)

Sensors and Signal Conditioning: Introduction to Sensor Electronics and terminology, Strain, Temperature, Pressure, Flow measurement, IR sensor, Accelerometer, Piezoelectric sensor. Wheatstone Bridge for sensors: Single/ two/ all element varying bridge, Bridge Design issues, Amplifying and linearizing Bridge, Driving Remote Bridges, Instrumentation amplifier, Integrated Bridge transducers, Smart Transducers. (10hours)

Project Work: Testing of Electronic components: Resistor, open/ short circuit, Capacitor, Diode, Transistor, op-amp. Design of DC Power supply, Working Concept, Types, study of LM95235-Q1 (Texas Instruments), Pressure Sensor: Working concept, Types, Study of FXTH87 (Freescale) , Working concept of Free scale Heart rate monitor, Study of IR sensor for distance measurement, Finger Print Recognition (MCF5249 Freescale), Accelerometer: working concept and study of MMA16xxW (Freescale) Automatic Temperature control circuit. (05hours)

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Op-Amps and Linear integrated Circuits	Ramakant A. Gayakward	Pearson Education, 4th edition
2	Integrated Electronics	Millman&Halkias	Tata McGraw Hill
RECOMMENDED BOOKS			
1.	Electronics Circuit Analysis and Design	Donald A. Neamen	Tata McGraw Hill
2.	Electronics and Circuits Lecture Notes,	Peter McLean	School of Electronic Mechanical and Mechatronic Systems University of Technology, Sydeny

Course Code	EC619
Course Title	VLSI Design (Theory)
Type of Course	Core
L T P	4 0 2
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Introduction to Electronics, AEC-I, AEC-II
Course Objectives (CO)	<ol style="list-style-type: none"> 1. To understand theoretical and 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 analyze CMOS logic circuit based on Power dissipation, Speed and Noise Margin.
Course Outcome	<ol style="list-style-type: none"> 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 Diagrams and 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 Dissipation and 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
3.	Integrated circuits	K.R. Botkar	Khanna Publishers
4.	CMOS Digital Integrated Circuits	Sung- Mo (Steve) Kang and Yusuf Leblebici	Tata McGraw Hill
RECOMMENDED BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
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 Code	EC620
Course Title	Information Theory & Coding
Type of Course	Departmental Honors Course
L T P	4 00
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Communication Engineering, Digital Communication
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 Galois 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	EC621
Course Title	Low Power VLSI Design
Type of Course	Departmental Honors Course
L T P	4 00
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Introduction to Electronics, AEC-I, AEC-II, VLSI Design
Course Objectives (CO)	<ol style="list-style-type: none"> 1. To provide an educational perspective on low-power design for CMOS circuit 2. Promote a structured design methodology for low power design 3. Appraise various power optimization and estimation techniques
Course Outcome	<p>Student will be able to:</p> <ol style="list-style-type: none"> 1. Demonstrate the sources of power dissipation in a CMOS circuit. 2. Describe various power reduction techniques. 3. Illustrate the power optimization and estimation techniques.

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

Low Power CMOS Logic Circuit:

Introduction, Power and Energy Basics, Dynamic Power Dissipation, Short Circuit Power, Switching Power, Glitching Power, Static Power Dissipation, Low power design through Voltage scaling, Estimation and optimization of Switching activity, Reduction of switched capacitance, Adiabatic Logic Circuits, Advanced MOS Transistors. (08hours)

Circuit level Low Power Design

Energy-delay Trade-off, Dynamic power Optimization: Multiple Supply voltages, transistor resizing, Technology mapping. Static power Optimization: Multiple threshold, Transistor stacking. (08hours)

Low Power Arithmetic Components :

Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look- Ahead Adders. (06hours)

SECTION-B**Low power Architectures, Algorithms, and Systems**

Architecture, algorithm trade-off space, Concurrency improves energy efficiency, Exploring alternative topologies, removing inefficiency, the cost of flexibility. (08hours)

Optimizing Standby Power and Runtime Power

Sleep mode management, Standby Dynamic power: Clock gating, Standby Static Power: Transistor sizing, Power gating, body biasing, Supply voltage ramping. Memory standby power optimization. Dynamic voltage and frequency scaling and Adaptive body biasing. (08hours)

Power Estimation Techniques

Logic power estimation – Simulation power analysis Probabilistic power analysis. (07hours)

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Low Power CMOS VLSI Circuit Design	Kaushik Roy and Sharat C. Prasad	Wiley Inter science Publications
2	Low Power Digital CMOS Circuit Design	Anantha P. Chandrakasan and Robert W. Brodersen	Kluwer Academic Publishers
RECOMMENDED BOOKS			
1	CMOS Digital Integrated Circuits	Sung- Mo (Steve) Kang and Yusuf Leblebici	Tata McGraw Hill
2	Low Power Design Essentials	J. Rabaey	Springer, 2009

Course Code	EC622
Course Title	Data Acquisition and Hardware Interfacing
Type of Course	Departmental Honors Course
L T P	4 00
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	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

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

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	EC623
Course Title	Smart System Technologies
Type of Course	Departmental Honors Course
L T P	4 00
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	This course shall introduce various MEMS, NEMS based smart system technologies. This would help them to process the acquired data from real world so as to make the system smart.
Course Outcome	<ol style="list-style-type: none"> 1. Analyze real life problems requiring smart systems. 2. Identify components to implement solutions.

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:

Main definitions for smart sensors and its properties, quasi-digital sensors, MTS, MEMS and system-on-chip (SoC); Sensors classifications from output point of view and quasi-digital sensors classification; Sensors architectures for integrated and smart sensors; Informative parameters (unified and frequency-time domain parameters of signal); Advantages of frequency as informative parameter including high noise immunity, high power of signal, wide dynamic range, high reference accuracy, simple interfacing, simple Integration and coding. (10)

Smart and Quasi-Digital Sensors State-of-the-Art:

Temperature sensors, pressure sensors and transducers, accelerometers, rotation speed sensors, intelligent opto (light and color) sensors, humidity sensors, mass variation chemical, gas and biosensors, magnetic sensors and others (tilt, torque, level, flow, conductivity, etc.) as well as multiparameters sensors. This lets to formulate main requirements for modern sensors systems. (8)

Classical Frequency-to-Digital Conversion Methods:

standard counting method, indirect counting method, combined method and interpolation method. Metrological performances (quantization error and other components of conversion error, conversion time, frequency range) and measures how to reduce the quantization error. It is shown that the use of weight functions can improve metrological characteristics. Phase shift-to-digital conversion. (4)

Advanced and Self-Adapted Conversion Methods:

Ratiometric counting method, reciprocal counting method, M/T counting method, constant elapsed time (CET) method single- and double buffered methods, DMA transfer method, method of dependent count (MDC) and method with non-redundant reference frequency. Methods for duty-cycle - to - digital and phase shift-to-digital conversion.

SECTION-B**Smart Sensor Systems:**

One-channel, multi-channel and software level sensor interfacing. Multilayer sensor based network architecture. A case study of smart sensor system - Anti-Lock Braking System (ABS) including rotation speed sensor, conversion method and sensor interfacing. (9)

Virtual Instruments:

Definition of virtual instrument. Differentiate virtual instruments from measuring systems based on PC interfacing, standalone measuring instruments, measuring systems with GUI and microcontroller-based measuring systems with virtual measuring channel. Industrial DAQ boards. Virtual instruments examples: virtual thermometer, data logger for pressure sensors, virtual tachometer and video-graphic paperless recorder. (7)

Sensor Buses, Protocols and Networks:

Sensor buses and protocols: I2C, SPI, SMBus, Maxim/Dallas 1-Wire and 3-Wire buses, CAN Bus. MODBus (protocol), SSI (bus and protocol), Fieldbus. Comparative analyze of different sensor buses. Comparative analyze of two wireless standard ZidBee and Bluetooth. (7)

Digital Sensors and Smart Sensors System Design:

Practical realizations of different smart sensors systems and digital sensors: optical sensors systems with color-to-digital and light-to-digital converters; a DAQ system for temperature sensors; accelerometers based systems; rotation speed digital sensors and systems; digital humidity sensors and data loggers; temperature and humidity multisensors system; pressure sensors systems and digital gauges; digital magnetic sensors and systems; multiparameters sensors systems.

IEEE 1451 Standard and Frequency Sensors:

Brief introduction to IEEE 1451 standard and its extension for any sensors and transducers from frequency-time signal domain. Direct Sensor-to-Microcontroller Interface for resistive, capacitance, inductance, resistive bridges sensing elements. Future Trends - The future development of main systems' components as the Universal Frequency-to-Digital Converter (UFDC-2) and Universal Sensors and Transducers Interface (USTI). Integration of all components of sensor system into a single system-on-chip (SoC) with advanced processing and conversion methods.

Project Work:

Students will work on different problems from industries and come up with some practical solutions.

RECOMMENDED BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Fundamentals of Instrumentation and Measurement	Placko. D	John Wiley & Sons; 2007
2	Understanding the Smart Sensors	Frank. R,	Artech House; Second edition; 2000
3	Fundamentals of Industrial Instrumentation and Process Control	Dunn. C.W	McGraw-Hill, 2005
4	Introduction to Instrumentation, Sensors and Process Control	Dunn. C. W	Artech House; 2006
5	Smart Sensor Systems	Meijer.M. C.G	John Willey & Sons Ltd; 2008

Course Code	HSS- 601
Course Title	Managing Innovation and Change
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	The main aim of this course is to make students learn how to manage innovation and change in organizations and understand how innovation and change can contribute to business success.
Course Outcome	The student will learn the technological, human, economic, organizational, social and other dimensions of innovation. The students will understand how to encourage, manage and implement innovation and change in organization and how to take a new idea to the stage where it can be implemented.

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 Innovation and Change

Concept, Types, Sources, Components, Invention vs. Innovation (6 hours)

Innovation in Organization

Innovation in Managerial Functions (Planning, Organizing, Staffing, Directing and Controlling), Innovation in Operational Functions (Marketing, Human Resource and Finance), Case Studies and Brainstorming Sessions (8 hours)

Innovation Policy

Innovation Cluster, National Innovation Systems (6 hours)

Innovation Management

Innovation Management: Innovation Strategies, Models, Processes and Structures

Case Study on Innovation Management (5 hours)

SECTION-B

Reactions to Change

Process of Planned Change, Responses to Change, Reasons for Resistance to Change,

Change Agents, Stages in Reaction to Change (8 hours)

Change Management

Key Dimensions and Factors, Organizational Change, Approaches to Change Management

Case Study on Change Management (7 hours)

Intellectual Property Right (IPR)

Patents, Copyrights and Trademarks (3 hours)

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

- 8 Steps to Innovation – Going from Jugaad to Excellence

- Innovation Secrets of Indian CEOs

- Jugaad Innovation: A Frugal and Flexible Approach to Innovation for the 21st Century

- The Ten Faces of Innovation (2 hours)

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	“Managing Change and Transition	Harvard Business School	Harvard University Press, 2003
2	“Managing Creativity and Innovation”, Harvard Business School, Pubs: Harvard University Press.	Harvard Business School	Harvard University Press, 2003
3	“Managing Change, Creativity and Innovation”	Dawson P. and Andriopoulos C.	Sage Publications, 2014
4	“Managing Strategic Innovation and Change”	Tushman M.L. and Anderson P.	2 nd Edition, Pubs: Oxford University Press, 2004
RECOMMENDED BOOKS			
1	“The International Handbook of Innovation”	Larisa V.S.	Elsevier Science, 2003
2	“Managing Innovation and	Mayle D.	3 rd Edition, Pubs: Sage

	Change”		Publications, 2006
3	“Managing Technology and Innovation for Competitive Advantage”	Narayanan V.K.	Pearson India, 2002
4	“Managing Technological Innovation, Competitive Advantage from Change”	Betz F.	Wiley, 2011

Course Code	HSS 602
Course Title	Principles of Management
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Basic understanding of management
Course Objectives (CO)	The main aim of this course is to make students understand the management process and principles along with its application in practical life and to help them manage different jobs and situations with the help of management functions.
Course Outcome	<ol style="list-style-type: none"> 1. The students will be able to apply management concepts and principles in daily life and thus, will be able to manage things efficiently and effectively. 2. The students will learn how to get work done easily by using management knowledge and functions.

SYLLABUS

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SECTION-A

Introduction to Management

Nature of Management: Art or Science, Principles and Functions of Management (4 Hours)

Evolution of Management Thought

Classical Theories: Bureaucratic, Scientific and Administrative Approach

Neo-Classical Theories: Human Relations and Human Behaviour Approach

Modern Theories of Management

Relevance of Management Thought in present scenario – Management Cases (9 Hours)

Planning

Nature of Planning, Planning Process, Application of Planning Process in a Hypothetical Situation, Types of Planning, Types of Plans, Management by Objective (MBO) (7 hours)

Organizing

Concept of Organization, Departmentation, Forms of Organization Structure, Analysis of Organization Structure – Case Studies

Hypothetical Formation of an Organization

New Methods of Managing Organizations (6 hours)

SECTION-B

Staffing

Human Resource Planning: HRP Process, Job Analysis: Job Description, Job Specifications and Used of Job Analysis

Recruitment: Sources and Methods

Selection: Selection Process, Role Playing and Case Study on Selection Tests and Interviews
 Training and Development: Techniques, Performance Appraisal: Methods
 Case Study on Staffing Practices (10 hours)

Directing

Concept, Leadership: Importance and Styles, Motivation: Theories and their relevance in present scenario, Communication: Process, Types and Barriers of Communication
 Management Game on Leadership, Motivation and Communication (6 hours)

Controlling

Nature and Process of Controlling, Requirements for Effective Controlling (3 hours)

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	“Principles and Practices of Management”	Rao V.S.P. and Narayana P	Konark Publishers, 1987
2	“Principles & Practice of Management”	Prasad L.M.	8 th Edition, Sultan Chand & Sons, 2012
RECOMMENDED BOOKS			
1	“Essentials of Management: International and Leadership Perspective”	Weihrich H. and Koontz H.	9 th Edition, McGraw Hill, 2012
2	“The New Era of Management”, ,	Daft R.L.	11 th Edition, Cengage Learning, 2014
3	“Management: Text and Cases”	Rao V.S.P. and Krishna V.H.	Excel Books, 2008
4	“Fundamentals of Management: Essential Concepts and Applications”,	Robbins S.P, DeCenzo D.A., Bhattacharya S. and Agarwal M.N.	6 th Edition, Pubs: Pearson India, 2009

Suggested Books:		
S.No.	Name of Book/ Authors/ Publisher	Year of Publication
1	“Principles and Practices of Management”, Rao V.S.P. and Narayana P.S., Pubs: Konark Publishers.	1987
2	“Principles & Practice of Management”, Prasad L.M., 8 th Edition, Pubs: Sultan Chand & Sons.	2012
3	“Essentials of Management: International and Leadership Perspective”, Weihrich H. and Koontz H., 9 th Edition, Pubs: McGraw Hill.	2012
4	“The New Era of Management”, Daft R.L., 11 th Edition, Pubs: Cengage Learning.	2014
5	“Management: Text and Cases”, Rao V.S.P. and Krishna V.H., Pubs: Excel Books.	2008
6	“Fundamentals of Management: Essential Concepts and Applications”, Robbins S.P, DeCenzo D.A., Bhattacharya S. and Agarwal M.N., 6 th Edition, Pubs: Pearson India.	2009

Course Code	HSS-603
Course Title	Marketing Management
Type of Course	Elective
L T P	3 0 0
Credits	3
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	The main aim of this course is to make students understand about the marketing concepts to be applied in real life and the marketing process for delivering value to customers.
Course Outcome	<ol style="list-style-type: none"> 1. The students will learn how to market goods and services effectively to different segments so as to deliver value to customers. 2. The students will be able to formulate marketing mix and marketing strategies for different products and different sets of customers.

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 Marketing

Concepts, Role, Scope and Types of Marketing, Case Study on Marketing Management
(4 hours)

Marketing Research

Scope and Process of Marketing Research, Hypothetical Marketing Research Analysis
(5 hours)

Consumer and Business Markets

Types of Markets, Building Customer Value
Consumer and Business Buying Behaviour: Factors Influencing Behaviour and Buying Decision Process
(6 hours)

Selection of Markets

Segmentation: Factors and Bases, Targeting and Positioning
Preparation of STP of Selected Product
(5 hours)

SECTION-B

Marketing Mix

7 P's of Marketing Mix: Product, Price, Physical Distribution, Promotion, People, Process and Physical Evidence, Formulation of Marketing Mix of Selected Product (6 hours)

Product Decisions

Product (Good or Service) Characteristics, Product Life-Cycle, Packaging and Branding, Product Development and Management (5 hours)

Pricing Decisions

Pricing Policies and Strategies, Factors Influencing Pricing (4 hours)

Physical Distribution Decisions

Marketing Channels, Channel Players, Physical Distribution, Managing Distribution, Analysis of Supply Chain Management – Case Studies (5 hours)

Promotion Decisions

Nature of Promotion Decisions, Managing Mass Communication and Personal Communication
Analysis of Promotional Strategies – Case Studies (5 hours)

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	"Marketing Management: Concepts, Cases, Challenges and Trends"	Govindarajan M	2nd Edition, PHI Learning, 2009
2	"Marketing Management",	Kotler P., Keller K.L., Koshy A. and Jha M.	14 th Edition, Pearson India, 2012
RECOMMENDED BOOKS			
1	"Marketing Concepts and Strategies",	Dibb S., Simkin L., Pride W.M. and Ferrell O.C.	Cengage Learning, 2012
2	"Marketing Management", , 2 nd Edition,	Kumar A. and Meenakshi N.	Vikas Publishing House Pvt. Ltd., Noida, 2011.
3	"Marketing Management"	Saxena R.	4 th Edition, McGraw Hill Education (India),2013
4	"Marketing: Managerial Introduction"	Gandhi J.C.	1 st Edition, McGraw Hill Education,1987
5	"Marketing"	Etzel M.J., Walker B.J., Stanton W.J. and Pandit A.	14 th Edition, McGraw Hill Education (India), 2010.
6	"Super Marketwala: Secrets to Winning Consumer India"	Mall D.	1 st Edition, Random House India, 2014.

SEVENTH SEMESTER

Course Code	EC710
Course Title	Wireless & Mobile 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 Engineering, Antennas & wave propagation, Digital Communication
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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. Illustrate wireless networking, GSM architecture and CDMA digital cellular standard.

SYLLABUS

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SECTION-A

Introduction :

12

Evolution of Mobile Communication Systems, Paging systems, cordless telephone 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

9

Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, parameters for mobile multipath channel, Small scale fading.

SECTION-B

Modulation Techniques	10
Amplitude modulation, Angle Modulation, Digital Modulation, Linear modulation techniques, Constant envelope modulation, spread spectrum modulation techniques, Equalization, Equalizers in communication receiver, Diversity techniques, RAKE receiver, Fundamentals of channel coding	
Multiple Access Techniques	3
FDMA, TDMA, CDMA, SDMA	
Wireless Networking	4
Difference between wireless and fixed telephone networks, development of wireless networks, ISDN	
Wireless Systems	7
GSM, GSM Architecture, CDMA digital cellular standard, IS-95 system.	

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Wireless Communications Principles and practice	Theodore S. Rappaport	Prentice Hall India
RECOMMENDED BOOKS			
2	Modern Wireless Communications	Simon Haykin , Michael Moher	PHI
3	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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Microprocessors, Microcontrollers & Interfacing, Advanced Microprocessors
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

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	EC 702
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	Engineering Mathematics-III
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

	<p>knapsack model, shortest route problem, workforce size models etc. of Dynamic programming.</p> <p>9. Learn about the serving schedules, arrival rates of customers and time to be spent in a queue at a service center.</p> <p>10. Learn about the strategy that a salesman should follow so that he can travel in all the destinations in minimum amount of time.</p> <p>11. Learn to solve problems in which decision variables cannot take fractional values, using Branch and Bound method and cutting plane algorithm etc.</p>
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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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Computer Networks
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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:	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)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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, Reciprocal Space, Energy Bands and Gaps of Semiconductors, Effective masses, Fermi surfaces, Localized particles, Donors, Acceptors and Deep Traps, Mobility, Excitons.

Properties of Individual Nanoparticles: 10

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: 6

Biological Building Blocks, Nucleic Acids, Biological Nanostructures.

SECTION-B

Tools: 10

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

Nanoscale Devices: 9

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	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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Digital Electronics, Digital System Design
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Data Structures & Algorithms
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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 propositional 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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	VLSI
Course Objectives (CO)	
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

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 equation Energy 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, Eiuistem 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-Semiconductor Schottky

Diodes, Multivalley Semiconductors, 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 Transistor: Introduction, BJT as a Variable current carrier storage, 1st order model of BJT, Current model, Heterojunction 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	EC 719
Course Title	Mobile Communication(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, 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. Illustrate wireless networking, GSM architecture and CDMA digital cellular standard.

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 :

12

Evolution of Mobile Communication Systems, Paging systems, cordless telephone 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

9

Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, parameters for mobile multipath channel, Small scale fading.

SECTION-B

Modulation Techniques	10
Amplitude modulation, Angle Modulation, Digital Modulation, Linear modulation techniques, Constant envelope modulation, spread spectrum modulation techniques, Equalization, Equalizers in communication receiver, Diversity techniques, RAKE receiver, Fundamentals of channel coding	
Multiple Access Techniques	3
FDMA, TDMA, CDMA, SDMA	
Wireless Networking	4
Difference between wireless and fixed telephone networks, development of wireless networks, ISDN	
Wireless Systems	7
GSM, GSM Architecture, CDMA digital cellular standard, IS-95 system.	

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

Course Code	EC 720
Course Title	Embedded Systems
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Microprocessors, Microcontrollers & Interfacing, Advanced Microprocessors
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1. Selecting the best ARM according to the application. 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 Code	EC 709
Course Title	Digital Signal Processing (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	Signals & Systems
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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.

7

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,

15

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.

SECTION-B

Digital Filters: 9

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.

Implementation of Discrete Time Systems: 5

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.

Multirate Signal Processing: 7

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

Processors: 2

Architecture of TMS320CXX series, Addressing modes, Memory management

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Signal Processing: Principles, Algorithms and Applications 4-E	Proakis&Manolakis	Pearson Education Ltd
RECOMMENDED BOOKS			
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 Code	EC 714
Course Title	Analog & Digital Communication (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	Signals & Systems
Course Objectives (CO)	<ol style="list-style-type: none"> 1. To study the analysis of Amplitude modulation, Frequency Modulation, and Phase Modulation. 2. To study Pulse modulation techniques and their mathematical analysis. 3. To study noise considerations in AM, FM, and Pulse modulation systems 4. To study different Digital Modulation and multiple access techniques.
Course Outcome	<ol style="list-style-type: none"> 1. Explain the concepts and mathematical analysis of AM, FM, and phase modulation systems. 2. Explain and analyze the theory and mathematical models of pulse modulation systems. 3. Analyze the effects of noise on different modulation techniques. 4. Explain and analyze digital modulation techniques and multiple access techniques.

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

Amplitude modulation

7

The need for modulation, mathematical analysis of AM, generation and demodulation of AM, Properties of AM signals, DSB-SC, generation of DSB-SC signals, Coherent reception of AM signals, Quadrature carrier multiplexing, single sideband and vestigial sideband modulation, Super-heterodyne receiver

Angle Modulation

8

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

Pulse Modulation

8

The need for sampling, the sampling process, Nyquist sampling theorem, Practical sampling, PAM, PWM, PPM, PCM, quantization noise, companding, Delta modulation, Differential PCM.

SECTION-B

Noise in communication systems

8

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

Digital modulation techniques:

7

PSK, FSK, MSK, QAM. Error calculations for PSK, FSK, MSK, QAM, Shannon's limit.

Multiplexing and Multiple Access:

7

Allocation of communication Resources, FDM/FDMA, TDM/TDMA, CDMA, SDMA, Multiple Access Communications and Architecture, Access Algorithms.

TEXT 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
RECOMMENDED BOOKS			
1.	Digital Communications	Bernard Sklar	PHI
2.	Principles of Communication Systems	H. Taub, D. L. Schilling, G. Saha	McGraw Hill, 2011
3.	Communication Systems: Analog and Digital	R P Singh and S D Sapre	Tata McGraw Hill
4.	Principles of Digital communication	J. Das, S. K. Mullick, P. K. Chatterjee	New Age International
5.	Digital Communications	J.G. Proakis	Tata McGraw Hill

Course Code	HSS -701
Course Title	Financial Management
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	The main aim of this course is to make students learn different financial decisions i.e. investing, financing and dividend, required to be taken by a company and provide knowledge about the functioning of the financial system (financial markets, financial institutions, financial services and financial instruments) of the country.
Course Outcome	<ol style="list-style-type: none"> 1. The students will learn to make best combination of financial decisions by considering risk and return trade-off. 2. The students will identify how business can gain maximum through the financial system. 3. The students will understand how to manage funds effectively so as to maximize returns.

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 Financial Management

Concept of Finance, Terminology Related to Finance, Financial Decisions, Factors Affecting Financial Decisions, Risk-Return Trade-Off (3 hours)

Financial System

Concept and Role of Financial System in Indian Economy (2 hours)

Financial Markets and Instruments (8 hours)

Concept and Relevance of Money Market and Capital Market

Money Market Instruments: Call Money, Treasury Bills, Commercial Papers, Certificate of

Deposits

Capital Market Instruments: Equity Shares, Preference Shares and Debentures

Hypothetical Trading in Financial Markets

Financial Services (7 hours)

Nature and Functions of Financial Services: Merchant Banking, Mutual Funds, Factoring, Forfeiting, Credit Rating

Case Study on Financial Services

SECTION-B

Financial Institutions (6 hours)

Nature and Functions of Financial Institutions: Reserve Bank of India (RBI), Securities and Exchange Board of India (SEBI), Discount and Finance House of India (DFHI)

Long Term Investment Decisions (7 hours)

Capital Budgeting: Concept, Importance, Factors

Techniques/Methods with Numerical Applications (Pay Back Period, Accounting Rate of Return, Net Present Value, Internal Rate of Return and Profitability Index), Case Study

Short Term Investment Decisions (5 hours)

Working Capital: Nature, Type and Factors Affecting the Requirement of Working Capital, Case Study

Financing Decisions (5 hours)

Capital Structure: Essentials and Approaches of Capital Structure

Sources of Finance (long-term and short-term), Financial Leverage: Concept and Numerical Application, Case Study

Dividend Decisions (2 hours)

Types of Dividend, Dividend Policy: Nature and Factors Affecting Dividend Policy, Case Study

Suggested Books:		
S.No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	"Financial Management", Shah P., 2 nd Edition, Pubs: Dreamtech Press	2009
2	"Financial Markets and Services", Gordon E. and Natarajan K., 3 rd Edition, Pubs: Himalaya Publishing House.	2006
3	"Financial Management: Theory and Practice", Chandra P., 8 th Edition, Pubs: McGraw Hill Education (India).	2012
4	"Financial Management", Pandey I.M., 10 th Edition, Pubs: Vikas Publishing House Pvt. Ltd., Noida.	2010
5	"Cases in Financial Management", Pandey I.M. and Bhat R., 3 rd Edition, Pubs: McGraw Hill Education (India).	2012
6	"Financial Institutions and Markets: Structure, Growth and Innovations", Bhole L.M. and Mahakud J., 5 th Edition, Pubs: McGraw Hill Education (India).	2009

7	"The Indian Financial System: Markets, Institutions and Services", Pathak B.V., 3 rd Edition, Pubs: Pearson India.	2010
8	"Financial Management and Policy", Horne J.C.V. and Dhamija S., 12 th Edition, Pubs: Pearson India.	2011

Course Code	HSS -702
Course Title	Business Laws
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	The main aim of this course is to make students understand different types of environment influencing business decisions and to provide knowledge about different laws that needs to be followed for initiating and managing business.
Course Outcome	
	The students will learn how companies follow corporate governance and social responsibility practices along with fulfilling economic objectives.
	The students will gain knowledge about application and implementation of various business laws in practice.

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 Business

(5 hours)

Scope and Characteristics of Business, Classification of Business Activities

Forms of Ownership of Business: Sole Proprietorship, Partnership and Company

Business Environment (10 hours)

Internal Environment: Concept and Elements (Value System, Vision Mission Objectives, Management Structure, Human Resources, Company Image etc.)

SWOT Analysis: Concept and Case Study

External Environment: Micro Environment (Suppliers, Customers, Competitors, Market Intermediaries etc.) and Macro Environment – PESTEL Analysis (Political, Economic, Social, Technological, Ecological and Legal), Case Study on Impact of Environment on Business

Globalization (5 hours)

Concept, Pros and Cons of Globalization, Impact of Global Environment on Business
Globalization of Company – Case Study

SECTION-B

Corporate Social Responsibility (5 hours)

Concept, Social Responsibility towards different stakeholders, Rationale for CSR
CSR – Case Studies

Corporate Governance (5 hours)

Concept, Elements and Essentials of Good Governance

Contract Law (5 hours)

Concept, Types and Essentials Elements of Contract

Partnership Law (5 hours)

Nature of Partnership, Provisions of Partnership Act, Issues Related to Partnership Firm,
Hypothetical Formation of a Partnership Firm

Company Law (5 hours)

Nature of Company, Provisions of Company Act, Issues Related to Incorporation of Company,
Hypothetical Formation of a Company

Suggested Books:		
<i>S.No.</i>	<i>Name of Book/ Authors/ Publisher</i>	<i>Year of Publication/ Reprint</i>
1	“Business Environment: Text and Cases”, Cherunilam F., 22 nd Edition, Pubs: Himalaya Publications.	2013
2	“Legal Aspects of Business”, Pathak A., 5 th Edition, Pubs: McGraw Hill Education.	2013
3	“Essential of Business Environment: Text, Cases and Exercises”, Aswathappa K., 11 th Edition, Pubs: Himalaya Publication.	2011
4	“Business Law Including Company Law”, Gulshan S.S. and Kapoor G.K., 15 th Edition, Pubs: New Age International (p) Ltd.	2011
5	“Business Law and Corporate Laws”, Tulsian P.C., 1 st Edition, Pubs: Sultan Chand Publishing.	2011
6	“Fundamentals of Business Organization & Management”, Bhushan Y.K., 19 th Edition, Pubs: Sultan Chand & Sons.	2013
7	“Corporate Governance: Principles, Policies and Practices”, Fernando A.C., 2 nd Edition, Pubs: Pearson India.	2011

Course Code	HSS 703
Course Title	Human Resource Management
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	1. The main aim of this course is to provide an overview of HRM, keeping the Indian business scenario in the background and to acquaint the students with the strategic role of HRM in managing an organization.
Course Outcome	1. The students will develop the ability to solve problems in area of HRM in organizations. 2. The students will become aware of latest developments in HRM practices which are essential for effective management in organization.

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 Human Resource Management (5 hours)

HRM: Nature, Scope, Functions, HRM Practices and Problems in India with Case Studies

Human Resource Planning (HRP) (5 hours)

Concept and Process of HRP, Factors Affecting HRP

Job Analysis and Designing (5 hours)

Uses and Process of Job Analysis, Job Description and Job Specification: Features and Hypothetical Formulation, Job Designing: Job Enrichment, Job Enlargement

Recruitment and Selection (6 hours)

Recruitment: Sources and Methods

Selection: Selection Process, Selection Tests, Types and Nature of Interviews

Role Playing and Case Study on Selection Process, Tests and Interview

SECTION-B

Induction and Internal Mobility (7 hours)

Induction Programme, Need and Scope of Internal Mobility: Transfer, Promotion, Demotion

Training and Development (8 hours)

Training: Need and Methods, Management Development: Need, Methods and Management Development Programme HRM Games for Development of Employees

Performance Appraisal and Compensation (6 hours)

Nature and Methods of Performance Appraisal, Hypothetical Performance Appraisal Compensation: Financial and Non-Financial Benefits

Employee Health and Safety (3 hours)

Concept, Issues related to Health and Safety, Workplace Health Hazards

Suggested Books:		
<i>S.No.</i>	<i>Name of Book/ Authors/ Publisher</i>	<i>Year of Publication/ Reprint</i>
1	“Human Resource Management: Text and Cases”, Rao V.S.P., Pubs: Excel Books.	2002
2	“Human Resource Management”, Dessler G. and Varkkey B., 12 th Edition, Pubs: Pearson India.	2011
3	“Human Resource Management: Text and Cases”, Aswathappa K., 7 th Edition, Pubs: McGraw Hill Education (India).	2013
4	“Human Resource Management: Text and Cases”, Gupta C.B., 14 th Edition, Pubs: Sultan Chand and Sons.	2012
5	“Human Resource Management: Text and Cases”, Bedi S.P.S. and Ghai R.K., Pubs: Bharti Publications.	2012
6	“Human Resource Management Applications: Cases, Exercises, Incidents and Skill Builders”, Fottler M.D., McAfee R.B. and Nkomo S.M., 7 th Edition, Pubs: Cengage Learning.	2013

Course Code	HSS-704
Course Title	Business Research
Type of Course	Elective
L T P	4 0 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	The main aim of this course is to make students understand the concepts of business research and learn the methods to formulate, analyze and interpret the business problems.
Course Outcome	<ol style="list-style-type: none"> 1. The students will develop ability to tackle problems in business by following research techniques. 2. The students will learn to collect the right data and to analyze and present the data in the right way.

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 Business Research (2 hours)

Concept and Types of Business Research

Problem Identification (6 hours)

Defining Problem, Literature Review: Essentials of Literature Review and Writing of Review,

Research Objectives: Essentials of Research Objectives and its Formulation
Framework for Business Research

Research Questions, Hypothesis: Essentials of Hypothesis and its Formulation,
Types of Variables (6 hours)

Introduction to Research Design (5 hours)

Purpose and Scope of Research Design, Research Proposal: Elements and Framing a Research Proposal

Measurement Scales (6 hours)

Rating Scales, Ranking Scales, Reliability, Validity, Questionnaire: Essentials of Questionnaire, Developing a Questionnaire on a Hypothetical Research

Problem

SECTION-B

Sampling Design

(4 hours)

Concept, Process and Techniques of Sampling, Framing of Sampling Design

Data Collection

(4 hours)

Sources and Methods of Data Collection

Presentation and Analysis of Data

(6 hours)

Tabular, Graphic and Diagrammatic Presentation of Data, Statistical Data Analysis, Presentations and Analysis of Data using MS Excel

Research Report

(6 hours)

Contents and Characteristics of Project Report, Formulation of Project Report

Suggested Books:		
S.No.	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	“Research Methods for Business: A Skill Building Approach”, Sekaran U. and Bougie R., 5 th Edition, Pubs: Wiley India Pvt. Ltd., New Delhi.	2011
2	“Research Methodology: Methods and Techniques”, Kothari C.R. and Garg G., 3 rd Edition, Pubs: New Age International.	2014
3	“Business Research Methods”, Bryman A. and Bell E., 2 nd Edition, Pubs: Oxford University Press.	2010
4	“Business Statistics”, Beri G.C., 3 rd Edition, Pubs: McGraw Hill Education (India).	2009
5	“Statistics for Management”, Levin R.I., Rubin D.S., Rastogi S. and Siddiqui M.H., 7 th Edition, Pubs: Pearson India.	2012
6	“Business Research Methods and Statistics using SPSS”, Burns R.P. and Burns R., 1 st Edition, Pubs: Sage Publications.	2008
7	“Statistics for Management”, Srivastava T.N. and Rego S., 2 nd Edition, Pubs: McGraw Hill Education (India).	2012

Course Code	EC 715
Course Title	ADVANCED DIGITAL SIGNAL PROCESSING
Type of Course	Honors Course
L T P	4-0-0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50

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

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	EC 716
Course Title	ADVANCED DIGITAL COMMUNICATION
Type of Course	Honors Course
L T P	4-0-0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50

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

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 10

Representations of digitally modulated signals, memory less modulation methods, PAM,PM,QAM, multidimensional signaling, Signaling scheme with memory, CPFSK,CPM, Power spectrum of Digitally modulated signals, PSD of a digitally modulated signals with memory, PSD of linearly modulated signals.

Optimum Receivers for Additive White Gaussian Noise Channels 10

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

Carrier and symbol synchronization 8

Signal parameter estimation, the likelihood function, carrier recovery and symbol synchronization in signal demodulation, carrier phase estimation, maximum likelihood carrier phase estimation, phase locked loop, effect of noise on the phase estimation, symbol timing estimation, maximum likelihood timing estimation, non-decision directed timing estimation.

Multichannel and Multicarrier System 8

Multichannel Digital Communication in AWGN channels, binary signals, M-ary orthogonal signals, Multicarrier communication, single-carrier versus multicarrier modulation, Capacity of a Nonideal 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.

Spread Spectrum Signals for Digital Communication 4

Model of spread spectrum digital communication system, direct sequence spread spectrum signals, frequency hopped spread spectrum signals, CDMA system based on FHSS signals, Synchronization of spread spectrum systems.

TEXT BOOKS			
S. No.	NAME	AUTHOR(S)	PUBLISHER
1	Digital Communications	JG Proakis& M Salehi	5 th Edition McGraw Hill
2	Digital Communication	Simon Haykins	John Wiley & Sons
RECOMMENDED BOOKS			
1	Principle of Communication systems	Taub& Schilling	Tata McGraw Hill
2	Digital Communications: Fundamentals and applications	Bernard Sklar	Prentice Hall Publications

Course Code	EC 717
Course Title	Sensor Based Application Systems
Type of Course	Honors Course
L T P	4-0-0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Objectives:	<ol style="list-style-type: none"> 1. Develop judgment of what sensors and modalities are appropriate for different applications 2. Know how to electronically condition the sensor, hook it up to a microcomputer, and process the signal (at least basically) 3. Have some idea of how/where these sensors were used before 4. Have a reasonable idea of how different sensors work
Course Outcome:	<ol style="list-style-type: none"> 1. An ability to apply knowledge of mathematics, science, and engineering. 2. An ability to design and conduct experiments, as well as to analyze and interpret data. 3. Students are assigned both individual and group projects, which require ability to conduct simulation, analyze and interpret results. 4. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. 5. An ability to function on multi-disciplinary teams. 6. An ability to identify, formulate, and solve engineering problems. Students are presented with engineering problems, like designing sensors for biomedical, automotive applications. 7. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

SYLLABUS

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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

Basics: Sensors: examples and definitions, Introduction to Sensor Electronics and terminology (Fraden Ch. 2)

Strain Gauges: Basics and Examples (FradenCh 3.5, 5.1, 5.2, 5.7, 9)

Thermometers: Measurement Techniques and Examples, Flow Sensors (Fraden Ch. 16)

Radiation Sensors: Overview of Types, Examples of Applications (Fraden Ch. 14)

IR Sensors and Demo: IR Motion

Capacitive sensors: Fundamentals, Applications and Examples (FradenCh. 3.2, 6.3, 7.3, 10.6)

(22 hrs)

SECTION-B

Accelerometers (Fraden Ch. 8)

Piezoelectric Sensors (Fraden Ch. 3.6, 5.2.4, 8.4)

Pressure sensors: Principles and Examples (Fraden Ch. 10)

Inductive and Magnetic Sensors (Fraden Ch. 3.3, 3.4, 7.4)

Active sounding: Methods for measurement, Examples (?)

Chemical Sensors, Biosensors, RF sensors

Applications of sensors in Process Control, Biomedical Field, Automation, Transportation, Agriculture, Post harvest supply chain and processing, Environment etc. (23 hrs)

Project work.

Students will work on different problems from industries and come up with some practical solutions.

Recommended Books:

- Fraden, J. *Handbook of Modern Sensors: Physics, Designs, and Applications*. 4th ed. Springer, 2010. ISBN: 9781441964656.
- Horowitz, P., and W. Hill. *The Art of Electronics*. 2nd ed. Cambridge University Press, 1989. ISBN: 9780521370950.
- John G. Webster *Medical Instrumentation: Application and Design., Ed.*; 4th edition, Wiley, New York,2010.

Course Code	EC 718
Course Title	Principles of Design Engineering and Product Development
Type of Course	Honors Course
L T P	4-0-0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Objectives:	<ol style="list-style-type: none"> 1. Conceptualisation and development of innovative, commercially important and socially sound decisions related to engineering products, processes and systems. 2. To train students to translate academic developments in electronics, computational, materials and energy engineering to real life applications of interest to industry for accelerated start of career.

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 designing (11 hrs)

Fundamentals of engineering designs and applications; social, economic, sustainability, environmental and aesthetic rationales in design engineering, design decisions related to customer focus, competitiveness of products, processes, services and systems. Impact of product design on business and market, product portfolio development through continuity in designing.

Managing technologies and innovations (12hrs)

Technology road mapping, market and trend analyses for design decisions, managing technology and innovations, protecting designs by intellectual property rights, IPR gap analysis, creative thinking, technology sharing and transfer, founding start-up companies, raising seed funding, challenges of conceiving, creating and growing a new venture.

SECTION-B

Design process

(12hrs)

Principles, tools and strategies for conceptualising the need and presenting designs - product specifications, digital tools, analog drawings, design modeling: mathematical modeling, simulation using computers, and creation of 2D and 3D scale models. Engineering fundamentals related to mechanical, electrical, electronic and computational concepts in designing; environmental, sustainability, life cycle analysis; upstream manufacturing economics and downstream assembly, distribution, recyclability, robustness, maintenance and safety aspects in design development; functional prototypes, iterations, validation of product concept, product development .

Smart Systems in Engineering Designs

(10 hrs)

Smart system technologies, real time sensing and communication, embedded intelligence, designing for internet of things, data acquisition and hardware interfacing and robotics. Case studies and minor projects related to devices for visually and hearing challenged individuals, traffic sensing and information analysis.

Recommended Books:

1. Michael Luchs, Scott Swan, Abbie Griffin, 2015. Design Thinking , John Wiley & Sons, Inc(ISBN 978-1-118-97180-2)
2. Journal of Product Innovation Management, Wiley Online Library
3. Geoffrey Boothroyd, Peter Dewhurst and Winston A Knight,2011. Product Design for Manufacture and Assembly. CRC Press.
4. Nigel Cross, 2008. Engineering Design Methods: Strategies for Product Design. Wiley & Sons (ISBN 978-0-470-51926-4)
5. Richard G Budynas and J Keith Nisbett, 2010. Mechanical Engineering Design. . McGraw Hill (ISBN 978-0-07-352928-8).

EIGHTH SEMESTER

Course Code	EC 808
Course Title	Digital Image Processing (Theory)
Type of Course	Elective
L T P	3 0 2
Credits	3
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Digital Signal Processing
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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	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.	159

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	3 0 2
Credits	3
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Communication Engineering, Digital Communication
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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

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

Elements of a Digital communication system: 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.	5
Digital modulation Schemes: Representations of digitally modulated signals, memory less modulation methods, PAM, PM, QAM, multidimensional signaling, Signaling schemes with memory, CPFSK,	9
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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: 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.		9	
SECTION-B			
Digital Communication through Band-Limited Channels: 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.		11	
Multichannel and Multicarrier System: 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.		11	
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	3 0 2
Credits	3
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Programming Fundamentals, Digital Electronics
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	
<i>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.</i>	
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, Mexican 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&Vijayalakh miPai	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	3-0-2
Credits	3+1
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	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 Title	ADVANCED DIGITAL SIGNAL PROCESSING (Practical)
Type of Course	Elective
Credits	1
Course Assessment Methods Continuous Assessment	50
Course Prerequisites	
LIST OF EXPERIMENTS	
	<p>(Implement the following programs in MATLAB)</p> <ol style="list-style-type: none"> 1. Convolution of Causal and Non Causal Sequences. 2. Circular Convolution. 3. DFT and FFT of Discrete time sequences. 4. Design of FIR Filters. 5. Design of IIR Filters. 6. Simulation of Digital Filters. 7. Analysis of Finite Word Length Effects using different Filter Structures. 8. Decimation and Interpolation of Discrete time sequences. 9. Implementation of an Arbitrary rate Sampling Rate Converter. 10. Illustrate Adaptive Filtering using LMS Algorithm. 11. Illustrate Adaptive Filtering using RLS Algorithm. 12. Enhancement of Narrowband signals buried in Noise using Adaptive Filters. 13. Illustrate Power Spectrum Estimation and Analysis using Welch method. 14. Illustrate Power Spectrum Estimation and Analysis using Burg method. 15. Illustrate Power Spectrum Estimation and Analysis using Yule-Walker method. 16. System Design based on chips.

Course Code	EC802
Course Title	HDL based Systems (Theory)
Type of Course	Elective
L T P	3 0 2
Credits	3
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	
<p>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.</p>	
SECTION-A	

Review of Logic Design Fundamentals		10	
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.			
Introduction to VHDL		12	
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.			
SECTION-B			
Introduction to programmable logic devices		5	
Brief overview of PLDs, Simple PLDs, Complex PLDs, Field Programmable Gate Arrays (FPGAs)			
Design examples		7	
BCD to 7-segments display decoder, ABCD adder, 32-bit adder, Traffic light controller, State graphs of control circuits, A shift & add multiplier, Array multiplier.			
Designing with FPGAs		11	
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.			
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-segment 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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Fiber Optic Communication Systems, computer Networks
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	
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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, 2 nd 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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	50
Course Prerequisites	Physics, Integrated Circuits, VLSI Design
Course Objectives (CO)	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	
<i>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.</i>	
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	6		
Introduction to scaling, Scaling in Geometry, scaling in rigid body dynamics, scaling in electrostatic forces, scaling in electromagnetic forces, scaling in electricity.			
Materials for MEMS & Microsystems	5		
Substrate & wafer, active substrate material, silicon as substrate, gallium arsenide, quartz, piezoelectric materials, polymers, packaging material.			
SECTION-B			
Microsystems Fabrication Processes	7		
Photolithography, Ion implantation, Diffusion, Oxidation, Chemical Vapor Deposition, Physical vapor deposition, epitaxy, etching.			
Overview of Micromachining	8		
Bulk micromachining, surface micromachining, LGA process.			
Microsystems Design	7		
Design Consideration, Process Design, Design of silicon die for micro manufacturing, Computer Aided Design, Introduction to Microsystems Packaging.			
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.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	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	
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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 gray level images	8

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	HSS 801
Course Title	Entrepreneurship and Project Management
Type of Course	Core
L T P	3 1 0
Credits	4
Course Assessment Methods	
End Semester Assessment (University Exam.)	50
Continuous Assessment (Sessional, Assignments, Quiz)	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	<ol style="list-style-type: none"> 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

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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	5 th Edition, Himalaya Publishing House
2	“Projects: Planning, Analysis, Selection, Financing, Implementation and Review”	Chandra P.	8 th 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
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