SCHEME OF INSTRUCTION & EXAMINATION
B.E. VI- SEMESTER
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	**PC601EC**	Digital Communication	3	1	0	4	30	70	3	3
2	**PC602EC**	Antennas and wave propagation	3	1	0	4	30	70	3	3
3	**PC603EC**	Microprocessor and Microcontroller	3	1	0	4	30	70	3	3
4	**HS604EC**	Managerial Economics & Accountancy	3	0	0	3	30	70	3	3
5	**PE – I**	Professional Elective-I	3	0	0	3	30	70	3	3
6	**OE – I**	Open Elective-I	3	0	0	3	30	70	3	3
Practical/Laboratory Courses										
7	**PC651EC**	Communication Lab	0	0	2	2	25	50	3	1
8	**PC652EC**	Microprocessor and Microcontroller Lab	0	0	2	2	25	50	3	1
9	**MC**	Mandatory Course	-	-	3	3	50	-	3	0
10	**PC653EC**	Summer Internship*	-	-	-	-	50	-	-	-
Total			**18**	**3**	**7**	**28**	**280**	**520**		**20**

PC: Professional Course **PE**: Professional Elective **OE**: Open Elective

HS: Humanities and Social Science **MC**: Mandatory Course

L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

Note:

1. Each contact hour is a Clock Hour.
2. The Practical class can be of two and half hour (clock hours) duration as per the requirement of a particular laboratory.
3. *The students have to undergo a summer internship of four week duration after sixth semester and credits will be awarded in seventh semester after evaluation.

Professional Elective – I			**Open Elective - I**		
S. No.	**Course Code**	**Course Title**	**S. No.**	**Course Code**	**Course Title**
1	PE671EC	Digital Image Processing	1	OE632AE	Automotive Safety & Ergonomics
2	PE672EC	Data Communication and computer networking	2	OE601CE	Disaster Management
3	PE673EC	Optical Communication	3	OE602CE	Geo Spatial Techniques
4	PE674EC	Digital TV Engineering	4	OE601CS	Operating Systems
			5	OE602CS	OOP using Java
			6	OE601EC	Principles of Embedded Systems **
			7	OE602EC	Digital System Design using Verilog HDL **
			8	OE601EE	Reliability Engineering
			9	OE602EE	Basics of Power Electronics
			10	OE601ME	Industrial Robotics
			11	OE602ME	Material Handling
			12	OE601LA	Intellectual Property Rights

Mandatory Course		
S. No.	Course Code	Course Title
1	MC951SP	Yoga Practice
2	MC952SP	National Service Scheme
3	MC953SP	Sports

Note: ** Indicates that subject is not offered to the students of Electronics and Communication Engineering Department.

Course Code	Course Title						Core/Elective
PC601EC	**DIGITAL COMMUNICATION**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PTSP PC403EC AC PC502EC	3	1	-	-	30	70	3

Course Objectives:

- Familiarize the students with elements of digital communication system and waveform coding techniques like PCM, DPCM, DM and ADM.
- Introduce the concepts of information theory and source coding
- Familiarize the students with channel coding techniques such as LBC, BCC and convolution codes
- Introduce the concepts of baseband digital data transmission and analyze the error performance of different digital carrier modulation schemes like ASK, FSK, PSK etc.
- Familiarize the students with the concepts of spread spectrum communication with emphasis on DSSS and FHSS

Course Outcomes:

- Classify the different types of digital modulation techniques PCM, DPCM, DM and ADM and compare their performance by SNR.
- Illustrate the classification of channels and Source coding methods.
- Distinguish different types of Error control codes along with their encoding/decoding algorithms.
- Examine the Performance of different Digital Carrier Modulation schemes of Coherent and Non-coherent type based on Probability of error.
- Generation of PN sequence using Spread Spectrum and characterize the Acquisition Schemes for Receivers to track the signals.

UNIT - I

Elements of Digital Communication System, Comparison of Digital and Analog Communication Systems, Waveform Coding: Analog to Digital Conversion, Quantization and Encoding techniques, PCM. Companding in PCM systems - u law and A law, Applications of PCM: Introduction to Linear Prediction Theory. Modulation and demodulation of DPCM, DM and ADM. Comparison of PCM, DPCM, DM and ADM. SNR_Q of PCM and DM

UNIT - II

Information Theory and Source Coding: Uncertainty, Information and entropy. Source-coding, Shannon – Fano and Huffman coding. Discrete memory less channel – Probability relations in a channel, priori & posteriori entropies, mutual information, Channel capacity - Binary Symmetric Channel, Binary Erasure Channel, , cascaded channels, information rate. Shannon-Hartley Theorem – Shannon Bound.

UNIT - III

Channel Coding: Types of transmission errors, need for error control coding, Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, Minimum distance of Linear block code, error correction and error detection capabilities, Standard array and syndrome decoding, Hamming codes. Binary cyclic codes (BCC): Description of cyclic codes, encoding, decoding and error correction using shift registers. Convolution codes: description, encoding – code tree, state diagram.

UNIT - IV

Introduction to Base band digital data transmission – block diagram, ISI, eye pattern Digital Carrier Modulation Schemes — Description and generation of ASK, FSK, PSK. optimum receiver – matched filter, correlation receiver. Gaussian error probability -Coherent detection of Binary ASK, FSK, PSK. DPSK. Comparison of digital carrier modulation schemes. M-ary signaling schemes – Introduction, QPSK, Synchronization methods.

UNIT - V

Spread Spectrum Communication: Advantages of Spread Spectrum, generation and characteristics of PN sequences. Direct sequence spread spectrum and Frequency hopping spread spectrum systems and their applications. Acquisition and Tracking of DSSS and FHSS signals.

Suggested Reading:

1. Simon Haykin, “Communication systems” 4/e, Wiley India 2011
2. Sam Shanmugam K, “Digital and Analog Communication systems”, Wiley 1979.
3. B.P.Lathi, “Modern digital and analog communication systems” 3/e, Oxford University Press. 1998
4. Leon W.Couch II., Digital and Analog Communication Systems, 6th Edn, Pearson Education inc., New Delhi, 2001.
5. R.E.Zimer&R.L.Peterson : Introduction to Digital Communication, PHI, 2001.

Course Code	Course Title						Core/Elective
PC602EC	**ANTENNAS AND WAVE PROPAGATION**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EMTL PC404EC	3	1	-	-	30	70	3

Course Objectives:

1. To familiarize the students with the basic principles of antennas and introduce the antenna terminology.
2. To introduce different types of wire antennas and make proficient in analytical skills for understanding practical antennas.
3. To familiarize with the design of different types of antennas for various frequency ranges and latest developments in the practical antennas.
4. To introduce need for antenna arrays and the concepts of measurements of antennas.
5. To introduce the various modes of Radio Wave propagation used.

Course Outcomes:

- To illustrate the basic principles of antennas and learn the antenna terminology.
- To design different types of wire antennas and make proficient in analytical skills for understanding practical antennas.
- To design different types of antennas for various frequency ranges and get updated with latest developments in the practical antennas.
- To apply the principles of antennas, to design antenna arrays and measure various parameters of antennas.
- To Identify and understand the suitable modes of Radio Wave propagation used in current practice

UNIT - I

Introduction, Fundamental Concepts- Physical concept of radiation, Radiation pattern, Isotropic Radiator, Front–to-back ratio, Antenna Field Regions, Radiation Intensity, Beam Area, Beam Efficiency, Reciprocity, Directivity and Gain, Antenna Apertures, Antenna Polarization, Antenna impedance, Antenna temperature, Friis transmission equation, Retarded potential.

UNIT - II

Current Distributions, Radiation from Infinitesimal Dipole, Half wave Dipole and Quarter wave Monopole, Loop Antennas - Introduction, Small Loop, Far field pattern of circular loop with uniform current, Comparison of far fields of small loop and short dipole, Slot Antennas, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes, wideband characteristics, radiation efficiency.

UNIT - III

V-antenna, Rhombic Antenna, Yagi-Uda Antenna, Folded Dipoles & their Characteristics, Log-periodic Antenna, Aperture Antennas- Huygens' principle, Radiation from apertures, Babinet's principle, Radiation from Horns and design considerations, Parabolic Reflector and cassegrain Antennas, Lens Antennas, Micro Strip Antennas- Basic characteristics, feeding Methods, Design of Rectangular Patch Antennas, Smart Antennas- Fixed weight Beam Forming basics and Adaptive Beamforming,

UNIT - IV

Array of point sources, two element array with equal and unequal amplitudes, different phases, linear n- element array with uniform distribution, Broadside and End fire arrays, Principle of Pattern Multiplication, Effect of inter element phase shift on beam scanning, Binomial array.

Antenna Measurements: Introduction, Antenna Test Site and sources of errors, Radiation Hazards, Patterns to be Measured, Radiation, Gain and Impedance Measurement Techniques.

UNIT - V

Ground wave propagation, Space and Surface waves, Troposphere refraction and reflection, Duct propagation, Sky wave propagation, Regular and irregular variations in ionosphere. Line of sight propagation.

Suggested Reading:

1. J. D. Kraus, R. J. Marhefka & Ahmad S. Khan, "Antennas and wave Propagation", McGraw-Hill, 4rth Edition, 2010.
2. Constantine A. Balanis, "Antenna Theory: Analysis and Design", Wiley, 3rd edition, 2005
3. Edward C. Jordan and Kenneth G. Balmain, “Electromagnetic Waves and Radiating Systems,” 2/e, PHI, 2001
4. R.E.Collins, Antennas and Radio Propagation, Singapore: McGraw Hill, 1985.
5. R Harish and M. Sachidananda, Antennas and Wave Propagation, Oxford University Press, 2011.

Course Code	Course Title						Core/Elective
PC603EC	**MICROPROCESSOR AND MICROCONTROLLER**						core
Prerequisite	Contact Hours per Week:4				CIE	SEE	Credits
	L	T	D	P			
COA PC505EC STLD PC304EC	3	1	-	-	30	70	3

Course Objectives:

- Understand architecture & programming of 8086 microprocessor and 8051 microcontrollers.
- Design Interfacing of memory , 8255,8257 and 8251 to 8086 processor
- Differentiation of 8086 and 8051 in terms of internal architecture, memory, programming.
- Design Interfacing & Programming of I/O ports, timers and UART using 8051.
- Design Interfacing of real time devices like ADC, DAC and stepper motor with 8051.

Course Outcomes:

- Explain the architecture of 8086 microprocessor and recognize different types of addressing modes.
- Write assembly language programming using 8086 microprocessor instruction set.
- Interface different peripherals to 8086 microprocessor.
- Explain the architecture of 8051 architecture and write Assembly/C language programming using 8051 microcontroller.
- Interface different peripherals to 8051 microcontroller.

UNIT - I

Intel 8086/8088 architecture, Segmented memory, Minimum and Maximum modes of operation, Timing diagram, addressing modes, Instruction set, assembly language programming using data transfer, arithmetic, logical and branching instructions

UNIT - II

Assembler directives, macros, procedures, assembly language programming using string manipulation instructions, 8086 Interrupt structure, IO and Memory Interfacing concepts using 8086, IC Chip Peripherals-8255 PPI, 8257 DMA controller, 8251 USART

UNIT - III

8051 Microcontroller – Internal architecture and pin configuration, 8051 addressing modes, instruction set, Bit addressable features. I/O Port structures, assembly language programming using data transfer, arithmetic, logical and branch instructions.

UNIT - IV

8051 Timers/Counters, Serial data communication and its programming, 8051 interrupts, Interrupt vector table, Interrupt programming.

UNIT - V

Interfacing of 8051 with LCD, ADC, DAC, external memory, Stepper Motor interfacing.

Suggested Reading:

1. Ray A.K &Bhurchandhi K.M, "Advanced Microprocessor and Peripherals," 2/e, TMH, 2007.
2. Mazidi M.A, Mazidi J.G &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C," 2/e, Pearson Education, 2007
3. Ayala K.J, "The 8051 Micro Controller Architecture, programming and Application," Penram International, 2007.
4. Scott MacKenzie and Raphael C.W.Phan. The 8051 Microcontroller.(4/e), Pearson education, 2008.
5. Douglas V.Hall, "Microprocessors and Interfacing Programming and Hardware", 2nd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 1994.

Course Code	Course Title						Core/Elective
HS604EC	**MANAGERIAL ECONOMICS AND ACCOUNTANCY**						Core
Prerequisite	Contact Hours per Week:2				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course objectives:

- To learn important concepts of Managerial Economics and apply them to evaluate business decisions.
- To understand various parameters that determines the consumers' behavior.
- To evaluate the factors that affect production.
- To understand the concepts of capital budgeting and payback period.
- To study the concepts of various book-keeping methods.

Course Outcomes:

- Apply the fundamental concepts of managerial economics to evaluate business decisions.
- Understand types of Demand and factors related to it.
- Identify different types of markets and determine price –output under perfect competition.
- Determine working capital requirement and payback period.
- Analyze and interpret financial statements through ratios.

UNIT - I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equimarginalism, Opportunity costs, Discounting, Time Perspective, Risk and Uncertainty, Profits, Case study method.

UNIT - II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked).

UNIT - III

Theory of Production and Markets: Production Function, Law of Variable Proportion, ISO quants, Economics of Scale, Cost of Production (Types and their measurement), Concept of Opportunity Cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price - Output determination under Perfect Competition and Monopoly (theory and problems can be asked).

UNIT - IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked).

UNIT - V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with simple adjustments, Analysis and interpretation of Financial Statements through Ratios.
(Theory questions and numerical problems on preparation of final accounts, cash book, and petty cash book, bank reconciliation statement, calculation of some ratios).

***Suggested Readings**:*

1. Mehta P.L., Managerial Economics —Analysis, Problems and Cases , Sulthan Chand & Sons Educational Publishers, 2011.
2. Maheswari S.N., Introduction to Accountancy , Vikas Publishing House, 2005.
3. Pandey I.M., Financial Management , Vikas Publishing House, 2009.

Course Code	Course Title						Core/Elective
PC651EC	**COMMUNICATION LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
AC PC502EC DC PC603EC	-	-	-	2	25	50	1

Course Objectives:

- Demonstrate AM, FM, Mixer, PAM, PWM and PPM techniques.
- Understand multiplexing techniques.
- Understand and simulate digital modulation (i.e., ASK, FSK, BPSK, QPSK) generation and detection.
- Model analog, pulse modulation, PCM, Delta and Digital modulation techniques using CAD tools
- Obtain data formats.

Course Outcomes:

- Understand and simulate modulation and demodulation of AM and FM.
- Construct pre-emphasis and de-emphasis at the transmitter and receiver respectively
- Understand and simulate the PAM,PWM&PPM circuits
- Understand baseband transmission (i.e., PCM, DPCM, DM, and ADM) generation and detection.
- Understand error detection and correction.

PART-A

Analog Communication Experiments

1. AM generation and detection
2. FM generation and detection
3. Pre emphasis and De-emphasis circuits
4. Multiplexing Techniques (FDM and TDM)
5. Mixer Characteristics
6. Sampling , PAM, PWM, and PPM generation and detection
7. Generation and Detection of Analog and Pulse modulation techniques by using MATLAB/Simulink/Labview

PART-B
Digital Communication Experiments

1. PCM generation and detection
2. Data formats / channel encoding and decoding.
3. Linear and Adaptive Delta Modulation and Demodulation
4. Modem characteristics.
5. ASK generation and Detection.
6. FSK and Minimum Shift Keying generation and Detection.
7. Phase shift keying methods (BPSK, QPSK) generation and Detection.
8. Generation and Detection of PCM, Delta modulation and Digital modulation Schemes (ASK. FSK, BPSK, QPSK) by using MATLAB/Simulink/Lab-view.

Note: Atleast ten experiments should be conducted in the semester, of which five should be from PART - B.

Course Code	Course Title						Core/ Elective
PC652EC	**MICROPROCESSOR AND MICROCONTROLLER LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
MPMC PC603EC	-	-	-	2	25	50	1

Course objectives:

- Apply Assembly language programs on 8086 trainer kit in standalone/serial mode
- Classify interface modules into input /output and Memory interfaces with 8086
- Develop and execute the embedded C programming concepts of 8051 microcontroller.
- Design and develop 8051embedded C programs for various interface modules.
- Develop Interface with serial and I2C bus.

Course Outcomes:

- Apply different addressing modes & Model programs using 8086 Instruction set
- Explain the usage of string instructions of 8086 for string manipulation, Comparison
- Develop interfacing applications using 8086 processor
- Design different programs using C cross compilers for 8051 controller
- Develop interfacing applications using 8051 controller

PART- A

1. Use of 8086 trainer kit and execution of programs. (Instruction set for simple Programs using 4 to 5 lines of instruction code under different addressing modes for data transfer, manipulation, Arithmetic operations)
2. Branching operations and logical operations in a given data.
3. Multiplication and division.
4. Single byte, multi byte Binary and BCD addition and subtraction
5. Code conversions.
6. String Searching and Sorting.
7. Interface a stepper motor to 8086 using 8255 PPI
8. Interface a USART 8251 to 8086 for serial data transfer/Receive

PART–B

[Experiments for 8051 using any C- Cross Compiler & appropriate hardware]

1. Familiarity and use of 8051/8031 Microcontroller trainer, and execution of programs.
2. Instruction set for simple Programs (using 4 to 5 lines of instruction code).
3. Timer and counter operations & programming using 8051.
4. Serial communications using UART
5. Programming using interrupts
6. Interfacing 8051 with DAC to generate waveforms.
7. Interfacing traffic signal control using 8051.
8. Program to control stepper motor using 8051.
9. ADC interfacing with 8051
10. Serial RTC interfacing with 8051
11. LCD interfacing with 8051

Note:

1. Preliminary explanation of the features and use of the tools must be made in 2/3 theory periods.
2. A total of not less than 12 experiments must be carried out during the semester with at least 6 from each part.

Suggested Reading:

1. Myke Predko – *Programming and Customizing the 8051 Microcontroller*, TMH, 2005
2. Mazidi M.A, Mazidi J.G &Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C," 2/e, Pearson Education, 2007

Course Code	Course Title						Core/Elective
PC653EC	**SUMMER INTERNSHIP**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	2	50	-	2*

Course Objectives:

- To give an experience to the students in solving real life practical problems with all its constraints.
- To give an opportunity to integrate different aspects of learning with reference to real life problems.
- To enhance the confidence of the students while communicating with industry engineers.
- Give an opportunity for useful interaction with them and familiarize with work culture and ethics of the industry.

Course Outcomes:

- Able to design/develop a small and simple product in hardware or software.
- Able to complete the task or realize a pre-specified target, with limited scope, rather than taking up a complex task and leave it.
- Able to learn to find alternate viable solutions for a given problem and evaluate thesealternatives with reference to pre-specified criteria.
- Able to implement the selected solution and document the same.

Summer Internship is introduced as part of the curricula for encouraging students to work on problems of interest to industries. A batch of two or three students will be attached to a person from an Electronics Industry / R & D Organization / National Laboratory / any other program approved by the department in consultation with the Chair, BOS and the same be informed to the Dean, Faculty of Engineering, for a period of four weeks. This will be during the summer vacation following the completion of the VI semester course. One faculty member will act as an internal guide for each batch to monitor the progress and interacts with the Industry guide.

After the completion of the project, students will submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the department. Award of sessional are to be based on the performance of the student at the work place to be judged by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

Note: *Students have to undergo summer internship of four weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.

PROFESSIONAL ELECTIVE-I

Course Code	Course Title						Core/Elective
PE671EC	**DIGITAL IMAGE PROCESSING**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
DSP PC503EC	3	-	-	-	30	70	3

Course Objectives:

- To provide an introduction to the basic concepts and methodologies for Digital Image processing.
- To familiar with spatial and transform domain techniques used in Image Enhancement, Restoration and Segmentation of Images.
- To gain knowledge about various Image transforms used in Image processing and Image compression problems.
- To understand various methods employed for edge , line and isolated points detection in an image.

Course Outcomes:

- Able to develop a foundation that can be used as the basis for higher study and research in the Image processing area.
- Able to design various filters for processing and deblurring of images without destroying fine details like edges and lines.
- Able to apply image processing techniques for processing and analysis of remotely sensed, Microscope, Radar and Medical images.
- Able to understand the need for Digital Image processing techniques for Machine vision applications and concept of image compression.

UNIT - I

Digital Image Fundamentals: Image sensing, acquisition, Image formation model, sampling and Quantization, Basic relationships between pixels; neighbors of a pixel, adjacency, connectivity, regions and boundaries. Image formation, brightness, adaptation and discrimination. Categorization of images according to their source of EM radiation.

UNIT - II

Image Transforms: 2D Fourier transform, Properties of 2D Fourier transform, Walsh, Hadamard, Slant, Haar, Discrete cosine transform and Hotelling transform.

UNIT - III

Image Enhancement: Spatial domain techniques: Contrast stretching, histogram equalization and histogram specification method, Neighborhood averaging and adaptive Median filter. Frequency domain methods: Ideal Low pass, Butterworth and Gaussian Lowpass filters. Ideal Highpass, Butterworth and Gaussian Highpass filters. Homomorphic filtering.

UNIT - IV

Image Restoration: Mathematical expression for degraded image, estimation of degradation functions: image observation, experimentation and by modeling, Inverse filter, Wiener filter, Geometric transformation, periodic noise reduction method.

UNIT - V

Image segmentation and Compression: Detection of discontinuities, point line And Edge detection methods: Gradient operation, Laplacian, Prewitt, Sobel, Laplacian of a Gaussian and Canny edge detectors. Image compression: Functional block diagram of a general image compression system various types of redundancies, Huffman coding, , Arithmetic coding.

Suggested Readings:

1. Rafeal C.Gonzalez, Richars E.Woods , *Digital Image Processing* ", Pearsons Education, 2009, 3rd Edition.
2. Anil K Jain, *Fundamentals of Digital Image Processing*, Prentice-Hall of India Private Limited, New Delhi, 1995.
3. Milan Sonka, Vaclav Havel and Roger Boyle, *Digital Image Processing and Computer vision*, Cengage Learning India Pvt. Limited, 2008.
4. Vipul Singh, Digital Image Processing with Matlab and Lab view" Elsevier 2013.
5. Qidwai, "Digital Image Processing," First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.

Course Code	Course Title						Core/ Elective
PE672EC	**DATA COMMUNICATION AND COMPUTER NETWORKING**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
AC PC502EC	3	-	-	-	30	70	3

Course Objectives:

- To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
- To study the principles of network protocols and internetworking
- To understand the Network security and Internet applications.
- To understand the concepts of switched communication networks.
- To understand the performance of data link layer protocols for error and flow control.
- To understand various routing protocols and network security.

Course Outcomes:

- Understand the working of various network topologies and circuit and packet switching
- Comprehend the role of data link layers and significance of MAC protocols
- Understand the networking protocols and Internet protocols
- Understand the transport layer working with TCP, UDP and ATM protocols
- Comprehend the functionality of application layer and importance of network security.

UNIT - I

Data communication: A Communication Model, The Need for Protocol Architecture and Standardization, Network Types: LAN, WAN, MAN. Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP.
Circuit switching: Circuit Switching Principles and concepts.
Packet switching: Virtual circuit and Datagram subnets, X.25.

UNIT - II

Data Link Layer: Need for Data Link Control, Design issues, Framing, Error Detection and Correction, Flow control Protocols: Stop and Wait, Sliding Window, ARQ Protocols, HDLC.
MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Wireless LAN. IEEE 802.2, 802.3, 802.4,802.11, 802.15, 802.16 standards. Bridges and Routers.

UNIT - III

Network Layer: Network layer Services, Routing algorithms : Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing, and Congestion Control Algorithms.

Internet Working: The Network Layer in Internet :IPV4, IPV6, Comparison of IPV4 and IPV6, IP Addressing, ATM Networks.

UNIT - IV

Transport Layer: Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, ATM AAL Layer Protocol.

UNIT - V

Application Layer: Domain Name System, SNMP, Electronic Mail, World Wide Web.

Network Security: Cryptography Symmetric Key and Public Key algorithms, Digital Signatures, Authentication Protocols.

Suggested Reading:

1. Andrew S Tanenbaum, "Computer Networks," 5/e, Pearson Education, 2011.
2. Behrouz A. Forouzan, "Data Communication and Networking,"3/e, TMH, 2008.
3. William Stallings, "Data and Computer Communications," 8/e, PHI, 2004.
4. Douglas E Comer, "Computer Networks and Internet", Pearson Education Asia, 2000.
5. Prakash C. Gupta, "Data Communications and Computer Networks", PHI learning, 2013

Course Code	Course Title						Core/Elective
PE673EC	**OPTICAL COMMUNICATION**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
DC PC601EC	3	-	-	-	30	70	3

Course Objectives:

- Learn concepts of propagation through optical fiber modes and configurations, Losses and dispersion through optical fiber.
- Understand operating principles of light sources and detectors used in optical transmitters and Receivers.
- Design an optical link in view of loss and dispersion.

Course Outcomes:

- Study of modes of optical communication through optical waveguides
- Analyze the losses inserted in an optical fibre
- Study of material used and underlying principles of optical signal generation
- Design of optical detection systems
- Design an optical link in view of loss and dispersion.

UNIT - I

Evolution of fiber optic system, Elements of Optical Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Waveguides, Overview Low frequency data transportation of Modes and Key concepts, Linearly Polarized Modes, Single Mode Fibers and Graded Index fiber structure.

UNIT - II

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination, Group Delay, Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in Guided Index fibers, Mode Coupling, Types of OFC Connectors and issues involved Design Optimization of Single and cut-off wavelength.

UNIT - III

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency, LED power, Modulation of LED, laser Diodes, Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers, Power Launching and coupling, Lensing schemes, Fiber-to-Fiber joints, Fiber splicing.

UNIT - IV

PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit.

UNIT - V

Point-to-Point link system considerations - Link Power budget, Rise - time budget, Noise Effects on System Performance, Operational Principles of WDM and Applications. Erbium-doped Amplifiers. Introductory concepts of SONET/SDH Network. Multiple signal interface in fibers, Bandwidth utilization, Interface with nano-electronic devices.

Suggested Reading:

1. Gourd Keiser, *"Optical Fiber Communication,"* 4/e, TMH, 2000.
2. J.Senior, *"Optical Communication, Principles and Practice,"* PHI, 1994.
3. J.Gower, *"Optical Communication System,"* PHI, 2001.
4. Binh, *"Digital Optical Communications,"* First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.
5. MMK.Liu, Principles and Applications of Optical Communications, TMH, 2010.

Course Code	Course Title						Core/Elective
PE674EC	**DIGITAL TV ENGINEERING**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
AEC PC401EC	3	-	-	-	30	70	3

Course objectives:

- Study the different camera and picture tubes.
- Know about various standard TV channels.
- Study about TV receiver, sync separation, detector etc.,
- Study about color signal encoding, decoding and receiver.

Course Outcomes:

- Study the types of camera tubes and signal transmission and propagation
- Analyze the TV receiver circuits for audio and video detection.
- Study of TV tuning circuits and separation of audio and video signals
- Understand the fundamentals of color television and colour signal transmission.
- Study of color receiver and tuning circuits.

UNIT - I

Introduction: TV transmitter and receivers, synchronization. Geometric form and aspect ratio, image continuity, interlaced scanning, picture resolution, Composite video signal, TV standards. Camera tubes: image Orthicon, Plumbicon, vidicon, silicon Diode Array vidicon, Comparison of camera tubes, Monochrome TV camera, TV Signal Transmission and Propagation: Picture Signal transmission, positive and negative modulation, VSB transmission, sound signal transmission, standard channel BW,TV transmitter, TV signal propagation, interference, TV broadcast channels, TV transmission Antennas.

UNIT - II

Monochrome TV Receiver: RF tuner, IF subsystem, video amplifier, sound section, sync separation and processing, deflection circuits, scanning circuits, AGC, noise cancellation, video and inter carrier sound signal detection, vision IF subsystem of Black and White receivers, Receiver sound system: FM detection, FM Sound detectors, and typical applications.

UNIT - III

Sync Separation and Detection: TV Receiver Tuners, Tuner operation, VHF and UHF tuners, digital tuning techniques, remote control of receiver functions. Sync Separation, AFC and Deflection Oscillators: Synchronous separation, k noise in sync pulses, separation of frame and line sync pulses. AFC, single ended AFC circuit, Deflection Oscillators, deflection drive Ics, Receiver Antennas, Picture Tubes.

UNIT - IV

Color Television: Colour signal generation, additive colour mixing, video signals for colours, colour difference signals, encoding, Perception of brightness and colours luminance signal, Encoding of colour difference signals, formation of chrominance signals, color cameras, Colour picture tubes. Color Signal Encoding and Decoding: NTSC colour system PAL colour system, PAL encoder, PAL-D Decoder, chrome signal amplifiers, separation of U and V signals, colour burst separation, Burst phase discriminator, ACC amplifier, Reference oscillator, Indent and colour killer circuits, U& V demodulators.

UNIT - V

Color Receiver: Introduction to colour receiver, Electron tuners, IF subsystem, Y-signal channel, Chroma decoder, Separation of U & V Color, Phasors, synchronous demodulators, Sub carrier generation, raster circuits.

Digital TV: Introduction to Digital TV, Digital Satellite TV, Direct to Home Satellite TV, Digital TV Transmitter, Digital TV Receiver, Digital Terrestrial TV, LCD TV, LED TV, CCD Image Sensors, HDTV.

Suggested Reading:

1. A.M.Dhake Television and Video Engineering-, 2nd Edition.
2. R.R.Gulati, Modern Television Practice – Principles, Technology and Service-, New Age International Publication, 2002.
3. R.R. Gulati, Monochrome and Colour TV- New Age International Publication, 2002.
4. Gerald w. Collins, Fundamentals of Digital Television Transmission', John Wiley, 2001.

OPEN ELECTIVE-I

Course Code	Course Title						Core/Elective
OE601EC	**PRINCIPLES OF EMBEDDED SYSTEMS**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
Basic Electronics	3	-	-	-	30	70	3

Course objectives:

- To understand the fundamentals of embedded systems.
- To study the block diagram and advanced hardware fundamentals.
- To study the software architecture of embedded systems.
- To learn the tool chain of embedded systems.
- To understand the tools and debugging process of embedded systems.

Course Outcomes:

- Able to acquire an overview of what an embedded system implies.
- Able to understand the architecture of a microprocessor and microcontroller to enable to design embedded applications using them.
- Able to apply theoretical learning to practical real time problems for automation.
- Able to understand how to build and debug an embedded system application.
- Able to analyze and design real world applications and interface peripheral devices to the microprocessor

UNIT - I

Fundamentals of embedded systems: Definition of Embedded system, Examples of Embedded Systems, Typical Hardware, Terminology, Gates, A few other basic considerations, Timing Diagrams, Memory.

UNIT - II

Advanced hardware fundamentals: Microprocessors, Buses, Direct Memory Access, Interrupts, Other Common Parts, Built-Ins on the Microprocessor, Conventions used in Schematics, Microprocessor Architecture, Interrupts Basics, Shared Data Problem, Interrupt Latency.

UNIT - III

Software architecture of embedded systems: Round- Robin, Round-Robin with Interrupts, Function- Queue- Scheduling Architecture, Real- Time Operating System Architecture, Selecting Architecture.

UNIT - IV

Embedded software development tools: Host and Target Machines, Cross compilers, Cross Assemblers and Tool Chains, Linkers /Locaters for Embedded Software, Getting Embedded Software into Target System: PROM programmers, ROM Emulators, In-Circuit Emulators.

UNIT - V

Debugging techniques: Testing on your host machine, Instruction Set Simulators, The assert Macro, Using Laboratory Tools.

Suggested Readings:

1. David. E. Simon, "*An Embedded Software Primer*", Low price edition, Pearson Education, New Delhi, 2006.
2. Frank Vahid and Tony Givargis "*Embedded System Design: A Unified Hardware/Software. Approach*". John Wiley & Sons, October 2001.
3. Rajkamal, "*Embedded systems: Programming, architecture and Design*", second edition, McGraw-Hill Education (India), March 2009.
4. Wayne Wolf, *"Computers as Components-Principles of Embedded Computer System Design"*, Morgun Kaufmann Publisher, 2006.
5. Tammy Noergaard, *"Embedded Systems-Architecture"* A comprehensive Guide for Engineers and Programmers" Elsevier Publishers 2nd Edition, 2013.

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>Core/Elective</td></tr>
<tr><td>OE602EC</td><td colspan="6">DIGITAL DESIGN USING VERILOG HDL</td><td>Elective</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4" rowspan="2">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">Basic Electronics</td><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>-</td><td>30</td><td>70</td><td>3</td></tr>
</table>

Course Objectives:

- Describe Verilog hardware description languages (HDL).
- Develop Verilog HDL code for combinational digital circuits.
- Develop Verilog HDL code for sequential digital circuits..
- Develop Verilog HDL code for digital circuits using switch level modeling and describes system tasks, functions and compiler directives
- Describes designing with FPGA and CPLD.

Course Outcomes:

- Understand syntax of various commands, data types and operators available with verilog HDL
- To design and simulate combinational circuits in verilog
- To design and simulate sequential and concurrent techniques in verilog
- Write Switch level models of digital circuits
- Implement models on FPGAs and CPLDs.

UNIT - I

Introduction to Verilog HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools

Verilog Data types and Operators, Binary data manipulation, Combinational and Sequential logic design, Structural Models of Combinational Logic, Logic Simulation, Design Verification and Test Methodology, Propagation Delay, Truth Table models using Verilog.

UNIT - II

Combinational Logic Circuit Design using Verilog: Combinational circuits building blocks: Multiplexers, Decoders , Encoders , Code converters, Arithmetic comparison circuits , Verilog for combinational circuits , Adders-Half Adder, Full Adder, Ripple-Carry Adder, Carry Lookahead Adder, Subtraction, Multiplication.

UNIT - III

Sequential Logic Circuit Design using Verilog: Flip-flops, registers & counters, synchronous sequential circuits: Basic design steps, Mealy State model, Design of FSM using CAD tools, Serial Adder Example, State Minimization, Design of Counter using sequential Circuit approach.

UNIT - IV

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, Instantiation with Strengths and Delays, Strength Contention with Trireg Nets.

System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters. System Tasks and Functions, File Based Tasks and Functions, Computer Directives, Hierarchical Access, User Defined Primitives.

UNIT - V

Designing with FPGAs and CPLDs: Simple PLDs,ComplexPLDs,Xilinx 3000 Series FPGAs, Designing with FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices (CPLDs), Altera FLEX 10K Series CPLDs.

Suggested Reading:

1. T.R. Padmanabhan, B Bala Tripura Sundari, *Design Through Verilog HDL*, Wiley 2009.
2. Samir Palnitkar, *Verilog HDL*, 2nd Edition, Pearson Education, 2009.
3. Stephen Brown, Zvonko Vranesic , *Fundamentals of Digital Logic with Verilog Design* -, TMH, 2nd Edition 2003.
4. William J. Dally and John W. Poulton, Digital Systems Engineering, Cambridge University Press, 2008.
5. Jayaram Bhaskar, A VHDL Primer, Prentice Hall India, 3rd Edition, 2009.

Course Code	Course Title						Core/Elective
MC951SP	**YOGA PRACTICE**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	-	-	-	3	50	-	0

Course Objectives:

- Enhances body flexibility.
- Achieves mental balance.
- Elevates Mind and Body co-ordination.
- Precise time management.
- Improves positive thinking at the expense of negative thinking.

Course Outcomes:

- Become more focused towards becoming excellent citizens with more and more discipline in their day-to-day life.
- An all-round development-physical, mental and spiritual health-takes place.
- Self-discipline and discipline with respect society enormously increases.
- University environment becomes more peaceful and harmonious.

UNIT - I

Introduction: Yoga definition-Health definition from WHO - Yoga versus Health - Basis of Yoga - yoga is beyond science- Zist of 18 chapters of Bhagavadgita - 4 types of yoga: Karma, Bhakti, Gnyana and Raja yoga – Internal and External yoga - Elements of Ashtanga yoga (Yama, Niyama, Asana, Pranayama, Prathyahara, Dharana, Dhyana and Samadhi) - Pancha koshas and their purification through Asana, Pranayama and Dhyana.

UNIT - II

Suryanamaskaras (Sun Salutations): Definition of sun salutations - 7 chakras (Mooladhaar, Swadhishtaan, Manipura, Anahata, Vishuddhi, Agnya and Sahasrar) - Vaious manthras (Om Mitraya, Om Ravaye, Om Suryaya, Om Bhanave, Om Marichaye, Om Khagaye, Om Pushne, Om Hiranya Garbhaye, Om Adhityaya, Om Savitre, Om Arkhaya, and Om Bhaskaraya) and their meaning while performing sun salutations - Physiology - 7 systems of human anatomy - Significance of performing sun salutations.

UNIT - III

Asanas (Postures): Pathanjali's definition of asana - Sthiram Sukham Asanam - 3rd limb of Ashtanga yoga - Loosening or warming up exercises - Sequence of perform in asanas (Standing, Sitting, Prone, Supine and Inverted) - Nomenclature of asanas (animals, trees, rishis etc) - Asanas versus Chakras - Asanas versus systems - Asanas versus physical health -Activation of Annamaya kosha.

UNIT - IV

Pranayama (Breathing Techniques): Definition of Pranayama as per Shankaracharya - 4th limb of Ashtanga yoga - Various techniques of breathing - Pranayama techniques versus seasons - Bandhas and their significance in Pranayama - Mudras and their significance in Pranayama - Restrictions of applying bandhas with reference to health disorders - Pranayama versus concentration - Pranayama is the bridge between mind and body - Pranayam versus mental health - Activation of Pranamaya kosha through Pranayama.

UNIT - V

Dhyana (Meditation): Definition of meditation - 7th limb of Ashtanga yoga - Types of mind (Conscious and Sub-Conscious) - various types of dhyana. Meditation versus spiritual health - Dharana and Dhyana - Extension of Dhyana to Samadhi - Dhyana and mental stress - Activation of Manomaya kosha through dhyana - Silencing the mind.

Suggested Reading:

1. Light on Yoga by BKS lyengar.
2. Yoga education for children Vol-1 by Swami Satyananda Saraswati.
3. Light on Pranayama by BKS lyengar.
4. Asana Pranayama Mudra and Bandha by Swami Satyananda Saraswati.
5. Hatha Yoga Pradipika by Swami Mukhtibodhananda.
6. Yoga education for children Vol-11 by Swami Niranjanananda Saraswati.
7. Dynamics of yoga by Swami Satyananda Saraswati.

Evaluation Process:

Total Marks: 50 marks for continuous evaluation

a) 15 marks for viva voce.

b) 35 marks for activities and exam

<table>
<tr><td>Course Code</td><td colspan="6">Course Title</td><td>Core/Elective</td></tr>
<tr><td>MC952SP</td><td colspan="6">NATIONAL SERVICE SCHEME (NSS)</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4" rowspan="2">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">-</td><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>3</td><td>50</td><td>-</td><td>0</td></tr>
<tr><td colspan="7">Course Objectives:
➢ To help in Character Moulding of students for the benefit of society.
➢ To create awareness among students on various career options in different fields.
➢ To remould the students behaviour with assertive skills and positive attitudes.
➢ To aid students in developing skills like communication, personality, writing and soft skills.
➢ To educate students towards importance of national integration, participating in electoral process etc by making them to participate in observing important days.</td></tr>
</table>

List of Activities:

1. Orientation programme about the role of NSS in societal development
2. Swachh Bharath Programme
3. Guest lecture's from eminent personalities on personality development
4. Plantation of saplings/Haritha Haram Programme
5. Blood Donation / Blood Grouping Camp
6. Imparting computer education to school children
7. Creating Awareness among students on the importance of Digital transactions
8. Stress management techniques
9. Health Checkup Activities
10. Observation of Important days like voters day, World Water Day etc.
11. Road Safety Awareness Programs
12. Energy Conservation Activities
13. Conducting Programme's on effective communication skills
14. Awareness programme's on national integration
15. Orientation on Improving Entrepreneurial Skills

16. Developing Effective Leadership skills
17. Job opportunity awareness programs in various defence, public sector undertakings
18. Skill Development Programmes
19. Creating awareness among students on the Importance of Yoga and other physical activities
20. Creating awareness among students on various government sponsored social welfare schemes for the people.

Note: At least Ten Activities should be conducted in the Semester**.** Each event conducted under swachh bharath, Plantation and important days like voters day, world water day may be treated as a separate activity.

Evaluation Process:

Total Marks: 50 marks for continuous evaluation

a) 15 marks for viva voce.
b) 35 marks for activities and exam

<table>
<tr><td>Course Code</td><td colspan="5">Course Title</td><td>Core/Elective</td></tr>
<tr><td>MC953SP</td><td colspan="5">SPORTS</td><td>Core</td></tr>
<tr><td rowspan="2">Prerequisite</td><td colspan="4">Contact Hours per Week</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td><td rowspan="2">Credits</td></tr>
<tr><td rowspan="2">-</td><td>L</td><td>T</td><td>D</td><td>P</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>3</td><td>50</td><td>-</td><td>0</td></tr>
</table>

Course Objectives:

- To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
- To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship.
- To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks.
- To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success.
- To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment.

Course Outcomes:

- Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position.
- Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training.
- Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions.
- Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition.
- Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive.

Requirements:

i) Track Pants (students should bring)
ii) Shoes
iii) Cricket, Volley Ball, Foot Ball, Badminton (Shuttle) etc.
iv) Ground, Court, indoor stadium, swimming pool etc.

Evaluation Process:

Total Marks: 50 marks for continuous evaluation

a) 15 marks for viva voce.
b) 35 marks for activities and exam