FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum for the Academic Year 2020-2021)

and

Syllabi

B.E. III and IV Semester

of

Four Year Degree Programme

in

Electronics and Communication Engineering

(With effect from the academic year 2020– 2021)

(As approved in the faculty meeting held on 25-06-2019)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2020

SCHEME OF INSTRUCTION & EXAMINATION
B.E. III- 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 Course										
1	BS201EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	HS202CM	Finance and Accounting	3	-	-	3	30	70	3	3
3	ES 215EC	Digital Electronics	3	1	-	3	30	70	3	4
4	PC201EC	Probability Theory and Stochastic Processes	3	1	-	3	30	70	3	4
5	PC202EC	Electronic Devices	3	1	-	3	30	70	3	4
6	PC203EC	Network Theory	3	1	-	3	30	70	3	4
Practical/Laboratory Course										
7	PC251EC	Electronic Devices Lab	-	-	2	2	25	50	2	1
8	PC252EC	Electronic Workshop	-	-	2	2	25	50	2	1
Total			**18**	**4**	**4**	**22**	**230**	**520**	**22**	**24**

PC: Professional Course **MC**: Mandatory Course **L**: Lecture **T:** Tutorial
P: Practical **D**: Drawing **G**: Grade (E/VG/G/S/U)
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Course Code	Course Title						Core/Elective
HS201EG	**Effective Technical Communication in English**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	-	-	-	30	70	3

Course Objectives: To Expose the students to

1. Features of technical communication
2. Types of professional correspondence
3. Techniques of report writing
4. Basics of manual writing
5. Aspects of data transfer and presentations.

Course Outcome: On successful completion of the course, the students would be able to

1. Handle technical communication effectively
2. Use different types of professional correspondence
3. Use various techniques of report writing
4. Acquire adequate skills of manual writing
5. Enhance their skills of information transfer and presentations

UNIT I

Definition and Features of Technical communication: Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)

UNIT II

Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals.

UNIT III

Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.

UNIT IV

Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.

UNIT V

Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested Readings:

1. Raman, Meenakshi & Sharma, Sangeeta. (2015). *Technical Communication: Principles and Practice*(3rd ed.). New Delhi.
2. Rizvi,Ashraf, M. (2017).*Effective Technical Communication*(2nd ed.).Tata McGraw Hill Education. New Delhi.
3. Sharma, R. C., & Mohan, Krishna. (2017). *Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication* (4th ed.). Tata McGraw Hill Education. New Delhi.
4. Tyagi, Kavita &Misra, Padma. (2011). *Advanced Technical Communication*. New Delhi, PHI Learning.

Course Code	Course Title						Core/Elective
HS202CM	**Finance and Accounting**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

The objectives of the course is

1. To provide basic understanding of Financial and Accounting aspects of a business unit
2. To provide understanding of the accounting aspects of business
3. To provide understanding of financial statements
4. To provide the understanding of financial system To provide inputs necessary to evaluate the viability of projects
5. To provide the skills necessary to analyse the financial statements

Course Outcomes

1. Evaluate the financial performance of the business unit.
2. Take decisions on selection of projects.
3. Take decisions on procurement of finances.
4. Analyse the liquidity, solvency and profitability of the business unit.
5. Evaluate the overall financial functioning of an enterprise.

UNIT-I

Basics of Accounting: Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)

UNIT-II

Final Accounts: Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit-Balance Sheet (including problems with minor adjustments)

UNIT-III

Financial System and Markets: Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)

UNIT-IV

Basics of Capital Budgeting techniques: Time Value of money- Compounding- Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities- Financial Appraisal of Projects– Payback Period, ARR- NPV, Benefit Cost Ratio, IRR (simple ratios).

UNIT-V

Financial statement Analysis: Financial Statement Analysis- Importance-Users-Ratio Analysis-liquidity, solvency, turnover and profitability ratios.

Suggested Readings:

1. Satyanarayana. S.V. and Satish. D., Finance and Accounting for Engineering, Pearson Education
2. Rajasekharan, Financial Accounting, Pearson Education
3. Sharma.S.K. and Rachan Sareen, Financial Management, Sultan Chand
4. Jonathan Berk, Fundamentals of Corporate Finance, Pearson Education
5. Sharan, Fundamentals of Financial Management, Pearson Education

Course Code	Course Title						Core/Elective
ES216EC	**Digital Electronics**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
	3	1	-	-	30	70	4

Course Objectives: To Expose the students to

1. To learn the principles of digital hardware and support given by it to the software.
2. To explain the operation and design of combinational and arithmetic logic circuits.
3. To design hardware for real world problems.

Course Outcome: On successful completion of the course, the students would be able to

1. Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.
2. Understand the number representation and design combinational circuits like adders, MUX etc.
3. Design Combinational circuits using PLDS and write VHDL code for basic gates and combinational circuits.
4. Analyse sequential circuits using flip-flops and design registers, counters.
5. Represent a sequential circuit using Finite State machine and apply state minimization techniques to design a FSM

UNIT – I

Design Concepts: Digital Hardware, Design process, Design of digital hardware. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples. Optimized implementation of logic functions using K-Map and Quine-McCluskey Tabular method

UNIT – II

Number representation: Addition and Subtraction of signed and unsigned numbers.

Combinational circuit building blocks: Adders and Subtractors, Multiplexers. Demultiplexers, Parity Checkers and Generators, Decoders. Encoders. Code converters, BCD to 7-segment converter, Arithmetic comparator circuits.

UNIT – III

Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays (PLAs), Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables(LUTs)

UNIT – IV

Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables. Registers and Counters

UNIT – V

Synchronous Sequential Circuits: Basic Design Steps, Finite State machine(FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.

Suggested Readings:

1. Moris Mano and Michael D CIletti, Digital Design, Pearson, fourth edition,2008
2. Zvi Kohavi, Switching and Finite Automata Theory, 3rd ed., Cambridge University Press-New Delhi, 2011.
3. R. P Jain, Modern Digital Electronics,4th ed., McGraw Hill Education (India) Private Limited, 2003
4. Ronald J.Tocci, Neal S. Widmer &Gregory L.Moss, "Digital Systems: Principles and Applications," PHI, 10/e, 2009.
5. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.

Course Code	Course Title						Core/Elective
PC201EC	**Probability Theory and Stochastic processes**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

1. To understand fundamentals of probability and Random variables as applicable to Electronic Engg.
2. To learn one Random variable characteristic functions of different variables using their density functions
3. To learn two Random variable characteristic functions of different variables using their density functions
4. To understand elementary concepts of the Stochastic Processes and their temporal characteristics
5. To understand elementary concepts of the Stochastic Processes and their Spectral characteristics

Course Outcomes

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

1. To understand different types of Random variables, their density and distribution functions
2. To learn one Random variable characteristic functions of different variables using their density functions
3. To extend the bi-variate distributions and the operations on them.
4. To understand elementary concepts of the Stochastic Processes in the Temporal domain.
5. To analyse the frequency domain information of Stochastic Processes.

UNIT-I: Probability and Random Variable

Concepts of Probability and Random Variable: Probability introduced through Set Theory and Operations – Definitions and Axioms, Causality versus Randomness, Borel Field, Probability Space – Discrete and Continuous, Events - Definition and independent events, Joint Probability, Conditional Probability, Repeated Trials, Combined Experiments, Bernoulli Trials, Bernoulli's Theorem, Total Probability, Baye's Theorem.

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables.

UNIT -II: Distribution & Density Functions and Operations on One Random Variable

Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Gamma, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, Properties.

Expected Value of a Random Variable, Function of a Random Variable g(x) and its distribution, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality (no proof), Characteristic Function, Moment Generating Function; Transformations of Random Variables.

UNIT-III: Two Random Variables and operations

Bi-variate Distributions, One Function of Two Random Variables, Two functions of two random variables, Joint Distribution and Density Function and their properties, Joint Moments, Joint Characteristic Functions, Conditional Distributions (Point & Interval), Conditional Expected Values. Central Limit Theorem (no proof); Engineering application (theoretical discussion) – Mutual information, Channel Capacity and Channel Coding

UNIT-IV Stochastic Processes – Temporal Characteristics

Introduction to stationarity (First and Second order; WSS; SSS), statistical independence, Time averages and ergodicity, random processes and independence, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties. Linear System Response of Mean and Mean-squared Value. Introduction to Gaussian and Poisson Random Processes.

UNIT-V Stochastic Processes – Spectral Characteristics

Power Spectral Density and its properties; Relationship between Power Spectrum and Autocorrelation Function; Relationship between Cross-Power Spectrum and Cross-Correlation Function; White and colored noise, response to linear systems and stochastic inputs, concept of Markov Processes.

SUGGESTED READINGS:

1. Henry Stark and John W. Woods, *Probability and Random Processes with Application to Signal Processing*, 3rd edition, Pearson Education, 2014.
2. Athanasius Papoulis and S. Unnikrishna Pillai, *Probability, Random Variables and Stochastic Processes*, 4th edition, McGraw Hill, 2006.
3. Peyton Z. Peebles, *Probability, Random Variables & Random Signal Principles*, 4th edition, Tata McGraw Hill, 2001.

Course Code	Course Title					Core/Elective
PC202EC	**Electronic Devices**					**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

1. Study semiconductor physics and Analyse the behaviour of Semiconductor diodes in Forward and Reverse bias.
2. Develop Half wave and Full wave rectifiers with L, C Filters.
3. Explain V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations.
4. Design DC Biasing techniques and evaluate A.C parameters for BJT in Amplifier Applications.
5. Explore V-I characteristics of FETs, MOSFETs and study IC fabrication techniques.

Course Outcomes

1. Interpret the characteristics and apply diode models to analyse various applications of diodes.
2. Identify the merits and demerits of various filters, formulate and design rectifier circuits with filters Calculate ripple factor, efficiency and percentage regulation of rectifier circuits.
3. Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability.
4. Analyse, Compare and design of BJT amplifiers with various biasing circuits.
5. Distinguish the working principles of BJT and FET also between FET & MOSFET.

UNIT-I

Basics of Semiconductors: Energy bands in intrinsic and extrinsic Silicon. Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers, Poisson and continuity equation, Hall Effect

Junction Diode: PN Junction formation, Characteristics, biasing–band diagram and current flow, Diode current equation, Breakdown in diodes, Diode as a circuit element, Small signal diode models, Diode switching characteristics, Zener Diode, Zener voltage regulator and its limitation, Schotky diode.

UNIT-II

PN Diode Applications: Half wave, Full wave and Bridge rectifiers–their operation, performance characteristics and analysis. Filters (L, C filters) used in power supplies and their ripple factor calculations, design of Rectifiers with and without Filters.

Special Diodes: Elementary treatment on the functioning of Light Emitting diode, Photodiode and Solar cells.

UNIT-III

Bipolar Junction Transistor: Transistor Junction formation (collector-base, base-emitter Junctions), Transistor biasing – band diagram for NPN and PNP transistors, current components and current flow in BJT, Ebers moll model, Modes of transistor operation, BJT V-I characteristics in CB, CE, CC configurations, BJT as an amplifier, BJT biasing techniques, operating point stabilization against temperature and device variations, Bias stabilization and compensation techniques, Biasing circuits design.

UNIT-IV

Small Signal Transistors equivalent circuits: Small signal low frequency h-parameter model of BJT, Approximate model, Analysis of BJT amplifiers using Approximate model for CB, CE and CC configurations; High frequency - Π model, Relationship between hybrid - Π and h – parameter model.

UNIT-V

Junction Field Effect Transistors (JFET): JFET formation, operation & current flow, V-I characteristics of JFET, Low frequency small signal model of FETs, Analysis of CS, CD and CG amplifiers.

MOSFETs: Enhancement & Depletion mode MOSFETs, current equation, V-I characteristics, DC-biasing

Suggested Readings:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, *Electronic Devices and Circuits*, 3rd ed., McGraw Hill Education, 2010.
2. G. Streetman and S. K. Banerjee, *Solid State Electronic Devices*, 7th edition, Pearson, 2014.
3. S. M. Sze and K. N. Kwok, *Physics of Semiconductor Devices*, 3rd edition, John Wiley& Sons, 2006.
4. D. Neamen, D. Biswas, *Semiconductor Physics and Devices*, McGraw-Hill Education.
5. Robert Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, 11th ed., Pearson India Publications, 2015.

Course Code	Course Title						Core/Elective
PC203EC	**Network Theory**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

1. Concepts of Two Port networks, study about the different two port parameter representations.
2. Concepts about the image impedance on different networks, design of attenuators.
3. Design concepts of equalizers.
4. Design concepts of different filters.
5. Design concepts of network synthesis.

Course Outcomes

1. Able to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits and how they are used in real time applications.
2. Able to learn how to calculate properties of networks and design of attenuators.
3. Able to design of equalizers.
4. Able to design different types of filters using passive elements.
5. Able to synthesize the RL & RC networks in Foster and Cauer Forms.

UNIT-I

Two Port networks: Z, Y, h, g and ABCD parameters, equivalence of two ports networks, T-π transforms, Reciprocity theorem, Interconnection of two port networks and Brune's test for inter connections.

UNIT-II

Symmetrical and Asymmetrical Networks: Characteristic impedance and propagation constant of symmetrical T and π networks, Image and iterative impedances, Image transfer constant and iterative transfer constant of asymmetrical L, T and π networks,

UNIT-III

Constant k- Filters- Low pass, high pass, band pass and band elimination filter design, m-derived low pass and high pass filter design, Composite filter design and notch filter.

UNIT-IV

Attenuators and Equalizers- Design of symmetrical T, π , Bridge-T and Lattice attenuators, impedance matching networks, Inverse networks, Equalizers, Constant resistance equalizer, full series and full shunt equalizer**.**

UNIT-V

Network Synthesis: Hurwitz polynomials, positive real functions, Basic Philosophy of Synthesis, L-C Immitance functions, RC impedance functions and RL admittance functions. RL impedance functions and RC admittance functions. Cauer and Foster's forms of RL impedance and RC admittance. Properties of RC, RL Networks**.**

Suggested Readings:

1. Ryder J.D, *Network Lines Fields,* 2nd edition, Prentice Hall of India,1991.
2. P.K. Jain and Gurbir Kau, *Networks, Filters and Transmission Lines,* Tata McGraw-Hill Publishing Company Limited.
3. A. Sudhakar Shyammohan, *Circuits Networks: Analysis Synthesis,* 4th edition, Tata McGraw-Hill, 2010.
4. Van Valkenburg M.E, *Introduction to Modern Network Synthesis,* Wiley Eastern 1994.
5. S.P. Ghosh and A.K. Chakraborty, *Network Analysis and Synthesis,* McGraw Hill, 1st edition, 2009.

Course Code	Course Title				Core/Elective		
PC251EC	**Electronic Devices Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ED PC221EC	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

1. Study the characteristics of PN diode
2. Learn the characteristics of BJT in CE, CB and CC configurations
3. Plot the characteristics of FET in CS and CD configurations
4. Observe the parameters of BJT and FET amplifiers
5. Design biasing circuits

Course Outcomes

1. Understand characteristics of Diodes
2. Plot the characteristics of BJT in different configurations.
3. Record the parameters of BJT and FET amplifiers.
4. Understand biasing techniques of BJT.
5. Use the SPICE software for simulating electronic circuits.

List of Experiments

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode Characteristics and its application as voltage regulator.
3. Design, realization and performance evaluation of half wave rectifiers without and with filters.
4. Design, realization and performance evaluation of full wave rectifiers without and with filters.
5. V-I Characteristics of BJT in CB configuration.
6. V-I Characteristics of BJT in CE configuration.
7. V-I Characteristics of JFET in CS configuration.
8. Frequency response of Common Emitter BJT amplifier.
9. Frequency response of Common Source FET amplifier.
10. BJT Biasing circuit design.
11. V-I characteristics of UJT
12. Simulate any four experiments using PSPICE

Note: A minimum of 10 experiments should be performed

Suggested Readings:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, Atext – Lab Manual*, 7th Edition, TMH 2001.

Course Code	Course Title					Core/Elective
PC252EC	**Electronic Workshop Lab**					**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

1. To learn the usage of basic electronic components, equipment and meters used in electronic laboratories
2. To learn practical electric AC and DC circuits
3. Verify the truth tables of combinational and sequential circuits
4. Realize combinational and sequential circuits
5. Design adder / subtractor

Course Outcomes

1. Use the basic electronic components and design circuits.
2. Verify various parameters of the circuits by applying theorems.
3. Understand the pin configuration of ICs and verify the operation of basic gates
4. Design and verify the combinational and logic circuits.

List of Experiments

Part A

1. Study of all types of discrete Active & passive devices, display devices, integrated components, electro mechanical components (switches, sockets, connectors etc.,) electromagnetic components (relays). Study and use of different meters (volt/ammeter, AVO/Multi meter) for the measurement of electrical parameters. Measurement of RLC components using LCR Meter.
2. Soldering and Desoldering
3. PCB design and circuit assembling
4. Study of CRO and its applications.
5. Design and Verification of Superposition and Tellegan's theorem
6. Design and Verification of Thevenin's and Maximum Power Transfer Theorem.
7. Measurement of two-port network parameters.
8. Measurement of Image impedance and Characteristics impedance.

Part B

Implement using digital ICs

9. Verification of truth tables of Logic gates and realization of Binary to Gray and Gray to Binary code converters.
10. Realization of Half adder/sub and full adder/sub using universal logic gates.
11. Realization of Full adder/Sub using MUX and Decoder
12. Design 2's complement Adder/subtractor using IC 74283 and verify experimentally.
13. Verification of truth tables of Flip Flops and Flip flop conversions form one form to the other.

Note: A minimum of 6 experiments in Part-A and 4 experiments in Part-B should be performed. The students may use any commercial / open source SPICE programs available like MULTISIM, PSPICE, TINA, LAB VIEW for simulation.

Suggesting Readings:

1. Paul B. Zbar, Albert P. Malvino, *Michael A. Miller, Basic Electronics, A Text – Lab Manual,* 7th Edition, TMH 2001.
2. Paul Tobin, *PSPICE for Circuit Theory and Electronic Devices,* Morgan & Claypool publishers, 1st ed., 2007.
3. Fundamentals of Logic Design- Charles H. Roth, Cengage Learning, 5th, Edition, 2004.

SCHEME OF INSTRUCTION & EXAMINATION
B.E. IV- 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 Course										
1	ES216EC	Signals and Systems	3	-	-	3	30	70	3	3
2	PC231EC	Analog Electronic Circuits	3	1	-	4	30	70	3	4
3	PC232EC	Electromagnetic Theory and Transmission Lines	3	1	-	4	30	70	3	4
4	PC233EC	Pulse and Digital Circuits	3	1	-	4	30	70	3	4
5	PC234EC	Computer Organization and Architecture	3	-	-	3	30	70	3	3
6	MC771EG	Human Values and Professional Ethics	2	-	-	3	30	70	3	0
Practical/Laboratory Course										
7	PC261EC	Analog Electronic Circuits Lab	-	-	2	2	25	50	3	1
8	PC262EC	Pulse and Digital Circuits Lab	-	-	2	2	25	50	3	1
Total			**17**	**3**	**4**	**24**	**230**	**520**	**24**	**20**

HS: Humanities and Social Sciences BS: Basic Science ES: Engineering Science
MC: Mandatory Course PC: Professional Core
L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Evaluation (Univ. Exam)
PY: Philosophy, BZ: Biology/ Life Sciences, CE: Civil Engineering,
MP: Mechanical / Production Engineering, EC: Electronics and Communication Engineering.

Note:
1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Course Code	Course Title						Core/Elective
ES216EC	**Signals and Systems**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	3	-	-	-	30	70	3

Course Objectives:

1. Analyze basic concepts related to continuous time signals and systems, mathematical representation of periodic signals.
2. Familiarize with basic operations on signals and mathematical representation of aperiodic signals using Fourier and Laplace transform.
3. Analyze basic concepts related to discrete time signals and systems, mathematical representation discrete time signals.
4. Describe the concept of Z- Transform and its properties and illustrate their applications to analyze systems.
5. Define convolution, correlation operations on continuous and discrete time signals.

Course Outcomes

1. Define and differentiate types of signals and systems in continuous and discrete time
2. Apply the properties of Fourier transform for continuous time signals
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs
4. Apply Z-transforms for discrete time signals to solve Difference equations
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation

UNIT-I

Definitions and classifications: Classification of signals. Elementary continuous time signals, Basic operations on continuous-time signals.

classification of continuous-time systems: continuous time & discrete time systems, lumped-parameter & distributed –parameter systems, static & dynamic systems, causal & non-causal systems, Time-invariant & time-variant systems, stable & unstable systems

UNIT-II

Representation of Continuous-time signals: Analogy between vectors and signals, orthogonality and completeness.

Fourier series Analysis of Continuous-time signals: Fourier series – Existence of Fourier series, Trigonometric and Exponential Fourier series, computational formulae, symmetry conditions, complex Fourier spectrum.

UNIT-III

Continuous-time Fourier Transform (FT): The direct and inverse FT, existence of FT, Properties of FT, FT of standard signals , properties of FT, The Frequency Spectrum.

Linear Convolution of continuous time signals: Graphical interpretation, properties of convolution, Correlation between continuous-time signals: Auto and Cross correlation, graphical interpretation, properties of correlation.

Laplace Transform (LT) Analysis of signals and systems: The direct LT, Region of convergence, existence of LT, properties of LT. The inverse LT, Solution of differential equations, system transfer function.

UNIT IV

Discrete-time signals and systems: Sampling, Classification of discrete-time signals, Basic operations on discrete time signals, Classification of discrete time systems, properties of systems.

Linear Convolution of discrete time signals: Graphical interpretation, properties of discrete convolution

Fourier analysis of discrete-time signals: Discrete-time Fourier transform (DTFT), properties of DTFT,

Transfer function, Discrete Fourier transform properties of DFT

UNIT V

Z-Transform analysis of signals & systems: The direct Z transform, Region of convergence, Z-plane and S-plane correspondence. Inverse Z transform, Properties of Z-transforms. Solution to linear difference equations, Linear constant coefficient systems, System transfer function.

Suggested Reading:

1. B. P. Lathi, *Linear Systems and Signals,* Oxford University Press, 2nd Edition, 2009
2. Alan V O P Penheim, A. S. Wlisky, *Signals and Systems,* 2nd Edition, Prentice Hall
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, *Signals and Systems,* 4th Edition, Pearson 1998.
4. Douglas K. Linder, *Introduction to Signals and Systems,* McGraw Hill, 1999
5. P. Ramesh babu, R Ananada Natarajan, *Signals and Systems,* SCITECH, 3rd edition 2009

Course Code	Course Title				Core/Elective		
PC231EC	**Analog Electronic Circuits**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	-1	**-**	**-**	**30**	**70**	**4**

Course Objectives

1. Analyse frequency response of Amplifiers in different frequency ranges.
2. Familiarize with concept and effect of negative feedback
3. Study positive feedback and Design different types of oscillators.
4. Design Power Amplifiers and calculate their efficiencies.
5. Familiarize with concept of tuned Amplifiers.

Course Outcomes

1. Design and Analyse low frequency, mid frequency and high frequency response of small signal single stage and Multistage RC coupled and Transformer Amplifiers using BJT and FET.
2. Identify the type of negative feedback, Analyse and design of negative feedback amplifiers.
3. Design Audio Frequency and Radio Frequency oscillators
4. Distinguish between the classes of Power Amplifiers and their design considerations
5. Compare the performance of single and double tuned amplifiers

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UNIT-I

Small Signal Amplifiers: Classification of amplifiers, mid-frequency, Low-frequency and high frequency analysis of single and multistage RC coupled amplifier with BJT and FET. Analysis of transformer coupled amplifier in mid frequency, Low frequency and high frequency regions with BJT.

UNIT-II

Feedback Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations, Local Versus global feedback

UNIT-III

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillators, LC oscillators, Crystal oscillator, Amplitude and frequency stability of oscillator.
Regulators: Transistorized series and shunt regulators

UNIT-IV

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transform less push-pull audio power amplifiers under Class-A. Class-B, Class D and Class-AB operations

UNIT-V

RF Voltage Amplifiers: General consideration, Analysis and design of single tuned and double tuned amplifiers with BJT, Selectivity, gain and bandwidth. Comparison of multistage, single tuned amplifiers and double tuned amplifiers. The problem of stability in RF amplifiers, neutralization & uni-laterisation, introduction to staggered tuned amplifiers.

Suggested Readings:

1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, Electronic Devices and Circuits, 3rd ed., McGraw Hill Education, 2010.
2. David A. Bell, Electronic Devices and Circuits, 5th ed., Oxford University Press, 2009.
3. S Salivahanan, N Kumar, and A Vallavaraj, Electronic Devices and Circuits, 2nd ed., McGraw Hill Education, 2007.
4. Jacob Millman, Christos Halkias, Chetan Parikh, Integrated Electronics, 2nd ed., McGraw Hill Education (India) Private Limited, 2011.
5. Donald L Schilling & Charles Belove, Electronics Circuits, Discrete & Integrated, 3rd ed., McGraw Hill Education (India) Private Limited, 2002.

Course Code	Course Title						Core/Elective
PC232EC	**Electromagnetic Theory and Transmission Lines**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives

1. Analyse fundamental concepts of vector analysis, electrostatics and magneto statics law and their applications to describe the relationship between Electromagnetic Theory and circuit theory
2. Formulate the basic laws of static electricity and magnetism and extend them to time varying fields to define the Maxwell's equations in differential and integral form.
3. Derive the wave equations for conducting and di-electric mediums to analyse the wave propagation characteristics of Uniform Plane Waves (UPW) in normal and oblique incidences
4. Analyse fundamental concepts of Transmission lines and to formulate the basic relationship between distortion less transmission lines & applications.
5. To understand the concepts of RF Lines and their characteristics, Smith Chart and its applications, acquire knowledge to configure circuit elements, QWTs and HWTs and to apply the same for practical problems.

Course Outcomes

1. Understand the different coordinate systems, vector calculus, coulombs law and gauss law for finding electric fields due to different charges and to formulate the capacitance for different capacitors.
2. Learn basic magneto-statics concepts and laws such as Biot-Savarts law and Amperes law, their application in finding magnetic field intensity, inductance and magnetic boundary conditions.
3. Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions, and use them for solving engineering problems.
4. Determine the Transmission Line parameters to characterize the distortions and estimate the characteristics for different lines.
5. Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems

UNIT-I

Electrostatics: Review of coordinate systems. Coulomb's Law, Electric field due to various Charge distributions and Electric flux density. Gauss's Law and its applications. Work, Potential and Energy, The dipole. Current and Current density, Laplace and Poisson's equations. Calculation of capacitance for simple configurations.

UNIT-II

Magnetostatics: Steady magnetic - Biot-Savart's law, Ampere's law. Stoke's theorem, Magnetic flux and magnetic flux density. Scalar and vector magnetic potentials. Electric and Magnetic fields boundary conditions. Maxwell's equations for static and time varying fields.

UNIT-III

Electromagnetic Waves:

Uniform plane waves in free space and in conducting medium, Polarization. Instantaneous, average and complex Power, Poynting theorem, Surface Impedence.

Reflection and Refraction: Normal and Oblique incidence on dielectric and conducting medium.

UNIT-IV

Transmission Lines 1:

Overview of T and π networks. Two wire Transmission lines, Primary and secondary constants. Transmission Line equations. Infinite line and characteristic impedance- Open and short circuit lines and their significance. Distortion less transmission line, Concept of loading of a transmission line, Campbell's formula.

UNIT-V

Transmission Lines 2:

Impedance of a transmission line, RF and UHF lines, transmission lines as circuit elements. Properties of λ/2, λ/4 and λ/8 Lines. Reflection coefficient and VSWR. Matching: Stub matching. Smith chart and its applications.

Suggested Readings:

1. Matthew N.O. Sadiku, *Principles of Electro-magnetics*, 6th edition, Oxford University Press, 2016
2. William H. Hayt Jr. and John A. Buck, *Engineering Electromagnetics*, 7th edition, Tata McGraw Hill, 2006.
3. John D. Ryder, *Networks Lines and Fields*, 2nd edition, Pearson, 2015.
4. E.C. Jordan and K.G. Balmain, *Electromagnetic Waves and Radiating Systems*, 2nd edition, Pearson, 2015
5. K.D. Prasad, *Antennas and Wave Propagation*, Khanna Publications.

Course Code	CourseTitle				Core/Elective		
PC233EC	**PULSE AND DIGITAL CIRCUITS**				Core		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
ED	3	1	-	-	30	70	4

Course Objectives:

1. To Introduce the students the wave shaping circuits, Switching characteristics of diode and transistor
2. Analyze different types of Multi vibrators and their design procedures.
3. Understand the operation of Sampling Gates
4. Design NAND and NOR gates using various logic families.

Course Outcome:

1. understand and analyze the responses of first order RC low pass and high pass filters for standard inputs.
2. understand the transfer characteristics of clipping circuits and the response of clamping circuits for sinusoidal and square wave signals.
3. understand the operation, analysis and design of multivibrators using BJTs
4. Analyze different types of sampling gate circuits
5. understand the operation of TTL, ECL,NMOS and CMOS logic families

UNIT I

LINEAR WAVESHAPING- High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.

UNIT II

NON-LINEAR WAVE SHAPING- Diode clippers, Transistor clippers, clipping at two independent levels, Comparators, applications of voltage comparators, clamping operation, clamping circuits taking source and diode resistances into account clamping circuit theorem, practical clamping circuits, the effect of diode characteristics on clamping voltage

Switching Characteristics OF Diodes and Transistors

UNIT III

MULTIVIBRATORS- Analysis, and Design of Bistable, Monostable, Astable Multivibrators, and Schmitt trigger using transistors.

TIME BASE GENERATORS- General features of a time base signal, methods of generating time base waveform

UNIT IV

SAMPLING GATES- Basic operating principles of sampling gates, Unidirectional and Bi-directional sampling gates, Reduction of the pedestal in gate circuits, Applications of sampling gates.

UNIT V

LOGIC FAMILIES: AND, OR gates using Diodes and Transistors Characteristics of Logic families,ECL, TTL, and CMOS Logic families and its comparison. TTL and CMOS Interfacing.

Suggested Reading:

1. J. Millman and H. Taub, Pulse, Digital and Switching Waveforms - McGraw-Hill, 1991.
2. David A. Bell, Solid State Pulse circuits - PHI, 4th Edn., 2002.
3. Anand Kumar A, “Pulse and Digital Circuits”, Prentice-Hall of India private Limited, New Delhi, 2007.

Course Code	Course Title						Core/Elective
PC234EC	**Computer Organisation and Architecture**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. Implement the fixed-point and floating-point addition, subtraction, multiplication & Division.
2. Describe the basic structure and operation of a digital computer.
3. Discuss the different ways of communicating with I/O devices and standard I/O interfaces.
4. Analyze the hierarchical memory system including cache memories and virtual memory.
5. Understand issues affecting modern processors.

Course Outcomes

1. Perform mathematical operations on fixed and floating point digital data.
2. Illustrate the operation of a digital computer.
3. Understand I/O interfacing of a computer.
4. Interface microprocessor with memory devices.
5. Understand latest trends in microprocessors.

UNIT-I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non-restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

UNIT-II

Basic Computer organization and Design: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and micro program sequencer.

UNIT-III

Central Processing Unit: General register organization, stack organization, instruction formats, addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing, Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

UNIT-IV

Input-output Organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor, CPU-IOP

communication, I/O channel.

UNIT-V

Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory: mapping functions, Virtual memory: address mapping using pages, Memory management.

Suggested Readings:

1. Morris Mano, M., "Computer System Architecture," 3/e, Pearson Education, 2005.
2. William Stallings, "Computer Organization and Architecture: Designing for performance," 7/e, Pearson Education, 2006.
3. John P. Hayes, “Computer Architecture and Organization,” 3/e, TMH, 1998.
4. Govindarajalu, “Computer Architecture and Organization” TMH.
5. Hebbar, “Computer Architecture”, Macmillan,2008

Course Code	CourseTitle				Core/Elective		
MC771EG	**Human Values and Professional Ethics**				Mandatory		
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	**T**	**D**	**P**			
-	**2**	**-**	**-**	**-**	**30**	**70**	-

Course Objectives: Student has understand the

1. To develop a critical ability to distinguish between essence and form, or between what is of value and what is superficial to life.
2. To move from discrimination to commitment. It is to create an ability to act on any discrimination in a given situation.
3. It encourage students to discover what they consider valuable, after learning the course, they should be able to discriminate between valuable and superficial in real situation in their life.

Course Outcome: At the end of the course, the students will be able to

1. It ensures students sustained happiness through identifying the essential of human values and skills.
2. It facilitates a correct understanding between profession and happiness.
3. It help students understand practically the importance of trust, mutually satisfying human behavior and enriching interaction with nature.
4. Ability to develop appropriate technologies and management patterns to create harmony in professional and personal life.

UNIT - I

Course Introduction - Need, basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self-Exploration - what is it? - its content and process; 'Natural Acceptance' and Experiential Validation - as the mechanism for self-exploration. Continuous Happiness and Prosperity - A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities - the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT - II

Understanding Harmony in the Human Being - Harmony in Myself!: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

UNIT - III

Understanding Harmony in the Family and Society- Harmony in Human - Human Relationship: Understanding harmony in the Family the basic unit of human interaction. Understanding values in human - human relationship; meaning of justice and program for its fulfillment; Trust and Respect as the foundational values of relationship. Difference between intention and competence. Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family)

UNIT - IV

Understanding Harmony in the nature and Existence - Whole existence as Coexistence: Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature - recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

UNIT - V

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

Suggested Readings:

1. R. R. Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. Prof. K. V. Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.Ivan IIIich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
3. E. F. Schumancher, 1973, Small is Beautiful: a study of economics as if people mattered. Blond & Briggs, Britain.
4. A Nagraj, 1998 Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak. Sussan George, 1976, How the Other Half Dies, Penguin Press, Reprinted 1986
5. Smriti Shristava, "Human Values and Professional Ethics", Katson Publications,2007

Course Code	Course Title				Core/Elective		
PC261EC	**Analog Electronic Circuit Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
AEC PC231EC	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

1. Design and analyse BJT, FET amplifiers.
2. Design and analyse multivibrators
3. Analyse Oscillator circuits
6. Understand Op-Amp. Applications
7. Understand filter circuits

Course Outcomes

1. Calculate gain and bandwidth of BJT, FET.
2. Study multivibrator circuits.
3. Study oscillator circuits.
4. Demonstrate filter circuits.
5. Demonstrate power amplifier and Op-Amp. Circuits

List of Experiments

1. Two Stage RC Coupled CE BJT amplifier.
2. Two Stage RC Coupled CS FET amplifier.
3. Voltage Series Feedback Amplifier.
4. Voltage Shunt Feedback Amplifier.
5. Current series feedback Amplifier
6. RC Phase Shift Oscillator.
7. Hartly & Colpitt Oscillators
8. Design of Class A and Class B Power amplifiers.
9. Constant-k low pass & high pass filters.
10. m-Derived low pass & high pass filters.
11. Series and Shunt Voltage Regulators
12. RF Tuned Amplifier

SPICE:

13. Two Stage RC Coupled CS FET amplifier.
14. Voltage Series Feedback Amplifier
15. Current Shunt Feedback Amplifier

Note: A minimum of 10 experiments should be performed. It is mandatory to simulate any three experiments using SPICE.

Suggested Readings:

1. Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, Basic Electronics, A text–Lab Manual*, 7th Edition, TMH 2001.

Course Code	Course Title						Core/Elective
PC262EC	**Pulse and Digital Circuits Lab**						**Core**
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
PDC **PC233EC**	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives

1. To implement high pass and low pass circuit and study it`s performance
2. To implement clipping and clamping circuits and study it`s performance
3. To design and test bi-stable, mono-stable multi-vibrators
4. To study the characteristics of a Schmitt trigger
5. To build sweep circuits and study it`s performance

Course Outcomes

1. Design and analyse linear and non-linear wave shaping circuits.
2. Design and analyse clipping and clamping circuits.
3. Design and analyse multivibrator circuits.
4. Design and analyse Schmitt trigger circuit
5. Verify the characterstics of TTL & CMOS circuits

List of Experiments

1. Low Pass and High Pass RC Circuits
2. Two level Clipping Circuit
3. Clamping Circuit
4. Transistor Switching Times
5. Collector Coupled Bistable Multivibrators
6. Collector Coupled Monstable Multivibrators
7. Collector Coupled Astable Multivibrators
8. Schmitt Trigger Circuit
9. Miller Sweep Circuit
10. Sampling Gates
11. UJT Relaxation Oscillator
12. Characteristics of TTL and CMOS logic circuits

Note: A minimum of 10 experiments should be performed

Suggested Readings:

1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 5th Edition, Prentice-Hall of India Private Limited, New Delhi, 1995.
2. David A. Bell, Laboratory Manual for "Electronic Devices and Circuits", 4th Edition, Prentice-Hall of India Private Limited, New Delhi, 2004.

FACULTY OF ENGINEERING
Scheme of Instruction & Examination
(AICTE Model Curriculum)

and

Syllabi

B.E. V and VI Semesters

of

Four Year Degree Programme

in

ELECTRONICS & COMMUNICATION ENGINEERING

(With effect from the Academic Year 2020 - 2021)
(As approved in the Faculty Meeting held on 17-02-2020)

Issued by

Dean, Faculty of Engineering
Osmania University, Hyderabad – 500 007
2020

SCHEME OF INSTRUCTION & EXAMINATION
B.E. V- 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 Course										
1	PC501EC	Analog Communication	3	-	-	3	30	70	3	3
2	PC502EC	Digital Signal Processing	3	1	-	4	30	70	3	4
3	PC503EC	Automatic Control Systems	3	1	-	4	30	70	3	4
4	PC504EC	Antenna and wave Propagation	3	-	-	3	30	70	3	3
5	PC505EC	Microprocessors & Microcontrollers	3	1	-	4	30	70	3	4
6	MC506EG	Gender Sensitization	3	-	-	3	30	70	3	0
Practical/Laboratory Course										
8	PC551EC	Systems and Signal Processing Lab	-	-	2	2	25	50	2	1
9	PC552EC	Microprocessor and Microcontroller Lab	-	-	2	2	25	50	2	1
10	PC553EC	Mini Project	-	-	2	2	50	-	2	1
Total			**18**	**3**	**6**	**27**	**280**	**520**	**24**	**21**

PC: Professional Course **MC**: Mandatory Course
L: Lecture **T:** Tutorial **P**: Practical **D**: Drawing **G**: Grade (E/VG/G/S/U)
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

Note-1:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Note-2:

*The students have to undergo a Summer Internship of four weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

****** Subject is not offered to the students of Electronics and Communication Engineering Department

Course Code	Course Title						Core/Elective
PC501EC	**ANALOG COMMUNICATION**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SATT	3	-	-	-	30	70	3

Course Objectives:

1. To analyze the analog communication system requirements
2. To understand the generation & detection of various analog modulation techniques
3. To analyze the noise performance of analog modulation techniques
4. To understand AM and FM receivers
5. To understand the pulse modulation techniques

Course Outcome:

1. Understand analog communication system
2. Compare and analyze analog modulation techniques
3. Calculate noise performance of analog modulation techniques
4. Design AM and FM receivers
5. Differentiate between pulse modulation techniques & continuous modulation techniques.

UNIT - I

Amplitude Modulation: Need for modulation, Amplitude Modulation (AM). Double side band suppressed carrier (DSB –SC) modulation, Hilbert transform, properties of Hilbert transform. Pre-envelop. Complex envelope representation of band pass signals, In-phase and Quadrature component representation of band pass signals. Low pass representation of band pass systems. Single side band (SSB) modulation and Vestigial-sideband (VSB) modulation Modulation and demodulation of all the modulation schemes, COSTAS Receiver.

UNIT - II

Angle modulation: Frequency Modulation (FM) and Phase modulation (PM), Concept of instantaneous phase and frequency. Types of FM modulation: Narrow band FM and wide band FM. FM spectrum in terms of Bessel functions. Direct and Indirect (Armstrong's) methods of FM Generation Balanced discriminator, Foster–Seeley Discriminator, Zero crossing detector and Ratio detector for FM demodulation Amplitude Limiter in FM

UNIT - III

Transmitters and Receivers: Classification of transmitters. High level and low level AM transmitters FM transmitters Principle of operation of Tuned radio frequency (TRF) and super heterodyne receivers Selection of RF amplifier Choice of Intermediate frequency Image frequency and its rejection ratio Receiver characteristics: Sensitivity, Selectivity, Fidelity, Double spotting, Automatic Gain Control.

UNIT - IV

Analog pulse modulation: Sampling of continuous time signals. Sampling of low pass and band pass signals Types of sampling Pulse Amplitude Modulation (PAM) generation and demodulation. Pulse time modulation schemes: PWM and PPM generation and detection. Time Division Multiplexing.

UNIT - V

Noise: Atmospheric noise, Shot noise and thermal noise. Noise temperature Noise in two-port network: noise figure, equivalent noise temperature and noise bandwidth. Noise figure and equivalent noise temperature of cascade stages. Narrow band noise representation S/N ratio and Figure of merit calculations in AM, DSB-SC, SSB and FM systems, Pre-Emphasis and De-Emphasis.

Suggested Reading:

1. Simon Haykin, "Communication Systems," 2/e, Wiley India, 2011.
2. B.P. Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", 4/e, Oxford University Press, 2016
3. P. Ramakrishna Rao, "Analog Communication," 1/e, TMH, 2011.
4. T G Thomas and S Chandra Shekar, Communication theory, 2/e, McGraw-Hill Education
5. R. P. Singh, S. D. Sapre, Communication Systems,2/e McGraw-Hill Education, 2008.

Course Code	Course Title						Core / Elective
PC502EC	**DIGITAL SIGNAL PROCESSING**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SATT	3	1	-		30	70	4

Course Objectives:

1. Describe the necessity and efficiency of digital signal processing.
2. Design and implementation of FIR and IIR digital filters.
3. Describe the basics of Multirate digital signal processing and its application.
4. Describe the DSP processor architecture for the efficient implementation of digital filters.

Course Outcomes:

1. Necessity and use of digital signal processing and its application.
2. Analyze FIR and IIR digital filters.
3. Applications of Multirate digital signal processing.
4. Acquaintance of DSP processor and its architecture.

UNIT – I

Discrete Fourier Transform and Fast Fourier Transform: Discrete Fourier Transform (DFT), Computation of DFT- Linear and Circular Convolution, FFT algorithms: Radix-2 case, Decimation in Time and Decimation in Frequency algorithms- in place computation- bit reversal.

UNIT - II

Infinite Impulse- response Filters (IIR): Introduction to filters, comparison between practical and theoretical filters, Butterworth and ChebyShev approximation, IIR digital filter design techniques- Impulse Invariant technique- Bilinear transformation technique, Digital Butterworth & Chebyshev filters. Implementation

UNIT - III

Finite impulse-response Filters (FIR) : Linear phase filters, Windowing techniques for design of Linear phase FIR filters- Rectangular, triangular, Bartlett, Hamming, Hanning, Kaiser windows, Realization of filters, Finite word length effects, Comparison between FIR and IIR.

UNIT - IV

Multirate Digital Signal Processing: Introduction- Decimation by factor D and interpolation by a factor I- Sampling Rate conversion by a Rational factor I/D- **Implementation of Sampling Rate conversion**- Multistage implementation of Sampling Rate conversion- Sampling conversion by a Arbitrary factor, Application of Multirate Signal Processing.

UNIT - V

Introduction to DSP Processors: Difference between DSP and other microprocessors architecture- their comparison and need for ASP, RISC and CPU- General Purpose DSP processors: TMS 320C54XX processors, architecture, addressing modes- instruction set.

Suggested Reading:

1. Alan V. Oppenheim and Ronald W. Schafer, "Digital Signal Processing", 2/e, PHI, 2010.
2. John G. Praokis and Dimtris G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Application", 4/e, PHI, 2007.
3. Avathar Singh and S. Srinivasan, "Digital Signal Processing using DSP Micrprocessor", 2/e, Thomson Books, 2004.
4. John G Proakis and Vinay K Ingle, " Digital Signal Processing using MATLAB" 3/e, Cengage Learning, 1997.
5. Richard G Lyons, "Understanding Digital Signal Processing", 3/e, Prentice Hall.

Course Code	Course Title						Core/Elective
PC503EC	**AUTOMATIC CONTROL SYSTEMS**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SATT	3	1	-	-	30	70	4

Course Objectives:

1. To Analyze the stability and performance of dynamic systems in both time and frequency domain.
2. To design feedback controllers, such as PID, lead and lag compensators, to meet desired system performance specifications.
3. To provide knowledge of state variable models and fundamental notions of state model design.
4. To understand the classical methods of control engineering and physical system modeling by linear differential equations.
5. To understand state space representation of control systems.

Course Outcomes:

1. Convert a given control system into equivalent block diagram and transfer function
2. Analyze system stability using time domain techniques
3. Analyze system stability using frequency domain techniques
4. Design a digital control system in the discrete time domain
5. Analyze a control system in the state space representation.

UNIT - I

Control System fundamentals and Components: Classification of control systems including Open and Closed loop systems, Transfer function representation, Mathematical modeling of Mechanical systems and their conversion into electrical systems, Block diagram representation, Block diagram algebra and reduction and Signal flow graphs and Mason's gain formula.

UNIT - II

Time Response: Transfer function and types of input. Transient response of second order system for step input. Time domain specifications Characteristic Equation of Feedback control systems Types of systems, static error coefficients, error series,

Stability: Concept of Stability, Routh-Hurwitz criterion for stability, Root locus technique and its construction.

UNIT - III

Frequency response plots: Bode plots, frequency domain specifications Gain and Phase margin. Principle of argument Nyquist plot and Nyquist criterion for stability

Compensation Techniques: Cascade and feedback compensation. Phase lag, lead and lag-lead compensators PID controller.

UNIT - IV

Discrete Control Systems: Digital control, advantages and disadvantages, Digital control system architecture. The discrete transfer function sampled data system Transfer function of sample data systems. Analysis of Discrete data systems

UNIT - V

State space representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and Observability

Suggested Reading:

1. Nagrath, I.J, and Gopal, M., "*Control System Engineering*", 5/e, New Age Publishers, 2009
2. NagoorKani*.," Control systems*", Second Edition, RBA Publications.
3. Ogata, K., "*Modern Control Engineering*", 5/e, PHI.
4. Ramesh Babu, "Digital Signal Processing", 2/e,
5. K.Deergha Rao, Swamy MNS, "Digital Signal Processing, Theory and Applications", 1/e, Springer Publications, 2018

Course Code	Course Title						Core/Elective
PC504EC	**ANTENNAS AND WAVE PROPAGATION**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
EMTL	3	-	-	-	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:

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

UNIT - I

Antenna Fundamentals:

Introduction, Fundamental Concepts- Physical concept of radiation, Retarded potential. 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,

UNIT – II

Thin Linear wire Antennas:

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

Non-Resonant Antennas:

V- antenna, Rhombic Antenna, Yagi - Uda Antenna, Folded Dipoles & their Characteristics, Log-
periodic Antenna, Aperture Antennas- Huygens' principle, Radiation from apertures, Babinets 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 Beam forming.

UNIT – IV

Antenna Arrays

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

Wave Propagation

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, & quot;Antenna Theory: Analysis and Design" Wiley, 3rd edition,
   Faculty of Engineering O.U. With effect from Academic Year 2020 – 2137 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
PC505EC	**MICROPROCESSOR AND MICROCONTROLLER**						core
Prerequisite	Contact Hours per Week:4				CIE	SEE	Credits
	L	T	D	P			
COA STLD	3	1	-	-	30	70	4

Course Objectives:

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

Course Outcomes:

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

UNIT - I

8086 Microprocessor:

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

8086 Programming and Interfacing:

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 and Interrupts:

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

UNIT – V

8051 Interfacing:

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
MC506EG	**GENDER SENSITIZATION**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
-	L	T	D	P			
	3	-	-	-	30	70	0

Course Objectives:

1 To develop students' sensibility with regard to issues of gender in contemporary India.
2 To provide a critical perspective on the socialization of men and women.
3 To introduce students to information about some key biological aspects of genders.
4 To help students reflect critically on gender violence.
5 To expose students to more egalitarian interactions between men and women.

Course Outcomes:

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Students will attain a finer grasp of how gender discrimination works in our society and How to counter it.
4. Students and professionals will be better equipped to work and live together as equals.
5. Students will develop a sense of appreciation of women in all walks of life.

UNIT - I

Understanding Gender: Why Should We Study It? Socialization: Making Women, Making Men: Introduction-Preparing for Womanhood-Growing up male-First lessons in caste-Different Masculinities; **Just Relationships: Being Together as Equals:** Mary Kom and Onler-Love and acid just do not mix-Love Letters-Mothers and Fathers-Further reading: Rosa Parks-The brave heart.

UNIT - II

Gender And Biology: Missing Women: Sex selection and Its Consequences – Declining sex ratio. Demographic Consequences; **Gender Spectrum: Beyond the Binary –** Two or many – Struggles with discrimination; **Our Bodies, Our Health.**

UNIT - III

Gender And Labour: Housework: the Invisible Labour: "My mother doesn't work"- Share the Load"; **Women's Work; Its Politics and Economics:** Fact and fiction-Unrecognized and unaccounted work- Wages and conditions of work.

UNIT - IV

Issues of Violence: Sexual Harassment: Say No! : Sexual harassment – not eve-teasing-Coping with everyday harassment-"Chupulu"; **Domestic Violence: Speaking Out:** Is home a safe place? When women unite-Rebuilding lives-New forums for justice; **thinking about Sexual Violence:** Blaming the victim – "I fought for my life". The caste face of violence

UNIT - V

Gender Studies: Knowledge - Through the Lens of Gender - Point of view - Gender and the structure of knowledge – Unacknowledged women artists of Telangana: **Who's History? Questions for Historians and Others:** Reclaiming a past-Writing other histories-Missing pages from modern Telangana history.

Suggested Readings:

1. A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, VasudhaNagarajAsma Rasheed, GoguShyamala, DeepaSreenivas and Susie Tharu, *"Towards a World of Equals: A Bilingual Text book on Gender"* Telugu Akademi, Hyderabad, 1st Edition, 2015.
2. www.halfthesky.cgg.gov.in

Course Code	Course Title						Core / Elective
PC551EC	**SYSTEMS AND SIGNAL PROCESSING LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
SATT PC304EC DSP PC503EC	-	-	-	2	25	50	1

Course Objectives:

1. Implement the basic algorithms of DFT, IDFT, FFT and IFFT.
2. Design FIR Filter with specific magnitude and phase requirements.
3. Design IIR Filter with specific magnitude and phase requirements.
4. Describe the basics of Multirate signal processing.
5. Design and implement digital filters on DSP processors.

Course Outcomes:

1. Illustrate various signal processing algorithms.
2. Analyze FIR Filter with specific magnitude and phase requirements.
3. Analyze IIR Filter with specific magnitude and phase requirements.
4. Illustrate the basics of Multirate signal processing.
5. Analyze digital filters on DSP processors.

PART-A

List of Signal Processing Experiments

Perform the following programs using MATLAB Simulator

1. Introduction to MATLAB and signal generation.
2. Perform DFT and FFT algorithm.
3. Perform Linear convolution.
4. Perform Circular Convolutions.
5. Perform FIR filters design using different window functions.
6. Perform IIR filters design: Butterworth and Chebyshev.
7. Perform Interpolation and Decimation.
8. Perform Implementation of multi-rate systems.
9. Perform Time response of non –linear systems.
10. Design of P, PI, PD and PID controllers (any two)

PART-B
List of DSP Processor Experiments

Implement the following experiments using DSK

1. Introduction to DSP processors.
2. Implement Solution of difference equations
3. Implement Impulse Response.
4. Implement Linear Convolution.
5. Implement Circular Convolution.
6. Perform Study of procedure to work in real-time.
7. Implement Fast Fourier Transform Algorithms.
8. Design of FIR (LP/HP) USING windows: (a) Rectangular (b) Triangular (c) Hamming windows.
9. Design of IIR (HP/LP) filters.

NOTE:

1. At least ten experiments to be conducted in the semester.
2. Minimum of 5 from Part A and 5 from Part B is Compulsory.
3. For Section 'A' MATLAB with different toolboxes like signal processing.
4. Block set and SIMULINK / MATHEMATICA / any popular software can be used.

Suggested Reading:

1. Jaydeep Chakravorthy, ''Introduction to MATLAB Programming: Toolbox and Simulink",1/e, University Press,2014.

Course Code	Course Title						Core / Elective
PC552EC	**Microprocessor and Microcontroller Lab**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
SATT DSP	L	T	D	P			
	-	-	-	2	25	50	1

Course Objectives:

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

Course Outcomes:

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

List of Experiments

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.
   i) transfer byte and word data from source to destination memory.
   ii) Count even and odd numbers from given Array of ten bytes.
   iii) Find Largest and Smallest number from given array of words
   iv) sort the Given array in ascending order ,Descending order
3. Multiplication and division
   i) use MUL and IMUL for Unsigned and signed multiplication on 8 bit and 16bit data sets
   ii) use DIV and IDIV for Unsigned and signed division on 8 bit and 16bit data sets
   iii) obtain given decimal number to unpacked BCD ex:1234_{10} as 01,02,03,04 and store in memory using DIV
   iv)Find Factorial of a given number using multiplication instructions
4. Single byte, multi byte Binary and BCD addition and subtraction
5. Code conversions.
   i) BCD Unpacked to Packed BCD

ii) Ascii code to BCD code
iii) BCD to Ascii

6. String Searching and Sorting.(Useing string instructions)
   i) Find number of repetitions of a character in a string
   ii) Find and replace a character in the given string
   iii) Convert Case of a given string
   iv) find whether given string is palindrome or not

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: PART-B Perform using assembler simulators like edsim51/keil software

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	-	-	3	30	70	3	3
2	PC602EC	Digital system Design with Verilog	3	-	-	3	30	70	3	3
3	PC603EC	Data Communication and computer networking	3	1	-	4	30	70	3	4
4	PC604EC	Electronic Measurements and Instrumentation	3	-	-	3	30	70	3	3
5	PE – I	Professional Elective-I	3	-	-	3	30	70	3	3
6	OE – I	Open Elective-I	3	-	-	3	30	70	3	3
Practical/Laboratory Courses										
7	PC651EC	Communication Lab	-	-	2	2	25	50	3	1
8	PC652EC	DCCN Lab	-	-	2	2	25	50	3	1
9	PC653EC	Digital system Design with Verilog Lab	-	-	2	2	25	50	3	1
10	PC654EC	Summer Internship*	-	-	-	-	50	-	-	2
Total			**18**	**1**	**6**	**24**	**305**	**570**	**27**	**24**

PC: Professional Course **PE**: Professional Elective **OE**: Open Elective
MC: Mandatory Course **SI**: Summer Internship **HS**: Humanities and Social Sciences
L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

Note-1:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Note-2:

*The students have to undergo a Summer Internship of four weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

****** Subject is not offered to the students of Electronics and Communication Engineering Department.

Open Elective-I:				**Professional Elective – I**		
S.No	**Course Code**	**Course Title**		**S.No.**	**Course Code**	**Course Title**
1	OE601EC	Principles of Electronic Communications		1	PE671EC	Image and Video Processing
2	OE602EC	Fundamental Digital design using Verilog HDL		2	PE672EC	Advanced Microcontrollers
				3	PE673EC	Optical Communications
				4	PE674EC	IOT Sensors

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

Course Objectives:

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

Course Outcomes:

1. Classify the different types of digital modulation techniques PCM, DPCM, DM and ADM and compare their performance by SNR.
2. Illustrate the classification of channels and Source coding methods.
3. Distinguish different types of Error control codes along with their encoding/decoding algorithms.
4. Examine the Performance of different Digital Carrier Modulation schemes of Coherent and Non-coherent type based on Probability of error.
5. 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: Check with autonomous Comparison of Digital and Analog Communication Systems, 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	**DIGITAL SYSTEM DESIGN THROUGH VERILOG HDL**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
STLD	L	T	D	P			
	3	-	-	-	30	70	3

Course Objectives:

1. Describe verilog HDL and develop digital circuits using gate level and data flow modeling
2. Develop verilog HDL code for digital circuits using switch level and behavioral modeling
3. Design and develop of digital circuits using Finite State Machines(FSM)
4. Prepare Algorithmic State Machines(ASM) of Digital design
5. Describes designing with Programmable Logic Devices (PLD's).

Course Outcomes:

1. Appreciate the constructs and conventions of the verilog HDL programming in gate level and data flow modeling.
2. Generalize combinational circuits in behavioral modeling and concepts of switch level modeling
3. Design and analyze digital systems and finite state machines.
4. Comprehend advanced features of verilog HDL and apply them to design complex real time digital system using ASMs
5. Design various circuits for memory devices and annotate the ASIC/FPGA design flow

UNIT - I

Introduction to HDLs: Overview of Digital Design with Verilog HDL, Basic Concepts, Data types, System tasks and Compiler Directives. Hierarchical modeling, concepts of modules and ports Gate level Modeling, Dataflow modeling-Continuous Assignments, Timing and Delays. Programming Language Interface

Design of Arithmetic Circuits using Gate level/ Data flow modeling –Adders, Subtractors**,** 4-bit Binary and BCD adders and 8-bit Comparators.

Verification: Functional verification, simulation types, Design of stimulus block.

UNIT - II

Switch Level Modeling and examples. Behavioral Modeling: Structured Procedures, Procedural Assignments, Timing Controls, and Conditional Statements, multi-way branching, Loops, Sequential and Parallel blocks, Generate blocks. Tasks and Functions **Behavioral/dataflow modeling of basic MSI combinational logic modules:** ALUs, Encoders, Decoders, Multiplexers, Demultiplexers, Parity generator/checker circuits, Bus Structure.
Basic concepts of Static timing analysis, Logic synthesis

UNIT - III

Behavioral modeling of sequential logic modules: Latches, Flip Flops, counters and shift registers applications

Synchronous Sequential Circuits: Analysis and synthesis of synchronous sequential circuits: Mealy and Moore FSM models for completely and incompletely specified circuits, State Minimization-Partitioning Minimization Procedure, sequence detector with verilog HDL modeling Design of a Modulo-8 Counter using the Sequential Circuit Approach and its verilog implementation. One-Hot Encoding

UNIT - IV

Algorithmic State Machines (ASMs): ASM chart, ASM block, simplifications and timing considerations with design example. ASMD chart for binary multiplier and Verilog HDL code, one hot state controller.

Asynchronous Sequential logic: Analysis procedure-Transition table, flow table, race conditions. Hazards with design example of Vending-Machine Controller

UNIT - V

Introduction to ASIC's: Full-custom, standard-cell and Gate array based ASICs. SPLDs: PROM, PAL, GAL, PLA. FPGA and CPLD simplified architecture and applications. ASIC/FPGA Design flow, CAD tools Combinational circuit Design with Programmable logic Devices (PLDs).

Suggested Reading:

1. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis," 2nd Edition, Pearson Education, 2006.
2. M. Morris Mano, Michael D. Ciletti, "Digital Design", 4th edition, Pearson Education.
3. Michael John Sebastian Smith, Application Specific Integrated Circuits, Pearson Education Asia, 3rd edition 2001.
4. Stephen Brown and ZvonkoVranesic,"Fundamentals of Digital Logic with Verilog Design",McGraw Hill.
5. Advanced Digital Design with the Verilog HDL Second Edition Michael D. Ciletti Pearson

Course Code	Course Title						Core/Elective
PC603EC	**DATA COMMUNICATION AND COMPUTER NETWORKING**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
AC	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:

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

UNIT - I

Introduction to 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 Principles and concepts,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 EComer, "Computer Networks and Internet", Pearson Education Asia, 2000.
5. PrakashC. Gupta, "Data Communications and Computer Networks", PHI learning, 2013

Course Code	Course Title						Core/Elective
PC604EC	**Electronic Measurements and Instrumentation**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
AC	3	-	-	-	30	70	3

Course Objectives:

1. Understand the different standards of measurements.
2. Study different types of transducers.
3. List various types of measurements and thermometers
4. Learn the design of digital voltmeters
5. Study various types of bio-medical instruments

Course Outcomes:

1. Describe characteristic of an instrument and state different Standards of measurements
2. Identify and explain different types of Transducers.
3. Draw and Interpret types of transducers.
4. Design and analyse the digital voltmeters and Prioritize the instruments.
5. Identify and classify types of Biomedical instruments.

UNIT - I

Electronic Measurement fundamentals

Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Standards of measurement, classification of standards, IEEE standards.

UNIT - II

Transducers: Classification, factors for selection of a transducer, transducers for measurement of velocity, acceleration. Passive electrical transducers- Strain gauges and strain measurement, LVDT and displacement measurement, capacitive transducer and thickness measurement. Active electrical transducers: Piezo electric, photo conductive, photo voltaic and photo emissive transducers.

UNIT - III

Electronic Sensors

Characteristics of sound, pressure, power and loudness measurement. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermo couples.

UNIT - IV

Measuring instruments

Block diagram, specification and design considerations of different types of DVMs. Spectrum analysers. The IEEE488 or GPIB Interface and protocol. Delayed time base oscilloscope and Digital storage oscilloscope. Introduction to virtual instrumentation, SCADA. Data acquisition system block diagram.

UNIT - V

Biomedical Instrumentation:

Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders – ECG, EEG, EMG, X- ray machines and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

Suggested Reading:

1. Albert D. Helfric, and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 2010.
2. H S Kalsi, "Electronic Instrumentation", 3/e, TMH, 2011.
3. Robert A Witte, "Electronic Test Instruments: Analog and Digital Measurements", 2/e, 2002
4. Nakra B.C, and Chaudhry K.K., "Instrumentation, Measurement and Analysis", TMH, 2004
5. Khandpur. R.S., "Handbook of Bio-Medical Instrumentation", TMH, 2003

Course Code	Course Title						Core/Elective
PC621EC	**COMMUNICATION LAB**						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
AC DC	-	-	-	2	25	50	1

Course Objectives:

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

Course Outcomes:

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

PART-A

List of Analog Communication Experiments

1. Perform AM modulation and demodulation
2. Perform FM modulation and demodulation
3. Perform Pre emphasis and De-emphasis
4. Perform Multiplexing Techniques (FDM and TDM)
5. Perform Mixer Characteristics
6. Perform Sampling , PAM, PWM, PPM generation and detection

PART-B

List of Digital Communication Experiments

1. Perform PCM modulation and demodulation
2. Perform channel encoding and decoding.
3. Perform Linear and Adaptive Delta Modulation and Demodulation
4. Perform ASK generation and Detection.
5. Perform FSK and Minimum Shift Keying generation and Detection.
6. Perform Generation and Detection ofPCM, Delta modulation and Digital modulation Schemes (ASK. FSK, BPSK, QPSK) by using MATLAB/Simulink/Lab-view.

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

Course Code	Course Title						Core/Elective
PC652EC	**DATA COMMUNICATION & COMPUTER NETWORKS LAB**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
-				2	25	50	1

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 flowcontrol.
- To understand various routing protocols and network security.

Course Outcomes:

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

List of Experiments
PART-A

1. Study of network devices in detail.

Design and implement the following experiments using C compiler or and packet tracer software

2. A HLDC frame to perform the following.

   i) Bit stuffing
   ii) Character stuffing.
3. Distance vector algorithm and find path for transmission.
4. Dijkstra's algorithm to compute the shortest routing path.
5. Simulation of network topologies.
6. Configuration of a network using different routing protocols.

PART-B

Simulate experiments using NS2/ NS3/ NCTUNS/ NetSim/ or any other equivalent tool.

7. Implement a point to point network with four nodes and duplex links between them. Analyse the network performance by setting the queue size and varying the bandwidth.
8. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
9. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
10. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
11. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
12. Implementation of Link state routing algorithm.

Note: **Do any 5 experiments from each part.**

Course Code	Course Title						Core/Elective
PC653EC	**DIGITAL SYSTEM DESIGN THROUGH VERILOG HDL LAB**						Elective
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
-				2	25	50	1

Course Objectives:

1. Describe verilog HDL and develop digital circuits using gate level and data flow modeling
2. Develop verilog HDL code for digital circuits using switch level and behavioral modeling
3. Design and develop of digital circuits using Finite State Machines(FSM)
4. Perform functional verification of above designs using Test Benches.
5. Implementation of experiments on FPGA/CPLD boards.

Course Outcomes: The students able to

1. Appreciate the constructs and conventions of the verilog HDL programming in gate level and data flow modeling.
2. Generalize combinational circuits in behavioral modeling and concepts of switch level modeling
3. Design and analyze digital systems and finite state machines.
4. Perform functional verification by writing appropriate test benches.
5. Implement designs on FPGA/CPLD boards.

List of Experiments:

Write the Code using VERILOG, Simulate and synthesize the following:

1. Write structural and dataflow Verilog HDL models for
   a) 4-bit ripple carry adder.
   b) 4-bit carry Adder – cum Subtractor.
   c) 2-digit BCD adder / subtractor.
   d) 4-bit carry look ahead adder
   e) 4-bit comparator
2. Write a Verilog HDL program in Hierarchical structural model for
   a) 16:1 mux realization using 4:1 mux
   b) 3:8 decoder realization through 2:4 decoder

c) 8-bit comparator using 4-bit comparators and additional logic

3. Write a Verilog HDL program in behavioral model for
   a) 8:1 mux
   b) 3:8 decoder
   c) 8:3 encoder
   d) 8 bit parity generator and checker
4. Write a Verilog HDL program in structural and behavioral models for
   a) 8 bit asynchronous up-down counter b) 8 bit synchronous up-down counter
5. Write a Verilog HDL program for 4 bit sequence detector through Mealy and Moore state machines.
6. Write a Verilog HDL program for traffic light controller realization through state machine.
7. Write a Verilog HDL program for vending machine controller through state machine.
8. Write a Verilog HDL program in behavioral model for 8 bit shift and add multiplier.
9. Write a Verilog HDL program in structural model for 8 bit Universal Shift Register.
10. Write a Verilog HDL program for implementation of data path and controller units
    a) Serial Adder b) ALU

Note:

1. All the programs should be simulated using test benches.
2. Minimum of two experiments to be implemented on FPGA/CPLD boards.

Course Code	Course Title						Core/Elective
PC671EC	**IMAGE AND VIDEO PROCESSING**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
DSP	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:

1. Able to develop a foundation that can be used as the basis for higher study and research in the Image processing area.
2. Able to design various filters for processing and deblurring of images without destroying fine details like edges and lines.
3. Able to apply image processing techniques for processing and analysis of remotely sensed, Microscope, Radar and Medical images.
4. 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 Low pass filters. Ideal High pass, Butterworth and Gaussian High pass 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 lineAnd 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. RafealC.Gonzalez, RicharsE.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
PC672EC	**ADVANCED MICROCONTROLLER**						Elective
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
MPMC	3	-	-	-	30	70	3

Course objectives:

1. To gain the knowledge of ARM cortex
2. To gain the knowledge on LPC 21xx microcontroller
3. To understand basic features of programmable DSP processor
4. To study instruction set and addressing modes of TMS 320C54XX.

Course Outcomes:

1. Understand the architecture of a ARM Processor
2. Compare and select ARM processor core based SoC with several features/peripherals based on requirements of embedded applications.
3. Develop simple applications using LPC 21xx microcontroller.
4. Characterize architecture by utilizing the ARM processor core and DSP Processor based platform.

UNIT I:

ARM Embedded Systems: The RISC design philosophy, The ARM design philosophy, ARM Processor fundamentals, registers, current program status register, pipeline exceptions, interrupts and vector table, core extensions, architecture revisions.

UNIT II:

LPC 2148 **microcontroller-** Internal memory, GPIOs, Timers, ADC,UART and other serial Interfaces, PWM,RTC,WDT

UNIT III:

Programmable DSP Processors: Basic Architectural features, DSP Computational Building blocks, Bus Architecture and memory, Data Addressing Capabilities, Address Generation unit, Programmability and program execution, Speed Issues.

UNIT-IV:

Commercial Digital Signal –Processing Devices:

Data addressing modes of TMS320C54xx Digital signal processors, Data addressing modes of TMS320C54xx processors, Memory space of TMS320C54xx processors, Program control TMS320C54xx instructions and programming,

UNIT V:

On-chip Peripherals, Interrupts of TMS320C54xx processors, pipeline operation of TMS320C54xx processors.

Suggested Reading:

1. Sloss Andrew N, symes dominic, wright Chris,"ARM System Developers Guide:Designing and optimizing",Morgan kaufman publication
2. Joseph yiu,"The definitive guide to ARM Cortex-M3", Elsevier, 2nd edition
3. Avatar singh and srinivasan.S, Digital signal processing Implementations, Thomson Book, Singapore, 2004.

Course Code	Course Title						Core/Elective
PC673EC	**IoT Sensors**						Elective
Fundamentals of Communication and Computer Network.	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
COA,MPMC	3	-	-	-	30	70	3

Course Objectives:

1. To understand what is Internet of things.
2. Describe architecture, Design, underlying technologies, platforms and cloud interface.
3. To introduce the concept of implementation of a design of sensor.
4. To introduce different hardware and software components utilising for IoT
5. To introduce different applications with case studies.

Course Outcomes:

1. Explain architecture and design of IoT.
2. Describe the Different Sensors connected in IoT.
3. Understand the underlying Technologies.
4. Understand the platforms in IoT.
5. Understand cloud interface to IoT

UNIT I

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT.

UNIT II

Sensors: Working principles, Different types of sensors such as capacitive, Resistive,MEMS, Surface Acoustic wave for Temperature.Equivalent circuite of a smart sensors. Importance and adavntages of smart sensors.

UNIT-III

IoT Platforms: What is an IoT Device, Exemplary Devices: Raspberry Pi, Raspberry Pi Interfaces, Other IoT Devices: pcDuino, Beagle Bone Black,LoRa,RFID-Tags, CubieBoard, ARDUINO.

UNIT-IV

Interfacing: Design procedure, Serial, SPI, I2C Interfaces, Interfacing Microcontroller sensor interface,Interfacing with communication module, Cloud Interface, ThingSpeak IoT Platform.

UNIT-V

Domain specific IoTs and Case studies: Home Automation, Smartcities, Environment Applications, Energy, Agriculture, Industry, Health and Lifestyle, Logistics.

Suggested Readings:

1. Internet of Things: A Hands-On Approach Arshdeep Bahga, Vijay Madisetti VPT – Paperback 2015 978- 0996025515 628/- 2.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things David Hanes, Gonzalo Salgueiro, Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1- 58714-456- 1 599.

3.Smart Internet of things projects Agus Kurniawan Packt - Sep 2016 978-1- 78646- 651-8 2 The Internet of Things Key Olivier Willy Publication 2nd Edition 978

Course Code	Course Title				Core/Elective		
PC674EC	**OPTICAL COMMUNICATION**				Elective		
Prerequisite	Contact Hours per Week:				CIE	SEE	Credits
	L	T	D	P			
DC	3	-	-	-	30	70	3

Course Objectives:

- Learn concepts of propagation through optical fibermodes 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:

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

UNIT – I

Optical fibers: structureswave guides

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 and Dispersion:

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

Optical Sources,Amplifiers and Coupling:

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

Photodetectors & Receivers:

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:

Digital Links ,Optical Networks:

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
OE601EC	**Principles of Electronic Communications**						**Open Elective-III**
Prerequisite	Contact Hours per Week				CIE	SEE	**Credits**
	L	T	D	P			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives

1. Provide an introduction to fundamental concepts in the understanding of communications systems.
2. Provide an introduction to network model and some of the network layers including physical layer, data link layer, network layer and transport layer.
3. Provide an introduction to the evolution of wireless systems and current wireless technologies.

Course Outcomes

1. Understand the working of analog and digital communication systems
2. Understand the OSI network model and the working of data transmission
3. Understand the evolution of communication technologies from traditional telephony systems to modern wireless communication systems.

UNIT – I

Introduction to communication systems: Electromagnetic Frequency Spectrum, Signal and its representation, Elements of Electronic Communications System, Types of Communication Channels.
Signal Transmission Concepts: Baseband transmission and Broadband transmission,
Communication Parameters: Transmitted power, Channel bandwidth and Noise, Need for modulation **Signal Radiation and Propagation:** Principle of electromagnetic radiation, Types of Antennas, Antenna Parameters and Mechanisms of Propagation.

UNIT – II

Analog and Digital Communications: Amplitude modulation and demodulation, FM modulation and demodulation, Digital converters, Digital modulation schemes – ASK, FSK, PSK, QPSK, Digital demodulation.

UNIT – III

Data Communication and Networking: Network Models, OSI Model, Data Link Layer – Media Access control, Ethernet, Network Layer – Internet Protocol (IPv4/IPv6), Transport Layer – TCP, UDP.

UNIT – IV

Telecommunication Systems: Telephones, Telephone system, Paging systems, Internet Telephony.
Optical Communications: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

UNIT – V

Wireless Communications: Evolution of Wireless Systems: AMPS, GSM, CDMA, WCDMA, OFDM. Current Wireless Technologies: Wireless LAN, Bluetooth, PAN and ZigBee, Infrared wireless, RFID communication, UWB, Wireless mesh networks, Vehicular adhoc networks.

Suggested Readings:

1. *Principles of Electronic Communication Systems*, Louis E. Frenzel, 3e, McGraw Hill, 2008.
2. *Data Communications and Networking*, Behrouz A. Forouzan, 5e TMH, 2012.
3. Kennady, Davis, *Electronic Communications systems*, 4e, McGraw Hill, 1999.

Course Code	Course Title						Open Elective
OE 602 EC	**Fundamental Digital design using Verilog HDL**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
STLD or DELD	**3**	**-**	**-**	**-**	**30**	**70**	**3**

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

.

Course Outcomes : The students able to

1. Describe Verilog hardware description languages (HDL).
2. Develop Verilog HDL code for combinational digital circuits.
3. Develop Verilog HDL code for sequential digital circuits..
4. Develop Verilog HDL code for digital circuits using switch level modeling and
5. describes system tasks, functions and compiler directives

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.

UNIT V:
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.

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.

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Course Code	Course Title						Core/Elective
SI 671 EC	**SUMMER INTERNSHIP**						**Core**
Prerequisite	**L**	**T**	**D**	**P**	**CIE**	**SEE**	**Credits**
-	**0**	**0**	**0**	**2**	**50**	**0**	**2***

Course Objectives: To prepare the students

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

Course Outcomes: On successful completion of this course student will be

1. Able to design/develop a small and simple product in hardware or software.
2. Able to complete the task or realize a prespecified target, with limited scope, rather than taking up a complex task and leave it.
3. Able to learn to find alternate viable solutions for a given problem and evaluate these alternatives with reference to prespecified criteria.
4. 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 Industry / R & D Organization / National Laboratory for a period of 4 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 marks are based on the performance of the student at the work place and awarded 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 4 weeks duration at the end of semester VI and credits will be awarded after evaluation in VII semester.