MAHATMA GANDHI INSTITUTE OF TECHNOLOGY (Autonomous)
B.Tech. in Electronics and Communication Engineering
Scheme of Instruction and Examination
(Choice Based Credit System)

With effect for the batches admitted from the academic year **2021-22**

I Semester

S.No	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
Induction Program									
1	MA101BS	Mathematics-I	3	1	0	30	70	3	**4**
2	PH102BS	Applied Physics	3	1	0	30	70	3	**4**
3	CS101ES	Programming for problem solving	3	1	0	30	70	3	**4**
4	ME101ES	Engineering Graphics	1	0	4	30	70	3	**3**
5	MC101ESC	Environmental Science	3	0	0	30	70	3	**0**
6	PH152BS	Applied Physics Lab	0	0	3	30	70	3	**1.5**
7	CS151ES	Programming for problem solving Lab	0	0	3	30	70	3	**1.5**
		Total Hours/Marks/Credits	**13**	**3**	**10**	**210**	**490**		**18**

II Semester

S. No	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	EN201HS	English	2	0	0	30	70	3	**2**
2	MA202BS	Mathematics-II	3	1	0	30	70	3	**4**
3	CH201BS	Chemistry	3	1	0	30	70	3	**4**
4	EE201ES	Basic Electrical Engineering	3	0	0	30	70	3	**3**
5	EN251HS	The English Language and Communication skills Lab	0	0	2	30	70	3	**1**
6	CH251BS	Engineering Chemistry Lab	0	0	3	30	70	3	**1.5**
7	ME251ES	Engineering Workshop	1	0	3	30	70	3	**2.5**
8	EE251ES	Basic Electrical Engineering Lab	0	0	2	30	70	3	**1**
		Total Hours/Marks/Credits	**12**	**2**	**10**	**240**	**560**		**19**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical **CIE** - Continuous Internal Evaluation **SEE** - Semester End Examination

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III Semester

S.No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	EC301PC	Electronic Devices and Circuits	3	1	0	30	70	3	4
2	EC302PC	Network Analysis and Transmission Lines	3	0	0	30	70	3	3
3	EC303PC	Digital System Design	3	1	0	30	70	3	4
4	EC304PC	Signals and Systems	3	0	0	30	70	3	3
5	EC305PC	Probability Theory and Stochastic Processes	3	0	0	30	70	3	3
6	MC301HS	Constitution of India	3	0	0	30	70	3	0
7	EC351PC	Electronic Devices and Circuits Lab	0	0	2	30	70	3	1
8	EC352PC	Digital System Design Lab	0	0	2	30	70	3	1
9	EC353PC	Basic Simulation Lab	0	0	2	30	70	3	1
10	EN351HS	Finishing School –I	0	0	2	30	70	3	1
		Total Hours/Marks/Credits	**18**	**2**	**8**	**300**	**700**	**-**	**21**

IV Semester

S.No.	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Examination Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	MA406BS	Probability Distributions and Transform Calculus	3	1	0	30	70	3	4
2	EC401PC	Electromagnetic Fields and Waves	3	0	0	30	70	3	3
3	EC402PC	Analog and Digital Communications	3	1	0	30	70	3	4
4	EC403PC	Linear IC Applications	3	0	0	30	70	3	3
5	EC404PC	Electronic Circuit Analysis	3	0	0	30	70	3	3
6	EC451PC	Analog and Digital Communications Lab	0	0	2	30	70	3	1
7	EC452PC	IC Applications Lab	0	0	2	30	70	3	1
8	EC453PC	Electronic Circuit Analysis Lab	0	0	2	30	70	3	1
9	EN452HS	Finishing School-II	0	0	2	30	70	3	1
10	MC451HS	Gender Sensitization Lab	0	0	2	30	70	3	0
		Total Hours/Marks/Credits	**15**	**2**	**10**	**300**	**700**	**-**	**21**

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V Semester

S.No	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	MS501HS	Business Economics and Financial Analysis	3	0	0	30	70	3	3
2	EC501PC	Computer Organization and Microprocessors	3	1	0	30	70	3	4
3	EC502PC	Digital Signal Processing	3	1	0	30	70	3	4
4	EC503PC	Control Systems	3	1	0	30	70	3	4
5		**Open Elective – I**	2	0	0	30	70	3	2
6	MC502ES	Cyber Security	3	0	0	30	70	3	0
7	EC551PC	Microprocessors and Microcontrollers Lab	0	0	3	30	70	3	1.5
8	EC552PC	Digital Signal Processing Lab	0	0	3	30	70	3	1.5
9	EC553PC	Scripting Languages Lab	0	0	2	30	70	3	1
10	MA554BS	Finishing School-III (Quantitative Aptitude and Analytical Ability)	0	0	2	30	70	3	1
		Total Hours/Marks/Credits	**17**	**3**	**10**	**300**	**700**	**-**	**22**

VI Semester

S.No	Course Code	Course Title	Instruction Hours Per Week			Examination Max. Marks		Duration of SEE in Hours	Credits
			L	T	P/D	CIE	SEE		
1	EC601PC	Antenna and Wave Propagation	3	0	0	30	70	3	3
2	EC602PC	Data Communications and Networks	3	1	0	30	70	3	4
3	EC603PC	VLSI Design	3	1	0	30	70	3	4
4		**Professional Elective – I**	3	0	0	30	70	3	3
5		**Professional Elective – II**	3	0	0	30	70	3	3
6		**Open Elective –II**	2	0	0	30	70	3	2
7	MC601HS	Intellectual Property Rights	3	0	0	30	70	3	0
8	MC601ES	Artificial Intelligence	3	0	0	30	70	3	0
9	EC651PC	Data Communications and Networks Lab	0	0	2	30	70	3	1
10	EC652PC	E-Cad and VLSI Lab	0	0	2	30	70	3	1
11	EN653HS	**Finishing School-IV** (Advanced Communication Skills Lab)	0	0	2	30	70	3	1
		Total Hours/Marks/Credits	**23**	**2**	**6**	**330**	**770**	**-**	**22**
12	MC601ESC	Environmental Science (**For Lateral Entry Students)**	3	0	0	30	70	3	0

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VII Semester

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	EC701PC	Microwave and Optical Communications	3	0	0	30	70	3	3
2	EC702PC	Internet of Things and Its Applications	3	0	0	30	70	3	3
3		**Professional Elective – III**	3	0	0	30	70	3	3
4		**Professional Elective – IV**	3	0	0	30	70	3	3
5		**Open Elective – III**	2	0	0	30	70	3	2
6	EC751PC	Microwave and Optical Communications Lab	0	0	2	30	70	3	1
7	EC752PC	Internet of Things Lab	0	0	2	30	70	3	1
8	EC753PC	Industrial Oriented Mini Project/ Summer Internship	0	0	4	-	100	-	2
9	EC754PC	Seminar	0	0	2	100	-	-	1
10	EC755PC	Project stage-I	0	0	4	30	70	-	**2**
		Total Hours/Marks/Credits	**14**	**0**	**14**	**340**	**660**	**-**	**21**

VIII Semester

S.No	Course Code	Course Title	Instruction			Examination			Credits
			Hours Per Week			Max. Marks		Duration of SEE in Hours	
			L	T	P/D	CIE	SEE		
1	MS803HS	Professional Practice, Law and Ethics	2	0	0	30	70	3	2
2		**Professional Elective – V**	3	0	0	30	70	3	3
3		**Professional Elective – VI**	3	0	0	30	70	3	3
4	EC851PC	Project Stage-II	0	0	16	30	70	-	8
		Total Hours/Marks/Credits	**8**	**0**	**16**	**120**	**280**	**-**	**16**

L: Lecture **T**: Tutorial **D**: Drawing **P**: Practical **CIE** - Continuous Internal Evaluation **SEE** - Semester End Examination

Grand Total of Credits

Semester	I	II	III	IV	V	VI	VII	VIII	**Total Credits**
Credits	18	19	21	21	22	22	21	16	**160**

***Note:** Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. And the report for the same is to be submitted in 7th semester for evaluation.

Department of Electronics and Communication Engineering

List of Professional Electives offered:

Professional Elective – I (Semester – VI)

Subject Code	Name of the Subject
EC611PE	Digital System Design Through Verilog HDL
EC612PE	Coding Theory & Techniques
EC613PE	Global Positioning System
EC614PE	Introduction to Data Science
CS616PE	IT Operations-I

Professional Elective – II (Semester – VI)

Subject Code	Name of the Subject
EC615PE	Advanced Processors
EC616PE	Embedded System Design
EC617PE	Python programming
EC618PE	Database Management Systems

Professional Elective – III (Semester – VII)

Subject Code	Name of the Subject
EC711PE	Cellular and Mobile Communications
EC712PE	Analog IC Design
EC713PE	Wireless Sensor Networks
EC714PE	Pattern Recognition and Machine Learning
CS713PE	IT Operations-II

Professional Elective – IV (Semester – VII)

Subject Code	Name of the Subject
EC715PE	Computer Vision
EC716PE	Digital Image Processing
EC717PE	System Design Using FPGAs
EC718PE	Cloud Computing

Professional Elective – V (Semester – VIII)

Subject Code	Name of the Subject
EC811PE	Satellite Communication
EC812PE	Speech and Video Processing
EC813PE	Deep Learning
EC814PE	Web Technologies

Professional Elective – VI (Semester – VIII)

Subject Code	Name of the Subject
EC815PE	LOW Power VLSI Design
EC816PE	Edge Computing
EC817PE	Smart Technologies
EC818PE	Network Security and Cryptography

List of Open Electives offered:

Open Elective–I

EC531OE	Principles of Electronic Communications
EC532OE	Computer Organization and Architecture

Open Elective–II

EC631OE	Data Communications and Networks
EC632OE	Digital Image Processing

Open Elective–III

EC731OE	Introduction to Embedded System Design
EC732OE	Introduction of Internet of Things (IoT)

L	T	P	C
3	0	0	3

B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
MS501HS: Business Economics and Financial Analysis
(Common to EEE, MECH, ECE, MCT & MME)

Course Objectives:

- Students will understand various forms of Business and the impact of economic variables on the business, concepts of Business economics and its significance.
- Gain the knowledge on various market dynamics namely Demand, elasticity of demand, and demand forecasting.
- To disseminate the knowledge on production function, laws of production, Market structures, while dealing with the concept of cost and breakeven analysis.
- To acquaint the students regarding Accounting and various books of accounts
- To enable the students to analyze a company's financial statements through ratios and come to a reasoned conclusion about the financial situation of the company.

Course Outcomes:

- Students will have ability to start a suitable business organization with available resources
- Analyze various aspects of Demand, Elasticity of demand and Demand Forecasting.
- Will be associated with different market structures, production theories, and cost variables and pricing objectives and methods
- Will learn preparation of Financial Statements
- Will analyze financial well being of the business while using ratios

Unit – I: Introduction to Business and Economics:

Business: Structure of Business Firm, Types of Business Entities – Sole Proprietorship – Partnership – Cooperative Societies - Limited Liability Companies, Sources of Capital – Conventional sources and Non-Conventional Sources of Finance.

Economics: Significance of Economics, Micro and Macro Economic Concepts, National Income - Concepts and Importance, Inflation, Business Cycle - Features and Phases.

Business Economics: Nature and Scope of Business Economics, Role of Business Economist, Multidisciplinary nature of Business Economics.

Unit – II: Demand and Supply Analysis:

Demand Analysis: Demand - Meaning, Determinants of Demand, Law of Demand, Exceptions of Law of Demand, Demand Function, Changes in Demand – Increase and decrease in Demand - Extension and Contraction in Demand.

Elasticity of Demand: Elasticity – Meaning, Types of Elasticity – Price Elasticity – Income Elasticity – Cross Elasticity – Advertising Elasticity of Demand, Factors affecting Elasticity of Demand, Measurement and Significance of Elasticity of Demand, Elasticity of Demand in decision making.

Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting – Survey methods – Consumer survey method – Sales force opinion method– Expert opinion method, Statistical methods – Trend Projection methods – Regression and Correlation Analysis – Barometric Technique, Test marketing.

Supply Analysis: Supply – Meaning, Determinants of Supply, Supply Function & Law of Supply.

Unit III: Production, Cost, Market Structures & Pricing:

Production Analysis: Production – Meaning, Factors of Production, Production Function, Production Function with one variable input, two variable inputs, Returns to Scale, Cobb-Douglas production function

Cost analysis: Cost–Meaning, Types of Costs, Short run and Long run Cost Functions. Market Structures: Nature of Competition, Features of Perfect competition, Monopoly, Oligopoly, Monopolistic Competition.

Pricing: Pricing -Meaning, Objectives of pricing, pricing methods – Cost based pricing methods – Demand based pricing methods – Competition based pricing methods – Strategy based pricing methods - Product Life Cycle based Pricing, Break Even Analysis (simple problems), Cost Volume Profit Analysis.

Unit IV: Financial Accounting:

Accounting concepts and Conventions, Accounting Equation, Double-Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, Preparation of Final Accounts along with adjustments– Trading account – Profit and loss account – Balance sheet (simple problems)

Unit – V: Financial Analysis through Ratios:

Concept of Ratio Analysis, Importance, Liquidity Ratios- Current Ratio – Quick Ratio – Absolute Liquid Ratio, Profitability Ratios – Gross Profit Ratio – Net Profit Ratio – Operating Ratio, Turnover Ratios – Stock Turnover Ratio – Debtors Turnover Ratio – Creditors Turnover Ratio, Leverage Ratios – Debt-to-Assets Ratio – Debt-Equity Ratio - Proprietary Ratios and interpretation (simple problems).

Suggested Readings:

1. Chaturvedi, D. D., Gupta, S. L. , Business Economics - Theory and Applications, International Book House Pvt. Ltd. 2013.
2. Khatri , Dhanesh K, Financial Accounting, Tata Mc –Graw Hill, 2011.
3. Ghosh , Geethika, Gosh, Piyali, Choudhury, Purba Roy, Managerial Economics, Tata Mc Graw Hill Education Pvt. Ltd., 2e, 2012.

Reference Books:

1. Shah, Paresh, Financial Accounting for Management, Oxford Press, 2e, 2015.
2. Maheshwari, S. N., Sunil K Maheshwari, Sharad K Maheshwari, Financial counting, Vikas Publications, 5e, 2013.

L	T	P	C
3	1	0	4

B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
EC501PC: Computer Organization and Microprocessors

Course Objectives:

- To understand basic organization of computer
- To provide the knowledge about interfacing techniques of bus & memory.
- To understand the concepts of 8086 architecture
- To study the basic concepts of 8051 microcontroller.
- To understand the how to interface peripherals with 8051 microcontroller.

Course Outcomes:

- Ability to understand the basic components and design of CPU.
- Ability to understand the memory organization and input-output organization of basic computer.
- Understands the internal architecture, organization, and assembly language programming of 8086 processors.
- Understands the internal architecture, organization and assembly language programming of 8051/controllers
- Understands the interfacing techniques to 8086 and 8051 based systems.

Unit I:
Basic Computer Structure: Computer Types, Functional Units, Bus structure
Register Transfer: Register Transfer Language, Bus and Memory Transfer, Arithmetic, Logic and Shift micro-operations. Design of single stage ALU unit.
Basic Computer Organization and Design: Instruction codes, Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

Unit II:
Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory- Techniques.

Unit III: 8086 Architecture, **Instruction Set and Assembly Language Programming of 8086**
8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Memory addresses, Physical Memory Organization, Architecture of 8086, Signal descriptions of 8086, interrupts of 8086.
Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

Unit IV: Introduction to Microcontrollers, **8051 Real Time Control**
Introduction to Microcontrollers: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.
8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters

Unit V: I/O And Memory Interface , **Serial Communication and Bus Interface**
I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

Suggested Readings:

1. Moris Mano, Computer System Architecture, Pearson/PHI, Third Edition.
2. Ray, A.K., and Bhurchandani, K. M., Advanced Microprocessors and Peripherals – TMH, 2nd Edition 2006.
3. Andrew, Sloss N., Symes Dominic, Wright Chris, ARM System Developers guide, Elsevier, 2012

Reference Books:

1. Kenneth. J. Ayala, The 8051 Microcontroller, Cengage Learning, 3rd Ed, 2004.
2. Hall, D.V., Microprocessors and Interfacing, TMGH, 2nd Edition 2006.
3. Rao, K. Uma, Andhe Pallavi, The 8051 Microcontrollers, Architecture and Programming and Applications - Pearson, 2009.
4. Donald Reay, Digital Signal Processing and Applications with the OMAP- L138 Experimenter, Wiley, 2012.

L	T	P	C
3	1	0	4

B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
EC502PC: Digital Signal Processing

Course Objectives:

- To provide background and fundamental material for the analysis and processing of digital signals.
- To understand the fast computation of DFT and appreciate the FFT processing.
- To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesize for given specifications.
- To acquaint in Multi-rate signal processing techniques and finite word length effects**.**

Course Outcomes:

- Understand the LTI system characteristics and Multirate signal processing.
- Understand the inter-relationship between DFT and various transforms.
- Design a digital filter for a given specification.
- Understand the significance of various filter structures and effects of round off errors.

Unit I: Introduction, Multirate Digital Signal Processing

Introduction: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Linear Shift Invariant Systems, Stability, and Causality, Time and Frequency Domain analysis on signals and systems, linear differential equation to difference equation**,** responses of first order FIR and IIR low and high pass filters, Resonator (Second order IIR filter), Significance of poles and zeros of first order FIR and IIR filters.

Multirate Digital Signal Processing: Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion and its applications.

Unit II: Discrete Fourier series, Fast Fourier Transforms Discrete Fourier series:

Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation**,** DFS Representation of Periodic Sequences, Properties of Discrete Series Fourier, Discrete Fourier Transforms: Properties of DFT, Computation of DFT: Linear and Circular Convolution of Sequences, Convolution using DFT, Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z-Transform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

Unit III: IIR Digital Filters

Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

Unit IV: FIR Digital Filters

Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

Unit V: Realization of Digital Filters, Finite Word Length Effects

Realization of Digital Filters: Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonical, Cascade and Parallel Forms.

Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade-Off Between Round-Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

Suggested Readings:

1. Oppenheim, A. V., and Schaffer, R.W. , Discrete Time Signal Processing, PHI, 2009
2. Proakis John G., Manolakis Dimitris G., Digital Signal Processing, Principles, Algorithms, and Applications: Pearson Education / PHI, 2007.

Reference Books:

1. Li Tan, Digital Signal Processing – Fundamentals and Applications, Elsevier, 2008
2. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using MATLAB, Thomson, 2007
3. Salivahanan, S., Vallavaraj, A., and Gnanapriya, C., Digital Signal Processing, TMH, 2009
4. Emmanuel C. Ifeachor and Barrie W. Jervis, Digital Signal Processing - A Practical approach, Pearson Education, 2nd Edition, 2009.

L	T	P	C
3	1	0	4

B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
EC503PC: Control Systems

Course Objectives:

- To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
- To assess the system performance using time domain analysis and methods for improving it
- To assess the system performance using frequency domain analysis and techniques for improving the performance
- To design various controllers and compensators to improve system performance.

Course Outcomes:

- Understand the modelling of linear-time-invariant systems using transfer function and state- space representations.
- Understand the concept of stability and its assessment for linear-time invariant systems.
- Design simple feedback controllers.

Unit I: Introduction to Control Problem
Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

Unit II: Time Response Analysis of Standard Test Signals
Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second- order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Unit III: Frequency-Response Analysis
Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Unit IV: Introduction to Controller Design
Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

Unit V: State Variable Analysis and Concepts of State Variables
State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Suggested Readings:

1. Gopal, M., Control Systems: Principles and Design, McGraw Hill Education, 1997.
2. Kuo, B. C., Automatic Control System, Prentice Hall, 1995.

Reference Books:

1. Ogata, K., Modern Control Engineering, Prentice Hall, 1991.
2. Nagrath, I. J., and Gopal, M., Control Systems Engineering, New Age International, 2009.

L	T	P	C
2	0	0	2

B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
EC531OE: Principles of Electronic Communications

Course Objectives:

- Introduce the students to modulation and various analog and digital modulation schemes.
- They can have a broad understanding of satellite, optical, cellular, mobile, wireless and telecom concepts.

Course Outcomes:

- Work on various types of modulations.
- Should be able to use these communication modules in implementation.
- Will have a basic understanding of various wireless and cellular, mobile and telephone communication systems.

Unit I: Introduction
Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels

Unit II: Simple description on Modulation
Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.

Unit III: Telecommunication Systems, Networking and Local Area Networks
Telecommunication Systems: Telephones Telephone system, Paging systems, Internet Telephony.
Networking and Local Area Networks: Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN

Unit IV: Satellite Communication, Optical Communication
Satellite Communication: Satellite Orbits, Satellite Communication Systems, Satellite Subsystems, Ground Stations Satellite Applications, Global Positioning systems.
Optical Communication: Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.

Unit V: Cellular and Mobile Communications, Wireless Technologies
Cellular and Mobile Communications: Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA.
Wireless Technologies: Wireless LAN, PANs and Bluetooth, Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB.

Suggested Readings:

1. Louis E. Frenzel, Principles of Electronic Communication Systems, 3e, McGraw Hill publications, 2008.
2. Kennedy, Davis, Electronic Communications systems, Mc.Graw Hill Education, 4e, 1999.

Reference Books:

1. Theodore, S. Rappaport, Wireless Communications - Principles and practice, Prentice Hall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Tomasi Wayne, Introduction to data communications and networking, Pearson Education, 2005.

L	T	P	C
2	0	0	2

B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
EC532OE: Computer Organization and Architecture

Course Objectives:

- The purpose of the course is to introduce principles of computer organization and the basic architectural concepts.
- It begins with basic organization, introduces simple register transfer language to specify various computer operations, design and programming of a simple digital computer.
- Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors.

Course Outcomes:

- Understand the basics of instructions sets and their impact on processor design.
- Demonstrate an understanding of the design of the functional units of a digital computer system.
- Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
- Design a pipeline for consistent execution of instructions with minimum hazards.
- Recognize and manipulate representations of numbers stored in digital computers.

Unit I: Digital Computers, Basic Computer Organization and Design

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Unit II: Central Processing Unit

General Register Organization, Instruction codes, Computer Registers, Instruction cycle, Addressing Modes, Computer instructions: Data Transfer and Manipulation, Program Control.

Unit III: Data Representation, Computer Arithmetic

Data Representation: Data Types, Complements, Fixed Point Representation, Floating Point Representation.

Computer Arithmetic: Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating – Point Arithmetic Operations. Decimal Arithmetic Unit, Decimal Arithmetic Operations.

Unit IV: Input-Output Organization

Input-Output Organization: Input-Output Interface, Asynchronous Data Transfer, Modes of Transfer: Programmed-controlled I/O, Interrupt-initiated I/O, Direct memory Access, Priority Interrupt.

Unit V: Memory Organization

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual memory.

Suggested Readings:

1. Moris Mano, Computer System Architecture, Pearson/PHI, Third Edition.

Reference Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, McGraw Hill, 5th Edition, 2014.
2. William Stallings, Computer Organization and Architecture, Pearson/PHI, Sixth Edition.
3. Andrew, S. Tanenbaum, Structured Computer Organization, PHI/Pearson, 4th Edition.

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B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
MC502ES: Cyber Security

Course Objectives:

- To familiarize various types of cyber-attacks and cyber-crimes
- To give an overview of the cyber laws
- To study the defensive techniques against these attacks

Course Outcomes:

- Understand cyber-attacks, types of cybercrimes, cyber laws and also how to protect them self and ultimately the entire Internet community from such attacks.

UNIT – I:

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, IP spoofing, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Comprehensive Cyber Security Policy.

UNIT – II:

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace.
Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

UNIT – III:

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations.

UNIT- IV:

Cyber Security: Organizational Implications: Introduction cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing.

Cybercrime and Cyber terrorism: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

UNIT – V:

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

Suggested Readings:

1. Nina God bole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, ComputerForensics and Legal Perspectives, Wiley, India 2012.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles,Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Reference Books:

1. Mark F. Grady, Fransesco Parisi, " The Law and Economics of Cyber security", Cambridge University Press,2006.
2. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press, 2016.
3. Introduction to Cyber Security, Chwan - Hwa (john) Wu, J. David Irwin, CRC Press T&F Group.

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B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
EC551PC: Microprocessors and Microcontrollers Lab

Course Objectives:

- Introduce ALP concepts and features
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Differentiate Serial and Parallel Interface
- Interface different I/Os with Microprocessors
- Be familiar with MASM

Course Outcomes:

- Apply the fundamentals of assembly level programming of microprocessors.
- Build a program on a microprocessor using instruction set of 8086.
- Summarize the concepts of Assembly level language programming and its applications.
- Develop the assembly level programming using 8086 instruction set.
- Analyze abstract problems and apply a combination of hardware and software to address the problem
- Contrast how different I/O devices can be interfaced to processor and will explore several techniques of interfacing.
- Experiment with standard microprocessor interfaces including GPIO, serial ports, digital-to-analog converters and analog-to-digital converters;
- Make use of standard test and measurement equipment to evaluate digital interfaces.

Part 1: Using 8086 Processor Kits and/or Assembler

Assembly Language Programs to 8086 to Perform

1. Arithmetic, Logical, String Operations on 16 Bit and 32-Bit Data.
2. Bit level Logical Operations, Rotate, Shift, Swap and Branch Operations.

Part 2: Using 8051 Microcontroller Kit

- Introduction to IDE
    1. Assembly Language Programs to Perform Arithmetic (Both Signed and Unsigned) 16 Bit Data Operations, Logical Operations (Byte and Bit Level Operations), Rotate, Shift, Swap and Branch Instructions
    2. Time delay Generation Using Timers of 8051.
    3. Serial Communication from / to 8051 to / from I/O devices.
    4. Program Using Interrupts to Generate Square Wave 10 KHZ Frequency on P2.1 Using Timer 0 8051 in 8 bit Auto reload Mode and Connect a 1 HZ Pulse to INT1 pin and Display on Port 0. Assume Crystal Frequency as 11.0592 MHZ
    5. ARM Basic Programming in KEIL: ALU and Addressing modes.

Part 3: Interfacing I/O Devices to 8051

1. 7 Segment Display to 8051.
2. Matrix Keypad to 8051.
3. Sequence Generator Using Serial Interface in 8051.
4. 8 bit ADC Interface to 8051.
5. Triangular Wave Generator through DAC interfaces to 8051.

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B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
EC552PC: **Digital Signal Processing Lab**

Course Objectives:

- To interpret the differences between Fourier, Laplace and Z-transforms.
- To study the effects of noise added to the signal.
- To understand the concepts of multirate sampling techniques.
- To design digital filters for given specifications.

Course Outcomes: Upon completing of this course, the student will be able to:

- Able to design a filter for given specifications and will process the signals with relevant filters.
- Able to improve their programming capability.
- Will be capable to design practical systems for real time signals.
- Will be able to process the signals using multirate sampling techniques.

The Programs shall be implemented in Software (Using Octave / MATLAB / Lab View / C Programming/ Python / Equivalent) and Hardware (Using TI / Analog Devices / Motorola / Equivalent DSP processors).

Note: - Minimum of 12 experiments has to be conducted.

List of Experiments:

1. Generate a discrete sequence and perform different types of operations on it. Determine Power and Energy of given signals.
2. Plot the spectra of a 50Hz signal with and without adding noise to it. Prove any three properties of Fourier transform.
3. Analyze first order difference equations of FIR low and high pass filters in time and frequency domains with and without in-built functions.
4. Analyze first order difference equations of IIR low and high pass filters in time and frequency domains with and without in-built functions.
5. Analyze first order differential equations of iIR low and high pass filters in time and frequency domains with and without in-built functions.
6. Analyze second order IIR filter (Resonator). Plot its poles and zeros for different radii and angle of oscillations.
7. To find DFT / IDFT of a given DT Signal. Also prove that DFT is Periodic.
8. FInd FFT and IFFT of a given Sequence with and without in-built functions.
9. Generation of DTMF Signals.
10. Perform Decimation and Interpolation processes on a speech signal. Also perform an I/D sampling rate conversion. Interpret the results by changing the frequency of the signal.
11. Design Butterworth low and high pass IIR filters for the given specifications. Plot the frequency response and filter a given signal through them.
12. Design Chebyshev Type-1 and Type-2 low and high pass IIR filters for the given specifications. Plot the frequency response and filter a given signal through them.
13. Design low and high pass FIR filters for the given specifications using different windows. Plot the frequency response and filter a given signal through them.
14. Plot the spectrograms of a speech signal with and without adding noise to it.

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B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
EC553PC: Scripting Languages Lab

Course Objectives:

- To Understand the concepts of scripting languages for developing web-based projects
- To understand the applications the of Ruby, TCL, Perl scripting languages

Course Outcomes:

- Ability to understand the differences between Scripting languages and programming languages
- Able to gain some fluency programming in Ruby, Perl, TCL

List of Experiments

1. Write a Ruby script to create a new string which is n copies of a given string where n is a non- negative integer
2. Write a Ruby script which accept the radius of a circle from the user and compute the parameter and area.
3. Write a Ruby script which accept the user's first and last name and print them in reverse order with a space between them
4. Write a Ruby script to accept a filename from the user print the extension of that
5. Write a Ruby script to find the greatest of three numbers
6. Write a Ruby script to print odd numbers from 10 to 1
7. Write a Ruby script to check two integers and return true if one of them is 20 otherwise return their sum
8. Write a Ruby script to check two temperatures and return true if one is less than 0 and the other is greater than 100
9. Write a Ruby script to print the elements of a given array
10. Write a Ruby program to retrieve the total marks where subject name and marks of a student stored in a hash
11. Write a TCL script to find the factorial of a number
12. Write a TCL script that multiplies the numbers from 1 to 10
13. Write a TCL script for Sorting a list using a comparison function
14. Write a TCL script to (i)create a list (ii)append elements to the list (iii)Traverse the list (iv)Concatenate the list
15. Write a TCL script to comparing the file modified times.
16. Write a TCL script to Copy a file and translate to native format.
17. a) Write a Perl script to find the largest number among three numbers.
    b) Write a Perl script to print the multiplication tables from 1-10 using subroutines.
18. Write a Perl program to implement the following list of manipulating functions
    a) Shift b) Unshift c) Push
19. a) Write a Perl script to substitute a word, with another word in a string.
    b) Write a Perl script to validate IP address and email address.
20. Write a Perl script to print the file in reverse order using command line arguments

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B.Tech. in Electronics and Communication Engineering
V Semester Syllabus
MA554BS: *Finishing School-III (Quantitative Aptitude and Analytical Ability)*
[Common to Group- II Branches: CE, EEE, ECE, ME, MCT and MME]

Course Objectives:

This is a foundation course and aims to enhance employability skills in students.

- Students will be introduced to higher order thinking skills and problem-solving on the following areas - Arithmetic ability, Numerical ability and General reasoning.
- Students will be trained to work systematically with speed and accuracy while solving problems.

Course Outcomes:

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

- Solve questions on the above-mentioned areas using shortcut and smart methods
- Understand the fundamental concepts of Aptitude skills
- Perform calculations with speed and accuracy

UNIT 1: QUANTITATIVE APTITUDE - NUMERICAL ABILITY

- Number systems
- LCM & HCF
- Speed Math
  - Divisibility Rules
  - Square root
  - Cube root
  - Problems on numbers with shortcuts

UNIT 2: QUANTITATIVE APTITUDE- ARITHMETIC ABILITY

Percentage
- Profit loss and discounts
- Simple and Compound interest
- Ratio proportions
- Averages
- Pipes and Cisterns
- Ages
- Time-Speed-Distance
- Clocks & Calendars
- Venn diagrams
- Tables and graphs

UNIT 3: REASONING ABILITY – GENERAL REASONING PART 1

Coding decoding

- Directions
- Series completions - Letter, Number & Element Series
- Seating arrangements
- Odd one out
- Spatial ability Questions

UNIT 4: REASONING ABILITY- GENERAL REASONING PART 2

Analogies

  - Alphabet Analogy
  - Numerical Analogy
- Classification
  - Alphabet Classification
  - Word Classification
  - Miscellaneous Classification
- Alphabet test
  - Arranging words in ALPHABETICAL ORDER
  - Problems based on LETTER-WORD
  - Problems based on ALPHABETICAL QUIBBLE
- Blood Relations
- Statements and conclusions
- Direction Sense test

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC601PC: Antenna and Wave Propagation

Course Objectives:

- To understand the concept of radiation, antenna definitions and significance of antenna parameters, to derive and analyze the radiation characteristics of thin wire dipole antennas and solve numerical problems.
- To analyze the characteristics and design relations of UHF, VHF and Microwave Antennas.
- To identify the antenna array requirements, to determine the characteristics of ULAs and estimate the patterns of BSA, EFA, and Binomial Arrays.
- To understand the concepts and set-up requirements for microwave measurements, and familiarize with the procedure to enable antenna measurements.
- To define and distinguish between different phenomenon of wave propagation (ground wave, space wave and sky wave), their frequency dependence, and estimate their characteristics, identifying their profiles and parameters involved.

Course Outcomes:

- Explain the mechanism of radiation, definitions of different antenna characteristic parameters and establish their mathematical relations
- Characterize the antennas based on frequency, configure the geometry and establish the radiation patterns of VHF, UHF and Microwave antennas and also antenna arrays.
- Specify the requirements for microwave measurements and arrange a setup to carry out the antenna far zone pattern and gain measurements in the laboratory.
- Classify the different wave propagation mechanisms, determine the characteristic features of different wave propagations, and estimate the parameters involved.

Unit I: Antenna Basics, Thin Linear Wire Antennas

Antenna Basics: Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures, Effective Height.
Fields from Oscillating Dipole, Field Zones, Front - to-back Ratio, Antenna Theorems, Radiation, Retarded Potentials – Helmholtz Theorem

Thin Linear Wire Antennas – Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height, Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre-fed Antennas of Different Lengths. Loop Antennas - Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, Radiation Resistances and Directivities of Small Loops (Qualitative Treatment).

Unit II: Antenna Arrays , Antenna Measurements

Antenna Arrays: Point Sources – Definition, Patterns**,** arrays of 2 Isotropic Sources - Different Cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their Characteristics and Comparison, BSAs with Non-uniform Amplitude Distributions – General Considerations and Binomial Arrays.

Antenna Measurements: Introduction, Concepts - Reciprocity, Near and Far Fields, Coordinate System, Sources of Errors. Patterns to be Measured, Directivity Measurement, Gain Measurements (by Comparison, Absolute and 3-Antenna Methods)

Unit III: VHF, UHF and Microwave Antennas - I

Arrays with Parasitic Elements, Yagi-Uda Array, Folded Dipoles and their Characteristics, Helical Antennas – Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes, Horn Antennas – Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns.

Unit IV: VHF, UHF and Microwave Antennas - II

Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Micro strip, Antennas. Reflector Antennas – Introduction, Flat Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features.

Unit V: Wave Propagation, Ground Wave Propagation, Space Wave Propagation, Sky Wave Propagation

Wave Propagation - Definitions, Categorizations and General Classifications, Different Modes of Wave Propagation, Ray/Mode Concepts,

Ground Wave Propagation –Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections.

Space Wave Propagation –Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Troposphere Propagation.

Sky Wave Propagation –Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation.

Suggested Readings:

1. Kraus, J. D., Marhefka R.J. and Khan, Ahmad S., Antennas and Wave Propagation – TMH, New Delhi, 4th ed., (Special Indian Edition), 2010.
2. Jordan E.C., and Balmain, K.G., Electromagnetic Waves and Radiating Systems – PHI, 2nd ed., 2000.

Reference Books:

1. Balanis, C.A., Antenna Theory - John Wiley & Sons, 3rd Ed., 2005.
2. Prasad, K.D., Satya Prakashan, Antennas and Wave Propagation – Tech India Publications, New Delhi, 2001.
3. Henney, Keith, Radio Engineering Handbook, TMH, 3rd edition.
4. John Leonidas Volakis, Antenna Engineering Handbook – 3rd edition, 2007.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC602PC: Data Communications and Networks

Course Objectives:

- To introduce the Fundamentals of data communication networks
- To demonstrate the Functions of various protocols of Data link layer.
- To demonstrate Functioning of various Routing protocols.
- To introduce the Functions of various Transport layer protocols.
- To understand the significance of application layer protocols.

Course Outcomes:

- Know the Categories and functions of various Data communication Networks
- Design and analyze various error detection techniques.
- Demonstrate the mechanism of routing the data in network layer
- Know the significance of various Flow control and Congestion control Mechanisms
- Know the Functioning of various Application layer Protocols.

Unit I: Introduction to Data Communications

Components, Data Representation, Data Flow, Networks- Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards

- Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs -The 802.11 Architecture,

Unit II: Data Link Layer

Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC(To be excluded), Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame.

Unit III: The Network Layer

Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol(IP):Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6

Unit IV: Transport Layer

Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go- Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control, TCP Congestion Control

Unit V: Application Layer

Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Web and HTTP, File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

Suggested Readings:

1. James, Kurose F., Keith W., Computer Networking A Top-Down Approach, Pearson 6th Edition.
2. Behrouz A. Forouzan, Data Communications and Networking, McGraw-Hill Education, 4th Edition.

Reference Books:

1. Trivedi, Bhusan, Data communication and Networks, Oxford university press, 2016
2. Andrew S. Tanenbaum, Computer Networks, Pearson Education, 4th Edition.
3. William A. Shay, Understanding Communications and Networks, Cengage Learning, 3rd Edition.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC603PC: VLSI Design

Course Objectives:

- Give exposure to different steps involved in the fabrication of ICs.
- Explain electrical properties of MOS and Bi-CMOS devices to analyze the behavior of inverters designed with various loads.
- Give exposure to the design rules to be followed to draw the layout of any logic circuit.
- Provide design concepts to design building blocks of data path of any system using gates.
- Understand basic programmable logic devices and testing of CMOS circuits.

Course Outcomes:

- Acquire qualitative knowledge about the fabrication process of integrated circuits using MOS transistors.
- Draw the layout of any logic circuit which helps to understand and estimate parasitic effect of any logic circuit
- Design building blocks of data path systems, memories and simple logic circuits using PLA, PAL, FPGA and CPLD.
- Understand different types of faults that can occur in a system and learn the concept of testing and adding extra hardware to improve testability of system.

Unit I: Introduction, Basic Electrical Properties

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & Bi-CMOS

Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

Unit II: VLSI Circuit Design Processes

VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

Unit III: Gate Level Design

Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

Unit IV: Data Path Subsystems, Array Subsystems

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

Unit V: Programmable Logic Devices, CMOS Testing

Programmable Logic Devices: Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs.

CMOS Testing: CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

Suggested Readings:

1. Eshraghian Kamran, Eshraghian Dougles and Pucknell, A., Essentials of VLSI circuits and systems – PHI, 2005 Edition
2. Neil H. E. Weste, David Harris, Banerjee Ayan, CMOS VLSI Design – A Circuits and Systems Perspective, Pearson, 3rd Ed, 2009.

Reference Books:

1. Lin Ming-BO, Introduction to VLSI Systems: A Logic, Circuit and System Perspective, CRC Press, 2011
2. John. P. Uyemura, CMOS logic circuit Design, Springer, 2007.
3. Wayne Wolf, Modern VLSI Design - Pearson Education, 3rd Edition, 1997.
4. Lal Kishore, K., Prabhakar, V. S. V., VLSI Design- I.K International, 2009.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC611PE: Digital System Design through Verilog HDL

Course Objectives:

- To know the basic language features of Verilog HDL and the role of HDL in digital logic design.
- To know the behavioural modelling of combinational and simple sequential circuits.
- To know the behavioural modelling of algorithmic state machines.
- To know the synthesis of combinational and sequential descriptions.
- To know the architectural features of programmable logic devices.

Course Outcomes:

- Demonstrate knowledge on HDL design flow, digital circuits design ,switch de-bouncing, meta-stability, memory devices applications
- Design and develop the combinational and sequential circuits using behavioural modelling
- Solving algorithmic state machines using hardware description language
- Analyze the process of synthesizing the combinational and sequential descriptions
- Memorizing the advantages of programmable logic devices and their description in Verilog

Unit I:

Introduction to Logic Design with Verilog: Structural models of combination logic, logic simulation, design verification, test methodology, propagation delay, truth table models of combinational and sequential logic with verilog modules, ports, gate types, gate delays, dataflow modelling, continuous assignments delays, expressions, operators, operands, operator types.

Unit II:

Logic Design With Behavioral Models of Combinational And Sequential Logic: Behavioral modelling, data types for behavioral modelling, behavioral models of combinational logic, propagation delay and continuous assignments, lathes and level sensitive circuits in verilog, cyclic behavioural models of flip flops and latches, cyclic behavior and edge detection, a comparison of styles for behavioral modelling.

Unit III:

Behavioral models of multiplexers, encoders and decoders, data flow model of a LFSR machines with multi cycle operations, algorithmic state machine charts for behavioral modelling, ASMD charts, behavioral models of counters, shift registers and register files, switch de-bounce, metastability, synchronizers for asynchronous signals.

Unit IV:

Introduction to synthesis: synthesis of combinational logic, synthesis of sequential logic with latches, synthesis of three state devices and bus interfaces, synthesis of sequential logic with flip flops, synthesis of explicit state machines registered logic.

Unit V:

Programmable logic devices, storage devices, programmable logic array, programmable array logic, programmability of PLDs, CPLDs.

Suggested Readings:

1. Michael D Ciletti, Advanced Digital Design with the VERILOG HDL, PHI, 2nd Edition, 2009.
2. Palnitkar, Samir, Verilog HDL, Pearson Education, 2nd edition, 2003.

Reference Books:

1. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog, TMH, 2nd Edition, 2008.
2. Navabi, Z., Verilog Digital System Design, McGraw Hill, 2nd Edition, 2005.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC612PE: Coding Theory and Techniques

Course Objectives:

- To acquire the knowledge in measurement of information and errors.
- T study the generation of various code methods.
- To study the various application of codes.

Course Outcomes:

- Learning the measurement of information and errors.
- Obtain knowledge in designing Linear Block Codes and Cyclic codes.
- Construct tree and trellies diagrams for convolution codes
- Design the Turbo codes and Space time codes and also their applications.

Unit I: Coding for Reliable Digital Transmission and storage , Linear Block Codes

Coding for Reliable Digital Transmission and storage: Mathematical model of Information, Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.

Linear Block Codes Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system

Unit II: Cyclic Codes

Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding, Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

Unit III: Convolutional Codes

Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

Unit IV: Turbo Codes

LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding

Unit V: Space-Time Codes

Introduction, Digital modulation schemes, Diversity, Orthogonal space- Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing: General Concept, Iterative APP Preprocessing and Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QL Decomposition and Interface Cancellation,

Performance of Multi – Layer Detection Schemes, Unified Description by Linear Dispersion Codes.

Suggested Readings:

1. Lin Shu, Daniel J. Costello, Jr, Error Control Coding- Fundamentals and Applications, Prentice Hall, Inc.
2. Rhee Man Young, Error Correcting Coding Theory- McGraw-Hill, 1989.

Reference Books:

1. Bernard Sklar, Digital Communications-Fundamental and Application -PE.
2. John G. Proakis, Digital Communications, TMH, 5th ed., 2008.
3. Moon Todd K., Error Correction Coding – Mathematical Methods and Algorithms, Wiley India, 2006.
4. Bose Ranjan, Information Theory, Coding and Cryptography, TMH, 2nd Edition, 2009.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC613PE: Global Positioning System

Course Objectives:

- Describe the fundamental theory and concepts of the Global Positioning System
- Calculate GPS satellite orbit positions and velocities.
- Calculate user position using GPS pseudorange data.
- Calculate and analyze error sources for GPS user position calculations.
- Correct GPS user position errors by using local area Differential GPS.

Course Outcomes:

- Identify GPS components and their functions
- Select GPS survey method
- Interpret the navigational message and signals received by the GPS satellite
- Identify error sources in GPS observations, and apply the corrections for accurate positioning
- Map the geospatial features

Unit I: Introduction
Basic concept, system architecture, GPS and GLONASS Overview, Satellite Navigation, Time and GPS, User position and velocity calculations, GPS, Satellite Constellation, Operation Segment, User receiving Equipment, Space Segment Phased development, GPS aided Geoaugmented navigation (GAGAN) architecture.

Unit II: Signal Characteristics
GPS signal components, purpose, properties and power level, signal acquisition and tracking , Navigation information extraction, pseudorange estimation, frequency estimation, GPS satellite position calculation, Signal structure, anti spoofing (AS), selective availability, Difference between GPS and GALILEO satellite construction.

Unit III: GPS Receivers & Data Errors
Receiver Architecture, receiver design options, Antenna design, GPS error sources, SA errors, propagation errors, ionospheric error, tropospheric error, multipath, ionospheric error, estimation using dual frequency GPS receiver, Methods of multipath mitigation, Ephemeris data errors, clock errors.

Unit IV: Differential GPS
Introduction, LADGPS, WADGPS, Wide Area Augmentation systems , GEO Uplink subsystem , GEO downlink systems , Geo Orbit determination , Geometric analysis , covariance analysis , GPS /INS Integration Architectures

Unit V: GPS Applications
GPS in surveying, Mapping and Geographical Information System, Precision approach Aircraft landing system, Military and Space application, intelligent transportation system. GPS orbital

parameters, description of receiver independent exchange format (RINEX) , Observation data and navigation message data parameters, GPS position determination, least squares method

Suggested Readings:

1. Grewal, Mohinder S., Lawrence R.Weill, Angus P.Andrews, "Global positioning systems, Inertial Navigation and Integration", Wiley 2007.
2. Bradford W. Parkinson & James J. Spilker., Global Positioning System: Theory and Applications, Vol I, 1996.

Reference Books:

1. Kaplan, E. D., Christopher J. Hegarty, "Understanding GPS Principles and Applications", Artech House Boston, 2005.
2. Hofmann W. B. & Collins, Lichtenegger, H., Global Positioning System – Theory and Practice, Springer-Verlag Wein, New York, 2001.
3. Seeber Gunter., Satellite Geodesy Foundations-Methods and Applications, 2003.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC614PE: Introduction to Data Science

Course Objectives:

- Learn concepts, techniques and tools they need to deal with various facets of data science
- practice, including data collection and integration
- Understand the basic types of data and basic statistics
- Identify the importance of data reduction and data visualization techniques

Course Outcomes:

- Understand basic terms what Statistical Inference means.
- Identify probability distributions commonly used as foundations for statistical modelling.
- Describe the data using various statistical measures
- Utilize R elements for data handling
- Perform data reduction and apply visualization techniques.

Unit – I:
Introduction: Definition of Data Science- Big Data and Data Science hype – and getting past the hype- Datafication - Current landscape of perspectives - Statistical Inference - Populations and samples -Statistical modeling, probability distributions, fitting a model – Over fitting. Basics of R: Introduction, REnvironment Setup, Programming with R, Basic Data Types.

Unit – II:
Data Types & Statistical Description
Types of Data: Attributes and Measurement, What is an Attribute? The Type of an Attribute, The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes. Basic Statistical Descriptions of Data: Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Interquartile Range, Graphic Displays of Basic Statistical Descriptions of Data.

Unit – III:
Vectors: Creating and Naming Vectors, Vector Arithmetic, Vector sub setting, Matrices: Creating and Naming Matrices, Matrix Sub setting, Arrays, Class. Factors and Data Frames: Introduction to Factors: Factor Levels, Summarizing a Factor, Ordered Factors, Comparing Ordered Factors, Introduction to Data Frame, subsetting of Data Frames, Extending Data Frames, Sorting Data Frames.
Lists: Introduction, creating a List: Creating a Named List, Accessing List Elements, Manipulating List Elements, Merging Lists, Converting Lists to Vectors

Unit – IV:
Conditionals and Control Flow: Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements. Iterative Programming in R:

Introduction, While Loop, For Loop, Looping Over List. Functions in R: Introduction, writing a Function in R, Nested Functions, Function Scoping, Recursion, Loading an R Package, Mathematical Functions in R.

Unit – V:

Data Reduction: Overview of Data Reduction Strategies, Wavelet Transforms, Principal Components Analysis, Attribute Subset Selection, Regression and Log-Linear Models: Parametric Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation. Data Visualization: Pixel-Oriented Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations.

Suggested Readings:

1. Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014.
2. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining: Concepts and Techniques, 3rd ed.
3. K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

Reference Books:

1. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.
2. Brain S. Everitt, "A Handbook of Statistical Analysis Using R", Second Edition, 4 LLC, 2014.
3. Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media, 2008.
4. Paul Teetor, "R Cookbook", O'Reilly, 2011.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
CS616PE: IT Operations-I(Value Added Course)

UNIT-I:
Evolution of Technologies & IT-ITES Industry- Overview of the IT Industry, services & activities, IT Production Support and Projects, Skills of Production support engineer
Transmission Media- Telephone lines, Cable Television Lines, satellites antennas, routers, Infrastructure - Data Centers, computers, Computer Networks, Database Management Devices, and a Regulatory system, Support the delivery of business systems and IT-enabled processes.
Introduction to Application Management Services- Services of enterprise application management, increase efficiency, service-oriented culture, cycle time of processes, ensuring uninterrupted IT and business continuity through resilient, reliable and predictable operations.

UNIT-II:
Introduction to IT Operations & Incident Analysis- Infrastructure & configurations, Governance and Disaster Recovery. Roles of IT Operations. IT Operations: IT Monitoring, Ticketing Systems & its life cycle, Shift Operations, Incident Management, Problem Management, Change Management, Escalations.

UNIT-III:
ITIL Basics: Introduction to IT Service Management: Value, Value co-Creation, Service Providers, Service Consumers, Stakeholders, Products, Services, Configuring resources for value creation, service Offerings, Service relationship, Utility & Warranty, Service Management, ITIL guiding Principles.

UNIT-IV:
Introduction to Cloud & Support- Definition, History, Market size, growth roadmap, Cloud Types, Cloud Service Models, Key Players, Key Offerings of Cloud MSPs. Introduction to AWS, AWS Global Infrastructure, Databases types, Sage Maker, DR/BCP Options.
Introduction to AI/ML & AIOPS- History of AI, Structured & Unstructured Data, AI Terminologies, Supervised & Unsupervised Learning, Basic algorithms, Differences between AI/Machine Learning/Deep Learning, Implications of Artificial Intelligence, and Introduction to Augmented Intelligence led IT Operations includes AIOps platform combines big data and machine learning functionality.

UNIT-V:
Information Security: Introduction to Information Security, Password Management, Email Usage, Internet Usage, Software Compliance & Data Storage. System Threats, Security Violations.

Common Tools: Overview and Introduction of Microsoft 365 entire suite of tools/Applications, Troubleshooting PC problems in Real life Problems.

Corporate Etiquette & Communication: Active Listening Skills, Effective Executive Speaking Skills Verbal Spoken Communication, Telephone Etiquette, Email Etiquette, Meeting Excellence.

Text Books/References:

1. Intelligent Automation by Pascal Bornet, Ian Barkin & Jochen Wirtz
2. IT Operations Management, ServiceNow EBook

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC615PE: Advanced Processors

Course Objectives:

- To enable the students to understand various controllers' architectures to design embedded applications
- To understand various microcontroller application development tools

Course Outcomes:

- The Intel microcontroller architecture and its components
- The basics of Motorola and PIC controllers
- The basics of ARM processors
- The detailed instruction sets of ARM and Thumb.
- Microcontroller application development tools

Unit I:
INTEL80196: 80196 Microcontroller Architecture, Memory Organization, Instruction set, Addressing modes, Timers, Interrupts.

Unit II:
Motorola MC68hC11: Architecture, Instruction set, Addressing modes, Memories, Interrupts.
PIC Microcontrollers – PIC16C61/71: Overview and Features, Architecture, Memory Organization, and Instruction set, Addressing modes, Timers, Interrupts.

Unit III:
ARM Processors: Introduction, Registers, Current program status register, Pipeline, Exceptions, Interrupts and Interrupt vector table, Core extensions, Architecture revisions-ARM9 & ARM11 Processors.

UNIT IV:
ARM Instruction Set: Data processing instructions, Branch instructions, Load-store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution.
Thumb Instruction Set: Thumb register usage, Branch instructions, Data processing instructions, Single register Load-store instructions, Multiple register Load-store instructions, Stack instructions, Software interrupt instructions.

UNIT V:
Microcontroller Application Development Tools: Development phases of a Microcontroller - Based System, Software development cycle and applications, Software development tools, Exemplary IDE – Microvision tools from Keil, Emulator and In-circuit Emulator (ICE), Target board, Device Programmer.
Exemplary 8051 Assembly Codes – Delays and Timer controlled delays**,** Serial communication.

Suggested Readings:

1. Raj Kamal, "Microcontrollers - Architecture, Programming, Interfacing and System Design", Pearson Education, 2009.
2. Ajay V. Deshmukh, "Microcontrollers - Theory and Applications", Tata McGraw Hill, 2010.
3. Andrew N. Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide - Designing and Optimizing System Software",Elsevier, 2013.

Reference Books:

1. Trevor Martin, 'The Insider's Guide to The Philips ARM7-Based Microcontrollers, An Engineer's Introduction To The LPC2100 Series", Hitex (UK) Ltd.
2. "ARM Architecture Reference Manual".
3. Muhammad Ali Mazidi, Janice Mazidi, RolinMcKinlay"8051 Microcontroller and Embedded Systems", Pearson Education, 2nd Edition, 2005.
4. PIC Microcontroller and Embedded Systems – Muhammad Ali Mazidi, RolinD.Mckinaly, Danny Causy – PE.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC616PE: Embedded System Design

Course Objectives:

- To provide an overview of principles of Embedded System.
- To provide an overview of 8051 microcontroller
- To provide a clear understanding of role of firmware, operating systems in correlation with hardware systems.

Course Outcomes:

- Expected to understand the selection procedure of processors in the embedded domain.
- Understand programming of 8051 microcontroller.
- Design procedure of embedded firm ware.
- Expected to visualize the role of real-time operating systems in embedded systems.
- Expected to evaluate the correlation between task synchronization and latency issues

Unit – I: Introduction to Embedded Systems

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit – II: Typical Embedded System

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators- Light Dependent Resistor, Thermistor, Photo Transistor, Light Emitting Diode, Relays, Stepper Motor. Communication Interfaces: SPI, I2C, UART, Onboard and External Communication Interfaces: WiFi, Bluetooth, ZigBee, USB

Unit – III: Other System Components of Embedded system :

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches: Super Loop Based Approach and OS based Approach, Development Languages: Assembly Language and High level Language

Unit – IV: RTOS Based Embedded System Design :

Operating System Basics, Types of Operating Systems-GPOS, RTOS, Tasks, Task States, Task Control Block, Process and Threads, Multiprocessing and Multitasking, Task Scheduling- Non-Preemptive Scheduling (FCFS, LCFS, SJF, Priority Based), Preemptive Scheduling(FCFS, LCFS, SJF, Priority Based, Round-Robin).

Unit – V: Task Communication :

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Communication/Synchronization Issues: Racing, Deadlock, Livelock, Starvation, Task Synchronization Techniques: Mutual exclusion through busy waiting/ Spin lock, Mutual exclusion through Sleep and Wakeup, Semaphores, Device Drivers, Methods to Choose an RTOS.

Suggested Readings :

1. Shibu K.V, "Introduction to Embedded Systems", McGrawHill.
2. RajKamal, "Embedded Systems",TMH.

Reference Books :

1. Frank Vahid, Tony Givargis, "Embedded Systems Design: A Unified Hardware / Software Introduction", John & Wiley Publications, 2002.
2. Lyla B. Das, "Embedded Systems",Pearson,2013.
3. David E. Simon, "An Embedded Software Primer", Pearson Education

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC617PE: Python Programming

Course Objectives:

- To learn about Python programming language syntax, semantics, and the runtime environment
- To be familiarized with universal computer programming concepts like data types, containers
- To be familiarized with general computer programming concepts like conditional execution, loops & functions
- To be familiarized with general coding techniques and object-oriented programming

Course Outcomes:

- Develop essential programming skills in computer programming concepts like data types, containers.
- Apply the basics of programming in the Python language.
- Solve coding tasks related Exceptions and Functions.
- Solve coding tasks related to the fundamental notions and techniques used in object- oriented programming.
- Solve coding tasks related to GUI Programming.

Unit – I:

Introduction: Introduction to Python, Program Development Cycle, Input, Processing, and Output, Displaying Output with the Print Function, Comments, Variables, Reading Input from the Keyboard, Performing Calculations, Operators. Type conversions, Expressions, More about Data Output.

Data Types and Expression: Strings Assignment, and Comment, Numeric Data Types and Character Sets, Using functions and Modules.

Decision Structures and Boolean Logic: if, if-else, if-elif-else Statements, Nested Decision Structures, Comparing Strings, Logical Operators, Boolean Variables.

Repetition Structures: Introduction, while loop, for loop, Input Validation Loops, Nested Loops.

Unit – II:

Sequences: Introduction to Sequences: Strings, Lists, and Tuples, Mapping, Set Types and Dictionaries

String: Strings and Operators, Built-in Methods and Special Features of String. Related Modules.

Lists: Operators, Built-in Functions, List Type Built in Methods, Special Features of List, Related Modules

Tuples: Built-in Functions, Tuple Type Built in Methods, Special Features of Tuples, Related Modules

Mapping and Set Type: Dictionaries, Dictionary Keys, Operators and Built-in Methods. Set type, Operator and Built in Methods. Related Modules.

Unit – III:

Errors and Exceptions: Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions, User-defined Exceptions, Defining Clean-up Actions, Redefined Clean-up Actions.

Functions: What are Functions, Defining and Creating functions, Function Arguments: Formal and Variable length, Calling functions, Recursive Functions and Variable Scope.

Modules: Modules, Standard Modules, Importing Modules, Namespaces and Packages.

Unit – IV:

File Operations: Reading config files in python, Writing log files in python, Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations

Object Oriented Programming: Concept of class, object and instances, Constructor, class attributes and destructors, Real time use of class in live projects, Inheritance , overlapping and overloading operators, Adding and retrieving dynamic attributes of classes, Programming using Oops support

Design with Classes: Objects and Classes, Data modelling Examples, Case Study An ATM, Structuring Classes with Inheritance and Polymorphism.

Unit – V:

GUI Programming: Introduction, Tkinter and Python Programming, Brief Tour of Other GUIs, Related Modules and Other GUIs.

Suggested Readings:

1. Fundamentals of Python First Programs, Kenneth. A. Lambert, Cengage, 2016.
2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson, 2018.

Reference Books:

1. Introduction to Python Programming, Gowrishankar.S, Veena A, CRC Press, 2019.
2. Introduction to Programming Using Python, Y. Daniel Liang, Pearson, 2017.
3. Core Python Programming, Wesley J.Chun, Second Edition ,Pearson 2007.

e-Resources:

https://www.tutorialspoint.com/python3/python_tutorial.pdf

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC618PE: Database Management Systems

Course Objectives:

- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- To understand the relational database design principles.
- To apply the concurrency control, recovery, and indexing for the real time data
- To become familiar with database storage structures and access techniques

Course Outcomes:

- Design a database using ER modeling.
- Develop complex queries using SQL.
- Apply normalization techniques on databases.
- Explain the ACID properties of transactions and apply the serializability tests.
- Solve problems using various indexing and hashing techniques.

Unit I:

Introduction: Purpose of Database Systems, View of Data, Database Languages, Database Models, Database Architecture, Database System Applications.

Introduction to Data base design: Database Design and ER diagrams, Entities, Attributes and Entity sets, Relationships and Relationship sets, Additional features of ER Model, Conceptual Design with the ER Model.

Unit II:

Relational Model: Introduction to the Relational Model, Integrity Constraints over Relations, Enforcing Integrity constraints, Querying relational data

SQL: Queries, Constraints, Form of Basic SQL Query, UNION,INTERSECT, and EXCEPT, Nested Queries, Aggregate Operators, NULL values Complex Integrity Constraints in SQL, Introduction to Views.

Unit III:

Functional Dependencies -Introduction, Basic Definitions, Trivial, Non Trivial functional dependencies, Closure of set of dependencies, Closure of Attributes

Schema Refinement: Problems caused by redundancy, decompositions, Properties of decomposition, Normalization- FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multi-valued dependencies, FOURTH normal form, FIFTH normal form.

Unit IV:

Transaction Management and Recovery: Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability,

Recoverability, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols.

Unit V:

Storage and Indexing: Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure- Insertion , Deletion and Searching.

Suggested Readings:

1. Raghu Ramakrishnan, Johannes Gehrke ,Data base Management Systems, , McGraw Hill Education (India) Private Limited, 3rd Edition.
2. A. Silberschatz, Henry. F. Korth, S. Sudarshan, Data base System Concepts, McGraw Hill Education(India) Private Limited, 6th edition.

Reference Books:

1. R Elmasri, ShamkantB.Navathe, Database Systems, 6th edition, Pearson Education.
2. M. L. Gillenson and others, Introduction to Database Management, Wiley Student Edition.
3. C. J. Date, Database Development and Management, Introduction to Database Systems, Pearson Education.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC631OE: Data Communications and Networks

Course Objectives:

- To introduce the Fundamentals of data communication networks
- To demonstrate the Functions of various protocols of Data link layer.
- To demonstrate Functioning of various Routing protocols.
- To introduce the Functions of various Transport layer protocols.
- To understand the significance of application layer protocols.

Course Outcomes:

- Know the Categories and functions of various Data communication Networks
- Design and analyze various error detection techniques.
- Demonstrate the mechanism of routing the data in network layer
- Know the significance of various Flow control and Congestion control Mechanisms
- Know the Functioning of various Application layer Protocols.

Unit I: Introduction to Data Communications

Components, Data Representation, Data Flow, Networks, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet, Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs

Unit II: Data Link Layer

Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission, Parity Checks, Check summing Methods, Framing, Flow Control and Error Control protocols, Multiple Access Protocols, Random Access , ALOHA.

Unit III: The Network Layer

Introduction, Forwarding and Routing, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, The Internet Protocol(IP):Forwarding and Addressing in the Internet- Datagram format, Ipv4 Addressing

Unit IV: Transport Layer

Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure.

Unit V: Application Layer

Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided

by the Internet, Web and HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works.

Suggested Readings:

1. James, Kurose F., Keith W., Computer Networking A Top-Down Approach, Pearson, 6th Edition.
2. Forouzan, Behrouz A., Data Communications and Networking, McGraw-Hill Education, 4th Edition

Reference Books:

1. Trivedi Bhusan, Data communication and Networks, Oxford university press,2016.
2. Andrew S. Tanenbaum, Computer Networks, , Pearson Education, 4th Edition.
3. Shay, W.A., Understanding Communications and Networks, Cengage Learning, 3rd Edition

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC632OE: Digital Image Processing

Course Objectives:

- To provide a approach towards image processing and introduction about 2D transforms
- To expertise about enhancement methods in time and frequency domain
- To expertise about segmentation and compression techniques
- To understand the Morphological operations on an image

Course Outcomes:

- Explore the fundamental relations between pixels and utility of 2-D transforms in image processer.
- Understand the enhancement, segmentation and restoration processes on an image.
- Implement the various Morphological operations on an image
- Understand the need of compression and evaluation of basic compression algorithms.

Unit I:

Digital Image Fundamentals & Image Transforms: Digital Image fundamentals, Sampling and quantization. Relationship between pixels, Image Transforms: 2-D FFT. Properties, Walsh transform, Hadamard Transform & Discrete Cosine Transform.

Unit II:

Image Enhancement (Spatial Domain): Introduction,Types of Point Processing, Histogram Manipulation, Local or Neighbourhood criterion, Median Filter, Spatial Domain High-Pass Filtering.
Image Enhancement (Frequency Domain): Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

Unit III:

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

Unit IV:

Image Segmentation: Detection of Discontinuities, Edge Linking and boundary detection, thresholding, Region oriented segmentation.
Morphological Image Processing: Dilation, Erosion, Opening and Closing, Hit or Miss Transformation.

Unit V:

Image Compression: Types of redundancies, Fidelity Criteria, Image Compression Models, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, JPEG 2000 Standards.

Suggested Readings:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 3rd Edition, Pearson, 2008.
2. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, TMH, 2010.

Reference Books:

1. ScotteUmbaugh, Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools , 2nd Ed, CRC Press, 2011.
2.Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, Digital Image Processing using MATLAB, 2nd Edition, TMH, 2010.
3. Somka, Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning (Indian edition) 2008.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
MC601HS: Intellectual Property Rights

Course Objectives:

- Understanding, defining and differentiating different types of intellectual properties (IPs) and their roles in contributing to organizational competitiveness.
- Understanding the Framework of Strategic Management of Intellectual Property (IP).
- Appreciating and appraising different IP management (IPM) approaches and describing how pioneering firms initiate, implement and manage IPM programs,
- Explaining how to derive value from IP and leverage its value in new product and service development
- Exposing to the Legal management of IP and understanding of real life practice of IPM.

Course Outcomes:

- Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
- Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
- Identify activities and constitute IP infringements and the remedies available to the IP owner and describe the precautious steps to be taken to prevent infringement of proprietary rights in products and technology development.
- Understand the processes of Intellectual Property Management (IPM) and various approaches for IPM and conducting IP and IPM auditing and explain how IP can be managed as a strategic resource and suggest IPM strategy.
- Anticipate and subject to critical analysis arguments relating to the development and reform of intellectual property right institutions and their likely impact on creativity and innovation.
- Demonstrate a capacity to identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.

Unit I:

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Unit II:

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

Unit III:

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Unit IV:

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

Unit V:

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

Text & Reference Books:

1. Deborah. E. Bouchoux, Intellectual property right, Cengage learning.
2. Ganguli Prabuddha, Intellectual property right – Unleashing the knowledge economy, Tata McGraw Hill Publishing company Ltd.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
MC601ES: Artificial Intelligence

Course Objectives:

To learn the distinction between optimal reasoning Vs. human like reasoning
- To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes:

- Ability to formulate an efficient problem space for a problem expressed in natural language.
- Select a search algorithm for a problem and estimate its time and space complexities.
- Possess the skill for representing knowledge using the appropriate technique for a given problem.
- Possess the ability to apply AI techniques to solve problems of game playing, and machine learning.

Unit – I:

Introduction: AI Definition, Agents and Environments, Structure of Agents, Types of Agents. Problem Solving Agents: Problem spaces, states, goals and operators.
Uninformed Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening depth first search, Bidirectional Search.

Unit – II:

Informed Search: Heuristic Search strategies, Hill Climbing, A*, Hill climbing search.
Game Playing: Adversarial Searches. Two player games. Min-max Search: Algorithm, Problems. Draw Back of Min-Max Algorithm. Alpha-beta pruning: Algorithm, Problems.
Constraint Satisfaction Problems: Definition, Crypt-Arithmetic Problems, Map Coloring, Backtracking.

Unit – III:

Basic Knowledge Representation and Reasoning: Propositional Logic: Basics of logic, truth tables and sentence conversions. First order logic: Difference between Proposition & First order logic. Conjunctive Normal form. Disjunctive Normal Form. Conversion of English

sentences into First order logic. Resolution and theorem proving. Problems of Resolution. Forward Chaining: Definition, Example problems. Backward Chaining: Definition, Example problems.

Unit – IV:

Planning Classical Planning: Definition of Classical Planning, Algorithms for Planning with State-Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. **Planning and Acting in the Real World:** Time, Schedules, and Resources, Hierarchical Planning, Planning and Acting in Nondeterministic Domains, Multi agent Planning.

Unit – V:

Uncertain knowledge and Learning Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use,

Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First-Order Probability

Learning: Forms of Learning, Supervised Learning, Learning Decision Trees.

Knowledge in Learning: Logical Formulation of Learning, Knowledge in Learning, Explanation-Based Learning, Learning Using Relevance Information, Inductive Logic Programming.

Suggested Readings:

1. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall. 2010, third edition.
2. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.

Reference Books:

1. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex problem Solving, Pearson Education, 6th ed., 2009.
3. Artificial Intelligence – Patric Henry Winston – Third Edition, Pearson Education

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC651PC: **Data Communications and Networks Lab**

Course Objectives:

- To introduce the basics of data communications and computer networks.
- To examine and understand network protocols and architectures.
- To educate the student in modern networking technologies.

Course Outcomes:

- Understand the rudiments of how computers communicate.
- Be familiar with the architecture of a number of different networks.
- Understand the principles of protocol layering.
- Be familiar with modern telecommunications.

Note:

A. Minimum of 12 Experiments have to be conducted
B. All the Experiments may be Conducted using Network Simulation software like NS-2, NSG-2.1 and Wire SHARK/equivalent software.

Note: For Experiments 2 to 10 Performance may be evaluated through simulation by using the parameters Throughput, Packet Delivery Ratio, Delay etc.

1. Writing a TCL Script to create two nodes and links between nodes
2. Writing a TCL Script to transmit data between nodes
3. Evaluate the performance of various LAN Topologies
4. Evaluate the performance of Drop Tail and RED queue management schemes
5. Evaluate the performance of CBQ and FQ Scheduling Mechanisms
6. Evaluate the performance of TCP and UDP Protocols
7. Evaluate the performance of TCP, New Reno and Vegas
8. Evaluate the performance of AODV and DSR routing protocols
9. Evaluate the performance of AODV and DSDV routing protocols
10. Evaluate the performance of IEEE 802.11 and IEEE 802.15.4
11. Evaluate the performance of IEEE 802.11 and SMAC
12. Capturing and Analysis of TCP and IP Packets
13. Simulation and Analysis of ICMP and IGMP Packets
14. Analyze the Protocols SCTP, ARP, NetBIOS, IPX VINES
15. Analysis of HTTP, DNS and DHCP Protocols

Major Equipment Required: Required software (Open Source) like NS-2, NSG-2.1 and Wire SHARK

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EC652PC: E-Cad &VLSI Lab

Course Objectives:

- Apply the concepts of basic combinational logic circuits, sequential circuit elements, and programmable logic in the laboratory setting.
- To develop familiarity and confidence with designing, building and testing digital circuits, including the use of CAD tools.
- Behavioural, register- transfer, logic, and physical-level structured VLSI design using CAD tools and hardware description languages.

Course Outcomes:

- Design CMOS logic circuits.
- Simulate circuits within a CAD tool and compare to design specifications.
- Design, implement, and simulate circuits using VHDL.
- Write machine language programs and assembly language programs for the simple computer.
- To learn by using Xilinx Foundation tools and Hardware Description Language (VHDL).
- To analyze the results of logic and timing simulations and to use these simulation results to debug digital systems.

Note: Any **SIX of** the following experiments from each part are to be conducted (Total 12)

Part - I

All the following experiments have to be implemented using HDL

1. Realize all the logic gates
2. Design of 8-to-3 encoder (without and with priority) and 2-to-4 decoder
3. Design of 8-to-1 multiplexer and 1-to-8 demultiplexer
4. Design of 4 bit binary to gray code converter
5. Design of 4 bit comparator
6. Design of Full adder using 3 modeling styles
7. Design of flip flops: SR, D, JK, T
8. Design of 4-bit binary, BCD counters (synchronous/ asynchronous reset) or any sequence counter
9. Finite State Machine Design

Part-II

Layout, physical verification, placement & route for complex design, static timing analysis, IR drop analysis and crosstalk analysis for the following:

1. Basic logic gates
2. CMOS inverter
3. CMOS NOR/ NAND gates
4. CMOS XOR and MUX gates
5. Static / Dynamic logic circuit (register cell)
6. Latch
7. Pass transistor
8. Layout of any combinational circuit (complex CMOS logic gate).

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
EN653HS: *Finishing School-IV* (Advanced Communication Skills Lab)
[Common CE, EEE, ECE, ME/MCT & MMT]

Course Objectives:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.
- To prepare the students for both oral as well as written presentation skills.
- To make the students be adept in Group Discussions, Presentation Skills and Interview Skills.

INTRODUCTION:
Advanced Communication Skills Lab is considered essential as the students need to prepare themselves for their careers which may require them to listen to speak, read and write in English both for their professional and interpersonal communication in the globalized context. This course would enable students to use English effectively and perform the following:

1. Gathering ideas and information to organize ideas relevantly and coherently.
2. Engaging in debates.
3. Participating in group discussions.
4. Facing interviews.
5. Writing project/research reports/technical reports.
6. Making oral presentations.
7. Writing formal letters.
8. Transferring information from non-verbal to verbal texts and vice-versa.
9. Taking part in social and professional communication.

SYLLABUS:

1. Activities on Fundamentals of Inter-personal Communication and Building Vocabulary - Starting a conversation – responding appropriately and relevantly – using the right body language, Role Play in different situations & Discourse Skills- using visuals – Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.

2. Activities on Reading Comprehension –General Vs Local comprehension

Reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading, effective googling.

3. Activities on Writing Skills

Structure and presentation of different types of writing – Letter writing/Resume writing/ e-correspondence/Technical Report writing/ – planning for writing – improving one's writing.

4. Activities on Presentation Skills – Oral presentations (individual and group)

JAM sessions/seminars/PPTs and written presentations through posters/projects/reports/ e-

Mails / assignments etc.

5. Activities on Group Discussion and Interview Skills

Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference &video-conference and Mock Interviews.

Suggested Readings:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt.Ltd, 2nd Edition.
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

References:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan, Pearson 2007.
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

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B.Tech. in Electronics and Communication Engineering
VI Semester Syllabus
MC601ESC: Environmental Science

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations.

Course Outcomes:

- Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

Unit I:

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

Unit II:

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non-renewable energy sources, use of alternate energy source, case studies.

Unit III:

Biodiversity and Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

Unit IV:

Environmental Pollution and Control Technologies, Global Environmental Issues and Global Efforts Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards.

Soil Pollution: Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.
Overview of air pollution control technologies, Concepts of bioremediation.

Global Environmental Issues and Global Efforts: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS).

Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

Unit V:

Environmental Policy, Legislation & EIA, Towards Sustainable Future Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio- economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP).

Towards Sustainable Future: Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

Suggested Readings:

1. Erach Bharucha, Textbook of Environmental Studies for Undergraduate Courses for University Grants Commission.
2. Rajagopalan, R., Environmental Studies, Oxford University Press.

Reference Books:

1. Richard T. Wright., Environmental Science: towards a sustainable future by PHL Learning Private Ltd. New Delhi, 2008.
2. Gilbert M. Masters and Wendell P. Ela., Environmental Engineering and science, PHI Learning Pvt. Ltd., 2008.
3. Daniel B. Botkin & Edward A. Keller, Environmental Science, Wiley INDIA edition.
4. Anubha Kaushik, Environmental Studies, 4th Edition, New age international publishers.
5. Reddy, Anji M., Text book of Environmental Science and Technology, BS Publications, 2007.
6. Anjaneyulu, Y., Introduction to Environmental Science, BS. Publications.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC701PC: Microwave and Optical Communications

Course Objectives:

- To get familiarized with microwave frequency bands, their applications and to understand the limitations and losses of conventional tubes at these frequencies.
- To distinguish between different types of microwave tubes, their structures and principles of microwave power generation.
- To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S- Matrix for various types of microwave junctions.
- Understand the utility of Optical Fibres in Communications.

Course Outcomes:

- Known power generation at microwave frequencies and derive the performance characteristics.
- Realize the need for solid state microwave sources and understand the principles of solid state devices.
- Distinguish between the different types of waveguide and ferrite components, and select proper components for engineering applications
- Understand the utility of S-parameters in microwave component design and learn the measurement procedure of various microwave parameters.
- Understand the mechanism of light propagation through Optical Fibres.

Unit I: Microwave Tubes, Helix TWTs

Microwave Tubes: Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications, O-type Tubes: 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for O/P Power and Efficiency. Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and O/P Characteristics.

Helix TWTs: Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations.

Unit II: M-Type Tubes, Microwave Solid State Devices

M-Type Tubes: Introduction, Cross-field Effects, Magnetrons – Different Types, - Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI- Mode, o/p characteristics,

Microwave Solid State Devices: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Principle of operation of IMPATT and TRAPATT Devices.

Unit III: Waveguide Components

Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities– Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators– Different Types, Resistive Card and Rotary Vane Attenuators; Waveguide Phase Shifters- Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions - E plane and H plane Tees. Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator,

Unit IV: Scattering matrix, Microwave Measurements

Scattering matrix : Scattering Matrix Properties, Directional Couplers – 2 Hole, Bethe Hole, [s] matrix of Magic Tee and Circulator.

Microwave Measurements: Description of Microwave Bench – Different Blocks and their Features, Errors and Precautions, Measurement of Attenuation, Frequency. Standing Wave Measurements, measurement of Low and High VSWR, Cavity Q, Impedance Measurements.

Unit V: Optical Fiber Transmission Media

Optical Fiber types, Light Propagation, Optical fiber Configurations, Optical fiber classifications, Losses in Optical Fiber cables, Light Sources, Optical Sources, Light Detectors, LASERS, WDM Concepts, Optical Fiber System link budget.

Suggested Readings:

1. Liao, Samuel Y., Microwave Devices and Circuits, Pearson, 3rd Edition, 2003.
2. Tomasi Wayne, Electronic Communications Systems, Pearson, 5th Edition

Reference Books:

1. Keiser Gerd, Optical Fiber Communication, TMH, 4th Ed., 2008.
2. David M. Pozar, Microwave Engineering, John Wiley & Sons (Asia) Pvt Ltd., 1989, 3rd ed., 2011.
3. Raghuvanshi, G.S., Microwave Engineering - Cengage Learning India Pvt. Ltd., 2012.
4. Kennedy George, Electronic Communication System, McGrawHill, 6th Ed.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC702PC: Internet of Things and Its Applications

Course Objectives:

- Understand the fundamentals of IoT.
- Understand the relation between IoT and M2M architecture.
- To give fundamentals on IoT reference models and deployment models.
- Explore the relationship between IoT, cloud computing, and big data.

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

- Describe what IoT is and how it works
- Understand the concept of IOT and M2M
- Study IOT architecture and applications in various fields

Unit – I:
Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates

Unit – II:
IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

Unit – III:
Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib.

Unit – IV:
IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

Unit – V:
IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs

Webserver – Web server for IoT, Cloud for IoT
IoT Applications – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle

Suggested Readings:

1. Madisetti, Vijay and Bahga, Arshdeep, Internet of Things (A Hands-on-Approach), VPT, 1st Edition, 2014.
2. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, 1st Edition, 2013.
3. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC711PE: Cellular and Mobile Communications

Course Objectives:

- To provide the student with an understanding of the cellular concept, frequency reuse, hand- off strategies.
- To provide the student with an understanding of Co-channel and Non-Co-Channel interferences.
- To give the student an understanding of cell coverage for signal and traffic, diversity techniques and channel assignment
- To give the student an understanding types of handoff.
- To understand challenges and application of Ad-hoc wireless Networks.

Course Outcomes:

- Known the evolution of cellular and mobile communication system.
- The student will be able to understand Co-Channel and Non-Co-Channel interferences.
- Understand impairments due to multipath fading channel and how to overcome the different fading effects.
- Familiar with cell coverage for signal and traffic, diversity, techniques, frequency management, Channel assignment and types of handoff.
- Know the difference between cellular and Ad-hoc Networks and design goals of MAC Layer protocol.

Unit I: Introduction to Cellular Mobile Radio Systems , Fundamentals of Cellular Radio System Design

Introduction to Cellular Mobile Radio Systems: Limitations of Conventional Mobile Telephone Systems, Basic Cellular Mobile System, First, Second, Third and Fourth Generation Cellular Wireless Systems, Uniqueness of Mobile Radio Environment-Fading-Tie Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.

Fundamentals of Cellular Radio System Design: Concept of Frequency Reuse, Co-Channel Interference, Co-Channel Interference Reduction Factor, Desired C/I from a Normal Case in a Omni Directional Antenna System, System Capacity Improving Coverage and Capacity in Cellular Systems- Cell Splitting, Sectoring, Microcell Zone Concept.

Unit II: Co-Channel Interference, Non Co-Channel Interference

Co-Channel Interference: Measurement of Real Time Co-Channel Interference, Design of Antenna System, Antenna Parameters and their effects, diversity techniques-space diversity, polarization diversity, frequency diversity, time diversity.

Non Co-Channel Interference: Adjacent Channel Interference, Near end far end interference, cross talk, effects on coverage and interference by power decrease, antenna height decrease, effects of cell site components.

Unit III: Cell Coverage for Signal and Traffic, Frequency Management and Channel Assignment

Signal Reflections in flat and Hilly Terrain, effects of Human Made Structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, path loss from a point to point prediction model in different conditions, merits of Lee model.

Frequency Management and Channel Assignment: Numbering and Grouping, Setup, Access and Paging Channels, Channel Assignments to Cell Sites and Mobile Units.

Unit IV: Handoffs and Dropped Calls

Handoff Initiation, types of Handoff, Delaying Handoff, advantages of Handoff, Power Difference Handoff, Forced Handoff, Mobile Assisted and Soft Handoff, Intersystem handoff, Introduction to Dropped Call Rates and their Evaluation.

Unit V: Ad Hoc Wireless Networks

Introduction, Cellular and Ad Hoc wireless Networks, Applications and Ad Hoc Wireless Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet, MAC Protocols for Ad Hoc Wireless, Introduction, issues in designing AMAC Protocol for Ad Hoc wireless Networks, Design Goals of AMAC protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols.

Suggested Readings:

1. Lee, W.C.Y., Mobile Cellular Telecommunications- Mc Graw Hill, 2nd Edn., 1989.
2. Theodore. S. Rapport, Wireless Communications, Pearson Education, 2nd Edn., 2002.

Reference Books:

1. Murthy, Sivaram, C., and Manoj, B.S., Ad Hoc Wireless Networks: Architectures and Protocols, PHI, 2004.
2. Simon S. Haykin, and Michael Moher, Modern Wireless Communications, Pearson Education, 2005.
3. Garg Vijay, Wireless Communications and Networking, Elsevier Publications, 2007.
4. Goldsmith Andrea, Wireless Communications, Cambridge University Press, 2005.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC712PE: Analog IC Design

Course Objectives:

- To understand most important building blocks of all CMOS analog Ics.
- To study the basic principle of operation, the circuit choices and the tradeoffs involved in the MOS transistor level design common to all analog CMOS ICs.
- To understand specific design issues related to single and multistage voltage, current and differential amplifiers, their output and impedance issues, bandwidth, feedback and stability.
- To understand the design of differential amplifiers, current amplifiers and OP AMPs.

Course Outcomes:

- Design basic building blocks of CMOS analog ICs.
- Design of single and two stage operational amplifiers and voltage references.
- Determine the device dimensions of each MOSFET's involved.
- Design various amplifiers like differential, current and operational amplifiers.
- Design of different type of comparators using Op-Amp circuits for the given specifications.

UNIT – I: MOS Devices and Modeling

The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

UNIT – II: Analog CMOS Sub-Circuits

MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT – III: CMOS Amplifiers

Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

UNIT – IV: CMOS Operational Amplifiers

Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power-Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT – V: Comparators

Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other Open-Loop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

Suggested Readings:

1. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
2. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

Reference Books:

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edn, 2013.
2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition.
3. CMOS: Circuit Design, Layout and Simulation-Baker, Li and Boyce, PHI.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC713PE: Wireless Sensor Networks

Course Objectives

The objectives of this course are to make the student

- To study the fundamentals of wireless Ad-Hoc Networks.
- To study the operation and performance of various ad-hoc wireless network protocols.
- To study the architecture and protocols of Wireless sensor networks

Course Outcomes

On completion of this course student will be able to

- Students will be able to understand the basis of Ad-hoc wireless networks.
- Students will be able to understand design, operation and the performance of MAC layer protocols of ad-hoc wireless networks.
- Students will be able to understand design, operation and the performance of routing protocol of ad-hoc wireless network.
- Students will be able to understand design, operation and the performance of transport layer protocol of ad-hoc wireless networks.
- Students will be able to understand sensor network Architecture and will be able to distinguish between protocols used in ad-hoc wireless network and wireless sensor networks.

UNIT – I:

Wireless LANs and PANs: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.

AD HOC WIRELESS NETWORKS: Introduction, Issues in Ad Hoc Wireless Networks.

UNIT – II:

MAC Protocols: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

UNIT – III:

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

UNIT – IV:

Transport Layer Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

UNIT – V:

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

Suggested Readings:

1. Siva Ram Murthy. C and Manoj B. S, Ad Hoc Wireless Networks: Architectures and Protocols, PHI, 2004.
2. Jagannathan Sarangapani, Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control, CRC Press.

Reference Books:

1. Toh C. K, Ad-Hoc Mobile Wireless Networks: Protocols & Systems, 1st Ed. Pearson Education.
2. Raghavendra C. S and Krishna M. Sivalingam, Wireless Sensor Networks, Springer, 2004.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC714PE: Pattern Recognition and Machine Learning

Course Objectives:

- The student will be able to
- Understand the mathematical formulation of patterns.
- To study the various linear models.
- Understand the basic classifiers.
- Can able to distinguish different models.

Course Outcomes:

- Learn the basics of pattern classes and functionality.
- Construct the various linear models.
- Understand the importance kernel methods.
- Learn the Markov and Mixed models.

Unit I: Introduction to Pattern recognition

Mathematical Formulation and Basic Functional Equation, Reduction of Dimensionality, Experiments in Pattern Classification, Backward Procedure for Both Feature Ordering- and Pattern Classification, Suboptimal Sequential Pattern Recognition, Nonparametric Design of Sequential Pattern Classifiers, Analysis of Optimal Performance and a Multiclass Generalization

Unit II: Linear Models

Linear Basis Function Models -Maximum likelihood and least squares, Geometry of least squares , Sequential learning, Regularized least squares, Multiple outputs , The Bias-Variance Decomposition, Bayesian Linear Regression -Parameter distribution, Predictive, Equivalent, Bayesian Model Comparison, Probabilistic Generative Models-Continuous inputs , Maximum likelihood solution, Discrete features, Exponential family, Probabilistic Discriminative Models - Fixed basis functions, Logistic regression, Iterative reweighted least squares, Multiclass logistic regression, Probit regression, Canonical link functions

Unit III: Kernel Methods

Constructing Kernels, Radial Basis Function Networks - Nadaraya-Watson model, Gaussian Processes -Linear regression revisited, Gaussian processes for regression, Learning the hyper parameters, Automatic relevance determination, Gaussian processes for classification, Laplace approximation, Connection to neural networks, Sparse Kernel Machines- Maximum Margin

Classifiers, Overlapping class distributions, Relation to logistic regression, Multiclass SVMs, SVMs for regression, Computational learning theory, Relevance Vector Machines- RVM for regression, Analysis of sparsity, RVM for classification

Unit IV: Graphical Models

Bayesian Networks, Example: Polynomial regression, Generative models, Discrete variables, Linear-Gaussian models, Conditional Independence- Three example graphs, Desperation, Markov Random Fields -Conditional independence properties, Factorization properties, Illustration: Image de-noising, Relation to directed graphs, Inference in Graphical Models- Inference on a chain, Trees, Factor graphs, The sum-product algorithm, The max-sum algorithm, Exact inference in general graphs, Loopy belief propagation, Learning the graph structure.

Unit V: Mixture Models and EM algorithm

K-means Clustering-Image segmentation and compression, Mixtures of Gaussians-Maximum likelihood, EM for Gaussian mixtures, An Alternative View of EM- Gaussian mixtures revisited, Relation to K-means, Mixtures of Bernoulli distributions, EM for Bayesian linear regression, The EM Algorithm in General, Combining Models- Tree-based Models, Conditional Mixture Models- Mixtures of linear regression models, Mixtures of logistic models, Mixtures of experts.

Suggested readings:

1. Fu, K. S., Sequential methods in Pattern Recognition and Machine Learning- Academic Press, volume no.52.
2. Bishop, C., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books:

1. Richard O. Duda. Peter E. Hart. David G. Stork, Pattern Classification, John Wiley & Sons, 2nd Ed., 2001.
2. Hastie, Trevor, The elements of Statistical Learning- Robert Tibshirani, Jerome H. Friedman, Springer, 2nd Ed., 2009.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
CS713PE: **IT Operations-II (Value Added Course)**

UNIT-1:
Introduction to Cloud: Introduction to Virtualization, Types of hardware Virtualization, Desktop virtualization: Software virtualization – Memory virtualization - Storage virtualization – Data virtualization – Network virtualization. Layers in cloud architecture, Types of Cloud Services, VMware Virtualization, CloudSim Simulator.

UNIT-2:
Big Data & Data Science: Introduction, Trends of Computing for Big Data, Big Data Overview, Big Data Tools – HADOOP, Advanced Analytical Theory and methods, High-performance Networking for Big Data.

UNIT-3:
Site Reliability Engineering (SRE): Introduction, Overview of Agile, ITSM. SRE Principles and Practices, Service Level Objectives, Error Budgets. Toil Management, Monitoring and Service Level Indicators, CI-CD Tools and Automation.

UNIT-4:
Introduction to ServiceNOW: Core Configuration, User Administration, Manage Data, Process Applications, Workflows, Case Studies.

UNIT-5:
Robotic Process Automation: Robotic Automation Process, Process Flow, Inputs and outputs, Error Management, Case Management.

Textbooks/References:

1. Intelligent Automation by Pascal Bornet, Ian Barkin & Jochen Wirtz
2. IT Operations Management, ServiceNow EBook David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Centre, Auerbach
3. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
4. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
5. Business Analytics: The Science of Data - Driven Decision Making, U Dinesh Kumar, John Wiley & Sons.
6. Introducing Data Science: Big Data, Machine Learning, and More, Using PythonTools, Davy Cielen, John Wiley & Sons.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC715PE: Computer Vision

Course Objectives:

- To develop understanding of the basic principles and techniques of image processing.
- Image understanding, and to develop skills in the design and implementation of computer vision software.

Course Outcomes:

- To implement fundamental image processing techniques required for computer vision
- Understand Image formation process
- To perform shape analysis
- Extract features form Images and do analysis of Images
- Generate 3D model from images
- To develop applications using computer vision techniques
- Understand video processing, motion computation and 3D vision and geometry

Unit I:

Introduction: Image Processing, Computer Vision and Computer Graphics , What is Computer Vision -Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality Image Formation Models: Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading,Photometric Stereo, Depth from Defocus , Construction of 3D model from images

Unit II:

Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete) ,Edge detection, Motion Estimation: Regularization theory , Optical computation , Stereo Vision , Motion estimation , Structure from motion

Unit III:

Shape Representation and Segmentation: Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors , Medial representations , Multiresolution analysis

Unit IV:

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis , Shape priors for recognition

Unit V:

Image Understanding: Pattern recognition methods, HMM, GMM and EM. Applications: Photo album –Face detection –Face recognition –Eigen faces –Active appearance and 3D shape models of faces Application: Surveillance –foreground-background separation –particle filters –Chamfer matching, tracking, and occlusion –combining views from multiple cameras –human gait analysis Application: In-vehicle vision system: locating roadway –road markings –identifying road signs –locating pedestrians

Suggested Readings:

1. Forsyth, D., and Ponce, J., Computer Vision, A modern approach, Prentice Hall.
2. Horn, B. K. P., Robot Vision, McGraw-Hill.
3. Richard Szeliski, Computer Vision: Algorithms and Applications.
4. Trucco, E., and Verri, A., Introductory Techniques for 3D Computer Vision, Prentice Hall Publisher.

Reference Books:

1. Gonzalez, R. C., and Woods, R. E., Digital Image Processing. Addison Wesley Longman, Inc., 1992.
2. Ballard, D. H. and Brown, C. M., Computer Vision. Prentice-Hall, Englewood Cliffs, 1982.
3. Szeliski, Richard, Computer Vision: Algorithms and Applications (CVAA). Springer, 2010

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC716PE: Digital Image Processing

Course Objectives:

- To provide a approach towards image processing and introduction about 2D transforms
- To expertise about enhancement methods in time and frequency domain
- To expertise about segmentation and compression techniques
- To understand the Morphological operations on an image

Course Outcomes:

- Explore the fundamental relations between pixels and utility of 2-D transforms in image processer.
- Understand the enhancement, segmentation and restoration processes on an image.
- Implement the various Morphological operations on an image
- Understand the need of compression and evaluation of basic compression algorithms.

Unit I:

Digital Image Fundamentals & Image Transforms: Digital Image fundamentals, Sampling and quantization. Relationship between pixels, Image Transforms: 2-D FFT. Properties, Walsh transform, Hadamard Transform, Discrete Cosine Transform, Haar transform, Slant transform, Hotelling transform.

Unit II:

Image Enhancement (Spatial Domain): Introduction, Image Enhancement in Spatial Domain, Enhancement through Point Processing, Types of Point Processing, Histogram Manipulation, Linear and Non – Linear Gray Level Transformation, Local or Neighbourhood criterion, Median Filter, Spatial Domain High-Pass Filtering.

Image Enhancement (Frequency Domain): Low Pass (Smoothing) and High Pass (Sharpening) Filters in Frequency Domain.

Unit III:

Image Restoration: Degradation Model, Algebraic Approach to Restoration, Inverse Filtering, Least Mean Square Filters, Constrained Least Squares Restoration, Interactive Restoration.

Unit IV:

Image Segmentation: Detection of Discontinuities, Edge Linking and boundary detection, thresholding, Region oriented segmentation.

Morphological Image Processing: Dilation, Structuring Element Decomposition, Erosion, Combining Dilation and Erosion, Opening and Closing, Hit or Miss Transformation.

Unit V:

Image Compression: Types of redundancies, Fidelity Criteria, Image Compression Models, Huffman and Arithmetic Coding, Error Free Compression, Lossy Compression, Lossy and Lossless Predictive Coding, Transform Based Compression, JPEG 2000 Standards.

Suggested Readings:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 3rd Edition, Pearson, 2008.
2. S Jayaraman, S Esakkirajan, T Veerakumar, Digital Image Processing, TMH, 2010.

Reference Books:

1. ScotteUmbaugh, Digital Image Processing and Analysis-Human and Computer Vision Application with using CVIP Tools , 2nd Ed, CRC Press, 2011.
2.Rafael C. Gonzalez, Richard E Woods and Steven L. Eddings, Digital Image Processing using MATLAB, 2nd Edition, TMH, 2010.
3. Somka, Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning (Indian edition) 2008.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC717PE: System Design Using FPGAs

Course Objectives:

The main aim of this course is
- To teach design and implementation of digital circuits using industry standard techniques.
- Describe general FPGA architecture, internals and use cases
- Have an understanding of building blocks that are available to digital designers

Course Outcomes:

- Apply design flow methodology for a given problem
- Create, synthesize and simulate various digital circuits
- Implement and debug various digital designs
- Analyze a given design based on synthesis, implementation and timing reports
- Solve timing related problems
- Demonstrate a working RTL design with all aspects in the projects

Unit I:

Introduction: Why digital?, components of digital system, logic families - TTL and CMOS equivalent of gates, Need for Minimization, reduction techniques available, Implementation of Combinational circuits, implementation of Combinational circuits with MUX and Memory

Programmable Logic: implementation of Combinational circuits with PLDs, limitations of PLDs, implementation using CPLD, Simple PLDs, CPLDs, ASIC/FPGA design flow, HDL, Role of HDL

Unit II:

Introduction to Verilog HDL, Hierarchical Modelling Concepts, Basic concepts and Modules and Ports: Evolution of CAD, emergence of HDLs, typical HDL-based design flow, why Verilog HDL?, trends in HDLs, Top-down and bottom-up design methodology, differences between modules and module instances, parts of a simulation, design block, stimulus block. Lexical conventions, data types, system tasks, compiler directives

Gate level modelling: Modelling using basic Verilog gate primitives, description of and/or and buf/not type gates, rise, fall and turn-off delays

Unit III:

Switch level modelling: Data flow modelling MOS and CMOS switches, bidirectional switches, modeling of power and ground, resistive switches, delay specification on switches.
Continuous assignments, delay specification, expressions, operators, operands, operator types.

Behavioral modelling Tasks and functions: Structured procedures, initial and always, blocking and non-blocking statements, delay control, generate statement, event control, conditional statements, multi-way branching, loops, sequential and parallel blocks,
Differences between tasks and functions, declaration, invocation, automatic tasks and functions

Unit IV:

Combinational and Sequential circuit design, State Machine Designs: Code converters, Flip-flops, counters, Shift registers, FIFO Moore and Mealy machine, Design and Analysis

Asynchronous Circuits: Analysis & Synthesis of asynchronous digital circuits, State Reduction, State Assignment, Hazards

Unit V:

Logic synthesis with Verilog HDL: Introduction to logic synthesis, impact of logic synthesis, Verilog HDL constructs and operators for logic synthesis, synthesis design flow, verification of synthesized circuits, modelling tips, design partitioning.

Introduction to FPGA Fabrics: Implementation Technology - PLDs, custom chips, standard cell and gate arrays

Logic Implementation of FPGA: Logic implementation by macro, logic synthesis, logic optimization, Physical design for FPGAs

Suggested Readings:

1. Mano M. Morris, Michael D. Ciletti, "Digital Design: With an Introduction to Verilog HDL", Pearson, Fifth Ed, 2007.
2. Palnitkar, Samir, "Verilog HDL: a guide to digital design and synthesis", Prentice Hall, Second Edition, 2003.

Reference Books:

1. Wolf, Wayne, "FPGA based System Design", Prentice Hall, 2004.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC718PE: Cloud Computing

Course Objectives:

- To know the basics of cloud computing and its advantages.
- To analyze the components of cloud computing and its business perspective.
- To understand various cloud service/deployment models.
- To evaluate the various cloud development tools
- To study various cloud service provider services.

Course Outcomes:

- Ability to understand the fundamentals of cloud computing.
- Understand the architecture of cloud computing model.
- Ability to understand various service and deployment models of cloud.
- Understand the concept of virtualization and its types.
- Understanding cloud service providers and cloud based applications.

UNIT – I:
Cloud Computing Fundamentals: Motivation for Cloud Computing, Basic Principles of Cloud computing. Five Essential Characteristics, Four Cloud Deployment Models, Three service Offering Models, Requirements for Cloud Services - Cloud Ecosystem, Cloud Application - Virtualization- approaches and types

UNIT – II:
Cloud Computing Architecture and Management: Cloud architecture Layers, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Networking Technologies, Applications on the Cloud, Managing the Cloud application, Migrating Application to Cloud-Phases of Cloud Migration - Approaches for Cloud Migration

UNIT – III:
Cloud Deployment Models: Private Cloud, Public cloud, Community Cloud and Hybrid Cloud – Characteristics, Suitability, Issues, Advantages and Disadvantages.
Cloud Service Models: Infrastructure as a Service, Platform as a Service, Software as a Service - Characteristics, Suitability, Pros and Cons and Summary.

UNIT – IV:
Virtualization technology
Virtual Machine Technology - Types of virtualization - System virtual machines- Virtual machines and elastic computing, Virtual machine migration - Virtualization Applications In Enterprises- Security through virtualization, Desktop virtualization, Server consolidation, Automating infrastructure management, Pitfalls Of Virtualization.

UNIT – V:

Cloud Service Providers and Applications: Amazon Web Services, Amazon Elastic Compute Cloud, Google Cloud Platform, Google App Engine, Microsoft Azure, Windows Azure, IBM Cloud Models – Cloud Security issues – Case studies in Cloud Computing and its applications.

Suggested Readings:

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014.
2. "Enterprise Cloud Computing Technology Architecture Applications", Gautam Shroff, Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010.

Reference Books:

1. Cloud Computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011.
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012.
3. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, rp 2011.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC731OE: Introduction to Embedded System Design

Course Objectives:

- To provide an overview of principles of Embedded System.
- To provide an overview of components of Embedded System
- To provide a clear understanding of role of firmware, operating systems in correlation with hardware systems.

Course Outcomes:

- Expected to understand the selection procedure of processors in the embedded domain.
- Design procedure of embedded firm ware.
- Expected to visualize the role of real-time operating systems in embedded systems.
- Expected to evaluate the correlation between task synchronization and latency issues

Unit – I: Introduction to Embedded Systems

Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit – II: Typical Embedded System

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators- Light Dependent Resistor, Thermistor, Photo Transistor, Light Emitting Diode, Relays, Stepper Motor. Communication Interfaces: SPI, I2C, UART, Onboard and External Communication Interfaces: WiFi, Bluetooth, ZigBee, USB

Unit – III: Other System Components of Embedded system :

Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches: Super Loop Based Approach and OS based Approach, Development Languages: Assembly Language and High level Language

Unit – IV: RTOS Based Embedded System Design :

Operating System Basics, Types of Operating Systems-GPOS, RTOS, Tasks, Task States, Task Control Block, Process and Threads, Multiprocessing and Multitasking, Task Scheduling- Non-Preemptive Scheduling (FCFS, LCFS, SJF, Priority Based), Preemptive Scheduling(FCFS, LCFS, SJF, Priority Based, Round-Robin).

Unit – V: Task Communication :

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Communication/Synchronization Issues: Racing, Deadlock, Livelock, Starvation, Task Synchronization Techniques: Mutual exclusion through busy waiting/ Spin lock, Mutual exclusion through Sleep and Wakeup, Semaphores, Device Drivers, Methods to Choose an RTOS.

Suggested Readings :

1. Shibu K.V, "Introduction to Embedded Systems", McGrawHill.
2. RajKamal, "Embedded Systems",TMH.

Reference Books :

1.Frank Vahid, Tony Givargis, "Embedded Systems Design: A Unified Hardware / Software Introduction", John & Wiley Publications, 2002.
2.Lyla B. Das, "Embedded Systems",Pearson,2013.
3.David E. Simon, "An Embedded Software Primer", Pearson Education

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC732OE: Introduction to Internet of Things

Course Objectives:

- Understand the concepts of Internet of Things and able to build IoT applications
- Learn the programming and use of Arduino and Raspberry Pi boards.
- Known about data handling and analytics in SDN

Course Outcomes:

- Known basic protocols in sensor networks.
- Program and configure Arduino boards for various designs.
- Python programming and interfacing for Raspberry Pi.
- Design IoT applications in different domains.

Unit – I:
Introduction to Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols, Sensor Networks.

Unit – II:
Machine-to-Machine Communications, Difference between IoT and M2M, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Unit – III:
Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi

Unit – IV:
Implementation of IoT with Raspberry Pi, Introduction to Software defined Network (SDN), SDN for IoT, Data Handling and Analytics..

Unit – V:
Cloud Computing, Sensor-Cloud, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT. Case Study: Agriculture, Healthcare, Activity Monitoring

Suggested Readings:

1. Madisetti, Vijay and Bahga, Arshdeep, Internet of Things (A Hands-on-Approach), VPT, 1st Edition, 2014.
2. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress Publications, 1st Edition, 2013.
3. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011.

Reference Books:

1. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks:Theory and Practice"
2. Beginning Sensor networks with Arduino and Raspberry Pi – Charles Bell, Apress, 2013.

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC751PC: Microwave and Optical Communications Lab

Course Objectives:

- Analyze and verify the characteristics of Reflex klystron, Gunn diode, Directional coupler, horn antenna, Circulator, attenuators and Isolator.
- To verify the characteristics of optical sources.
- To measure attenuation and distortions in optical fiber link.
- Calculate the numerical aperture, losses in fibers and analyze the characteristics of LED, LASER sources and PIN detector experimentally.

Course Outcomes:

- Verify characteristics of Reflex Klystron.
- Analyze various parameters of Waveguide Components.
- Estimate the power measurements of RF Components such as directional Couplers.
- Demonstrate characteristics of various optical sources.
- Measure data Rate, Numerical Aperture and Losses in Optical Link.

Note: Any **twelve** of the following experiments

LIST OF EXPERIMENTS:

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Attenuation measurement
4. Directional coupler Characteristics.
5. Scattering parameters of wave guide components
6. Frequency measurement.
7. Impedance measurement
8. VSWR measurement
9. Characterization of LED.
10. Characterization of Laser Diode.
11. Intensity modulation of Laser output through an optical fiber.
12. Measurement of Data rate for Digital Optical link.
13. Measurement of Numerical Aperture of fiber cable.
14. Measurement of losses for Optical link

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B.Tech. in Electronics and Communication Engineering
VII Semester Syllabus
EC752PC: Internet of Things Lab

Course Objectives:

- Understand the concepts of Internet of Things and able to build IoT applications
- Learn the programming and use of Arduino and Raspberry Pi boards.
- Known about data handling and analytics in IoT

Course Outcomes:

- Program and configure Arduino boards for various designs.
- Python programming and interfacing for Raspberry Pi.
- Design IoT applications in different domains.

Note: Any **twelve** of the following experiments

LIST OF EXPERIMENTS:

1. Blinking LED using Arduino
2. Controlling LED with SWITCH using Arduino
3. Sense the available Networks using Arduino
4. Measure the Distance using Ultrasonic Sensor and Make Led Blink Using Arduino
5. Detect the Vibration of an Object using Arduino
6. Connect with the available Wi-Fi using Arduino
7. Controlling LED based on Light intensity using Arduino
8. Temperature Notification using Arduino
9. LDR to Vary the Light Intensity of LED using Arduino
10. Switch Light On and Off Based on the Input of user using Raspberry Pi
11. Sending DHT sensor data to ThingSpeak Using Arduino
12. Installation of Operating System in Raspberry Pi
13. Controlling LED with SWITCH using Raspberry Pi
14. MySQL Database Installation in Raspberry Pi
15. SQL Queries by Fetching Data from Database in Raspberry Pi

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
MS803HS: Professional Practice, Law & Ethics
(Common to All Branches)

Course Objectives:

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession.

Course Outcomes:

- The students will understand the importance of professional practice, Law and Ethics in their personal lives and professional careers.
- The students will learn the rights and responsibilities as an employee, team member and a global citizen.

Unit I: Professional Practice and Ethics
Definition of Ethics, Professional Ethics - Engineering Ethics, Personal Ethics; Code of Ethics - Profession, Professionalism, Professional Responsibility, Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures. Introduction to GST- Various Roles of Various Stake holders

Unit II: Law of Contract
Nature of Contract and Essential elements of valid contract, Offer and Acceptance, Consideration, Capacity to contract and Free Consent, Legality of Object. Unlawful and illegal agreements, Contingent Contracts, Performance and discharge of Contracts, Remedies for breach of contract. Contracts-II: Indemnity and guarantee, Contract of Agency, Sale of goods Act -1930: General Principles, Conditions & Warranties, Performance of Contract of Sale.

Unit III: Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system
Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

Unit IV: Engagement of Labour and Labour & other construction-related Laws (6 hours)
Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other - Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

Unit V: Law relating to Intellectual property: Introduction

meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents under Patents Act, 1970

Suggested Readings:

1. Subramanian, R., Professional Ethics: Oxford University Press, 2015.
2. Ravinder Kaur, Legal Aspects of Business, 4e, Cengage Learning, 2016.

Reference Books:

1. RERA Act, 2017.
2. Wadhera, Intellectual Property Rights, Universal Law Publishing Co.,
3. Ramappa, T., Intellectual Property Rights Law in India, Asia Law House, (2010).
4. Malhotra, O.P., Law of Industrial Disputes, N.M. Tripathi Publishers.

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
EC811PE: Satellite Communication

Course Objectives:

- To acquired foundation in orbital mechanics and launch vehicles for the satellites.
- To provide basic knowledge of link design of satellite.
- To understand multiple access systems and earth station technology
- To understand the concepts of satellite navigation and GPS.

Course Outcomes:

- Understand basic concepts and frequency allocations for satellite communication, orbital mechanics and launch vehicles.
- Envision the satellite sub systems and design satellite links for specified C/N.
- Understand the various multiple access techniques for satellite communication systems and earth station technologies.
- Known the concepts of LEO, GEO Stationary Satellite Systems and satellite navigation

Unit I: Introduction , Orbital Mechanics and Launchers

Introduction: Origin of Satellite Communications, Historical Back-ground, Basic Concepts of Satellite Communications, Satellite Frequency Bands, Frequency Allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

Orbital Mechanics and Launchers: Orbital Mechanics, Kepler's Three Laws of Planetary Motion, Look Angle determination, Elevation Angle Calculation, Azimuth Angle Calculation, Orbital Perturbations, Orbit determination, Launches and Launch vehicles, Placing Satellites into Geostationary Orbit, Orbital Effects in Communication Systems Performance, Solar Eclipse.

Unit II: Satellite Subsystems

Attitude and Orbit Control System, Telemetry, Tracking, Command And Monitoring, Power Systems, Communication Subsystems,Transponders,Satellite Antennas, Equipment Reliability and Space Qualification.

Unit III: Satellite Link Design, Multiple Access

Satellite Link Design: Basic Transmission Theory, System Noise Temperature and G/T Ratio, Noise Figure and Noise Temperature, Design of Down Links, Link Budgets, Up Link Design, Design Of Satellite Links For Specified C/N, Uplink Attenuation and (C/N)up, Downlink Attenuation and (C/N)dn, System Design Examples, Ku Band Uplink Design, Ku Band Downlink Design.

Multiple Access: Frequency Division Multiple Access (FDMA), Inter modulation, Calculation of C/N, Time Division Multiple Access (TDMA), Frame Structure, Examples, Satellite Switched TDMA, Onboard Processing,Baseband Processing Transponders, DAMA, Code Division Multiple Access (CDMA), Spread Spectrum Transmission and Reception.

Unit IV: Earth Station Technology

Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Primary Power, Test Methods, Noise Power Ratio, Measurement of G/T.

Unit V: Low Earth Orbit and Geo-Stationary Satellite Systems, Satellite Navigation & Global Positioning System

Low Earth Orbit and Geo-Stationary Satellite Systems: Orbit Considerations, Coverage and Frequency Consideration, Frequency band, Elevation Angle Considerations, Delay & Throughput Considerations, System Considerations, Operational NGSO Constellation Designs.

Satellite Navigation & Global Positioning System: Radio and Satellite Navigation, GPS Position Location Principles, GPS Time, GPS Receivers and Codes, The C/A Code, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, GPS Receiver Operation, GPS C/A Code Accuracy, Dilution of Precision: HDOP, VDOP, and GDOP, Differential GPS.

Suggested Readings:

1. Pratt Timothy, Bostian Charles and Allnutt Jeremy, WSE, Satellite Communications,Wiley Publications, 2nd Edition, 2003.
2. Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, Satellite Communications Engineering, 2nd Edition, Pearson Publications, 2003.

Reference Books:

1. Richharia, M., Satellite Communications : Design Principles,BS Publications, 2nd Edition, 2003.
2. Agarwal, D.C., Satellite Communication, Khanna Publications, 5th Ed.
3. Raja Rao, K. N., Fundamentals of Satellite Communications, PHI, 2004
4. Roddy Dennis, Satellite Communications, McGraw Hill, 4th Edition, 2009.

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
EC812PE: Speech and Video Processing

Course Objectives:

- Knowledge on speech and video processing techniques
- Understand basic algorithms of speech analysis and speech recognition.
- Understand the speech production and perception process.

Course Outcomes:

- Describe the mechanisms of human speech production systems and methods for speech feature extraction.
- Explain basic techniques in digital video processing, including imaging characteristics an sensors.
- Apply motion estimation and object tracking algorithms on video sequence.

UNIT - I:
Speech processing concepts: The speech production mechanism, Discrete time speech signals, Pole-Zero modeling of speech, relevant properties of the fast Fourier transform for speech recognition, convolution, linear and nonlinear filter banks, spectral estimation of speech using DFT. Linear Prediction analysis of speech.

UNIT - II:
Speech recognition: Real and Complex Cepstrum, application of cepstral analysis to speech signal, feature extraction for speech, static and dynamic feature for speech recognition, robustness issues, discrimination in the feature space, feature selection, MFCC, LPCC, Distance measures, vector quantization models. Gaussian Mixture model, HMM.

UNIT - III:
Basics of Video Processing: Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two-dimensional motion models. Three-Dimensional Rigid Motion, Approximation of projective mapping.

UNIT - IV:
Motion estimation Techniques: Optical flow, motion representation, motion estimation criteria, optimization methods, pixel-based motion estimation, Block matching algorithm, gradient Based, Intensity matching, feature matching, frequency domain motion estimation, Depth from motion. Motion analysis applications: Video Summarization, video surveillance.

UNIT - V:
Object tracking and segmentation: 2D and 3D video tracking, blob tracking, kernel based counter tracking, feature matching, filtering Mosaicing, video segmentation, mean shift based, active shape model, video shot boundary detection. Interframe compression, Motion compensation

Suggested Readings:

1. L. Rabiner and B. Juang, Fundamentals of Speech recognition, Prentice Hall signal processing series.
2. A Murat Tekalp, Digital Video processing, Prentice Hall.
3. Thomas F. Quatieri, Coth, Discrete-time speech signal processing: principles and practice.
4. Yao Wang, J. Osternann and Qin Zhang, Video Processing and Communications, Pearson Education.

Reference Books:

1. B.Gold and N. Morgan, “Speech and Audio Signal Processing”, Wiley.
2. Todd R. Reed, “Digital image sequence processing, Compression, and analysis”, CRC Press.
3. Al Bovik, “Handbook of Image and Video processing”, Academic press, second Edition

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
EC813PE: Deep Learning

Course Objectives:

By the end of the course, students will be able to:

- Understand complexity of Deep Learning algorithms and their limitations
- Understand modern notions in data analysis oriented computing
- Be capable of confidently applying common Deep Learning algorithms in practice and implementing their own;
- Be capable of performing distributed computations; be capable of performing experiments in Deep Learning using real-world data.

Course Outcomes:

- Understand various learning models.
- Design and develop various Neural Network Architectures.
- Understand approximate reasoning using Convolution Neural Networks.
- Analyze and design Deep learning algorithms in different applications.
- Ability to apply CNN and RNN techniques to solve different applications.

Unit-I:

Introduction to Deep Learning: Introduction: Historical Trends in Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptron, Perceptron Learning Algorithm. Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feed forward Neural Networks, Representation Power of Feed forward Neural Networks

Unit-II:

Feed Forward Neural Networks: Back propagation, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMS Prop, Adam, Eigenvalues and eigenvectors, Eigenvalue Decomposition, Basis Principal Component Analysis and its interpretations, Singular Value Decomposition

Unit-III:

Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, Ensemble methods, Dropout, Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization

Unit-IV:

Convolutional Neural Network: The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Innitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types. LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Visualizing Convolutional Neural Networks, Guided Back propagation, Deep Dream, Deep Art, Fooling Convolutional Neural Networks

Unit-V:

Recurrent Neural Networks: Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs, Encoder Decoder Models, Attention Mechanism, Attention over images

Suggested Readings:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

Reference Books:

1. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
EC814PE: Web Technologies

Course Objectives:

- To introduce Client-side scripting with JavaScript and AJAX.
- To introduce PHP language for server-side scripting
- To introduce XML and processing of XML Data with Java
- To introduce Server-side programming with Java Servlets and JSP

Course Outcomes:

- Gain knowledge of client-side scripting, validation of forms and AJAX programming.
- Understand what is XML and how to parse and use XML Data with Java
- Understand server-side scripting with PHP language
- Gain knowledge of Server-side programming with Java Servlets
- Gain knowledge of Server-side programming with JSP.

UNIT- I:
HTML Common tags- List, Tables, images, forms, Frames, Cascading Style sheets.
Client-side Scripting: Introduction to Javascript, Javascript language – declaring variables, scope of variables, Objects, Functions, event handlers (onclick, onsubmit etc.), HTML Document Object Model, Form validation, Introduction to AJAX.

UNIT – II:
XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, XML-Document Object Model, XHTML Parsing XML Data – DOM and SAX Parsers in java.

UNIT- III:
Introduction to PHP: Declaring variables, data types, arrays, strings, operators, expressions, control structures, functions, Reading data from web form controls like text boxes, radio buttons, lists etc., Handling File Uploads. Connecting to database (MySQL as reference), executing simple queries, handling results, Handling sessions and cookies
File Handling in PHP: File operations like opening, closing, reading, writing, appending, deleting etc. on text and binary files, listing directories.

UNIT – IV:
Introduction to Servlets: Common Gateway Interface (CGI), Life cycle of a Servlet, deploying a servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Handling Http Request & Responses, Using Cookies and Sessions, connecting to a database using JDBC.

UNIT – V:
Introduction to JSP: The Anatomy of a JSP Page, JSP Processing, Scripting Elements, Directive Elements, Action Elements Implicit objects, Using Beans in JSP Pages, Using

Cookies and session for session tracking, connecting to database in JSP, Introduction to Content Management System(CMS).

Suggested Readings:

1. Web Technologies, Uttam K Roy, Oxford University Press
2. The Complete Reference PHP — Steven Holzner, Tata McGraw-Hill

Reference Books:

1. Web Programming, building internet applications, Chris Bates 2″ edition, Wiley Dreamtech
2. Java Server Pages —Hans Bergsten, SPD O'Reilly,
3. Beginning Web Programming-Jon Duckett WROX.

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
EC815PE: Low Power VLSI Design

Course Objectives:

- The student will be able to understand the Fundamentals of Low Power VLSI Design.
- In this course, students can study low-Power Design Approaches, Power estimation and analysis.
- Another main object of this course is to motivate the graduate students to study and to analyze the Low-Voltage Low-Power Adders, Multipliers.
- The concepts of Low-Voltage Low-Power Memories and Future Trend and Development of DRAM

Course Outcomes:

- Infer about the second order effects of MOS transistor characteristics.
- Analyse and implement various CMOS static logic circuits.
- Learn the design techniques low voltage and low power CMOS circuits for various applications.
- Learn the different types of memory circuits and their design.
- Design and implementation of various structures for low power applications

Unit – I:

Fundamentals: Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

Unit – II:

Low-Power Design Approaches: Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures and Mask level Measures

Unit – III:

Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low Voltage Low-Power Design Techniques –Trends of Technology and Power Supply Voltage, Low Voltage Low-Power Logic Styles.

Unit – IV:

Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

Unit – V:

Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

Suggested Readings:

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", TMH, 2011.
2. Kiat-Seng Yeo, Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems", TMH Professional Engineering.

Reference Books:

1. Ming-BO Lin, "Introduction to VLSI Systems: A Logic, Circuit and System Perspective", CRC Press
2. Anantha Chandrakasan, "Low Power CMOS Design", IEEE Press, /Wiley International, 1998.
3. Kaushik Roy, Sharat C. Prasad, "Low Power CMOS VLSI Circuit Design", John Wiley, & Sons, 2000.
4. Gary K. Yeap, "Practical Low Power Digital VLSI Design", Kluwer Academic Press, 2002.
5. Bellamour, M. I. Elamasri, "Low Power CMOS VLSI Circuit Design", A Kluwer Academic Press.
6. Siva G. Narendran, Anatha Chandrakasan, "Leakage in Nanometer CMOS Technologies", Springer, 2005.

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
EC816PE: Edge Computing

Course Objectives:

- Knowledge on how edge computing and Internet of Things (IoT) can be used as a way to meet application demands in intelligent IoT systems.

Course Outcomes:

- Understand use of the IoT architecture with its entities and protocols, from the IoT devices.
- Security and privacy issues related to the area of edge computing and IoT.
- Understand the Raspberry Pi architecture and its components.
- Work with Raspberry Pi components and evaluate its performance.

Unit – I:
IoT and Edge Computing Definition and Use Cases: Introduction to Edge Computing Scenario's and Use cases - Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge vs Fog Computing, Communication Models - Edge, Fog and M2M.

Unit – II:
IoT Architecture and Core IoT Modules-A connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of a network and Metcalfe's and Beckstrom's laws, IoT and edge architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study – Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

Unit – III:
RaspberryPi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout and Pinouts, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Programming Raspberry Pi, Connecting Raspberry Pi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

Unit – IV:
Implementation of Microcomputer Raspberry Pi and device Interfacing, Edge to Cloud Protocols, MQTT, MQTT publish-subscribe, MQTT architecture details, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

Unit – V:
Edge computing with Raspberry Pi, Industrial and Commercial IoT and Edge, Edge computing and solutions.

Suggested Readings:

1. Perry Lea, IoT and Edge Computing for Architects, Second Edition, Publisher: Packt Publishing, 2020, ISBN: 9781839214806.
2. Simon Monk, Raspberry Pi Cookbook, 3rd Edition, Publisher: O'Reilly Media, Inc., 2019, ISBN: 978149204322.

Reference Books:

1. Rajkumar Buyya, Satish Narayana Srirama, Fog and Edge Computing: Principles and Paradigms, wiley publication, 2019, ISBN: 9781119524984.
2. David Jensen, "Beginning Azure IoT Edge Computing: Extending the Cloud to the Intelligent Edge, Microsoft Azure.

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
EC817PE: Smart Technologies

Course Objectives:

- Provides a detailed description of the integral aspects of 'smart technologies' and their evolution to their current state.
- Discusses the potential use of Internet of things (IoT) in reducing counterproductive work behaviours and identifying some of the challenges that organizations might face while implementing IoT in its systems.
- Presents case studies using easy-to-understand language to explain the breadth and scope of application areas.

Course Outcomes:

- Understand the concept of 'smart technologies', especially 'Internet of Things' (IoT).
- Understand and elaborates upon various constituent technologies, their evolution and their applications to various challenging problems in society.
- Understand the application and implementation of IoT-based smart technologies for various application areas like agriculture, farming, automobiles, financial transactions and industrial applications.

Unit - I
Smart Technologies—Scope and Applications, Cutting-Edge Digitization Challenges in Vehicle Cyber-Physical Systems and Cyber security, Big Data Analytics as an Enabler in Smart Governance for the Future Smart Cities

Unit - II
Digital Masters: Blueprinting Digital Transformation, UAVs/Drones-Based IoT Services, Role of Cyber Security in Drone Technology

Unit - III
Bitcoins as an Implementation of Blockchain and Its Convergence with Internet of Things, Tomorrow's AI-Enabled Banking, Exploring Connected Cars

Unit - IV
Vehicular Cyber security Through Intrusion Detection and Prevention Architecture, Mechanism Protecting Vehicle-to-Vehicle Communication, Advanced Driver Assistance Systems

Unit - V
Cybercare—Role of Cyber Security in Healthcare Industry, Smart Agriculture: A Tango Between Modern IoT-Based Technologies and Traditional Agriculture Techniques, Importance of Being 'NICE' While Developing IoT-Based Smart Farming Solutions: A Case Study About 'NICE' Labs

Suggested Readings:

1. K. B. Akhilesh, Dietmar P. F. Möller, Smart Technologies-Scope and Applications, Springer publications, 2020.
2. Keith Worden, W A Bullough and J. Haywood, Smart Technologies, World Scientific Publishing Company (April 14, 2003).

Reference Books:

1. Tomayess Issa, Piet Kommers, Theodora Issa, and Pedro Isais, Smart Technology Applications in Business Environments, IGI Global; 1st edition (3 March 2017).
2. Heinz D. Kurz, Marlies Schütz, Rita Strohmaier and Stella S. Zilian**,** The Routledge Handbook of Smart Technologies**,** Routledge, 1st Edition**,** 2022.

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B.Tech. in Electronics and Communication Engineering
VIII Semester Syllabus
EC818PE: Network Security and Cryptography

Course Objectives

Students undergoing this course are expected to

- Learn fundamentals of cryptography and its application to network security.
- Understand network security threats, security services, and countermeasures.
- Acquire background on well known network security protocols such as IPSec, SSL, and WEP.
- Understand vulnerability analysis of network security.
- Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.

Course Outcomes

- Understand various Cryptographic Techniques
- Apply various public key cryptography techniques
- Implement Hashing and Digital Signature techniques
- Understand the various Security Applications
- Implement system level security applications

Unit – I:
Security: Need, security services, Attacks, OSI Security Architecture, one-time passwords, Model for Network security, Classical Encryption Techniques like substitution ciphers, Transposition ciphers, Cryptanalysis of Classical Encryption Techniques.

Unit – II:
Number Theory: Introduction, Fermat's and Euler's Theorem, The Chinese Remainder Theorem, Euclidean Algorithm, Extended Euclidean Algorithm and Modular Arithmetic.

Unit – III:
Private-Key (Symmetric) Cryptography: Block Ciphers, Stream Ciphers, RC4 Stream cipher, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Triple DES, RC5, IDEA, Linear and Differential Cryptanalysis.

Unit – IV:
Public-Key (Asymmetric) Cryptography: RSA, Key Distribution and Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Message Authentication Code, hash functions, message digest algorithms: MD4 MD5, Secure Hash algorithm, RIPEMD-160, HMAC.

Unit – V:
Authentication and System Security: IP and Web Security Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure Socket Layer, Secure

Electronic Transaction Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Countermeasures, Firewalls, Trusted Systems.

Suggested Readings:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, 3rd Edition.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security, Private Communication in a Public World", Prentice Hall, 2nd Edition.

Reference Books:

1. Christopher M. King, Ertem Osmanoglu, Curtis Dalton, "Security Architecture, Design Deployment and Operations", RSA Pres,
2. Stephen Northcutt, Leny Zeltser, Scott Winters, Karen Kent, and Ronald W. Ritchey, "Inside Network Perimeter Security", Pearson Education, 2nd Edition.
3. Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident Detection and Response", William Pollock Publisher, 2013.