Swami Ramanand Teerth Marathwada University, Nanded

Syllabus for TY (Electronics and Telecommunication Engg) AY 2020-2021

Semester-V

Coarse Code	Coarse Name	Teaching Scheme				Examination Scheme				Total
		L	T	P	CR	PR/ OR	T W	MSE	ESE	
1	Digital Signal Processing	3	1	2	5	25	25	30	70	150
2	Control System	3	0	0	3	0	0	30	70	100
3	Electromagnetic Engineering	3	0	0	3	0	-	30	70	100
4	Communication Engineering	3	0	2	4	25	25	30	70	150
5	Professional Elective-I	3	1	2	5	25	25	30	70	150
6	Economic and Management	3	0	0	3	0	0	30	70	100
		18	2	6	23					750
	Professional Elective-I 1. Biomedical Signal Processing 2. Machine Learning 3. Computer Organization									

Semester-VI

Coarse Code	Coarse Name	Teaching Scheme				Examination Scheme				Total
		L	T	P	CR	PR/OR	TW	MSE	ESE	
1	Embedded Systems	3	0	2	4	25	25	30	70	150
2	Antenna Wave Propagation	3	0	0	3	0	0	30	70	100
3	Power Electronics	3	0	2	4	25	25	30	70	150
4	Digital Communication	3	0	2	4	25	25	30	70	150
5	Professional Elective-II	3	0	2	4	25	25	30	70	150
6	Cyber Security	3	0	0	3	0	0	30	70	100
7	Mini Project	0	0	2	1	25	25	--	--	50
					22	125				850
	Professional Elective-II 1. Digital Image Processing 2. FPGA Based Digital Design 3. Smart Sensors									

Detail Course-wise Syllabus:

Course Code-1	Digital Signal Processing	3L:1T:2P	5 credits

Course Educational Objectives:

1. Coverage of characterization and classification of signals and DSP systems
2. Knowledge of discrete time Fourier transform, discrete Fourier transform, its properties, computations of DFT of real sequences
3. Knowledge of Z-transform and its properties, ROC of rational z-transform, Inverse Z-transform,
4. Concept of digital Filters, All pass Transfer function, Minimum phase and Maximum phase transfer function,
5. Study of block diagram representation, Basic FIR /IIR structures, FIR and IIR filter design

Course Learning Outcomes:

Upon successful completion of this course, the student will be able to:

1. Represent discrete-time signals analytically and visualize in time domain
2. Understand the meaning and implications of the properties of systems and signals,
3. Understand transform domain and its significance and problems related to computational complexity
4. Specify and design digital filters
5. Draw the structure for realization of a given system

Course Syllabus:

1. **Signal and signal processing:**
   Characterization and classification of signal, signal processing systems, examples, Applications of DSP

2. **Discrete Time signals in transform domain:**
   Discrete time Fourier Transform, Discrete Fourier Transform, Relationship between DTFT and DFT and their inverses, Computation of DFT of real sequences, Liner convolutions using DFT, Z-Transform, ROC, Inverse Z-transform, Z-transform properties, Transform domain representation of random signals

3. **LTI discrete time systems in transform domain:**
   Finite dimensional discrete time systems, Frequency response, Transfer function, its types, Simple digital filters, All pass transfer function, Complementary transfer function, Inverse systems, System identification, Digital two pairs

4. **Digital Filter Structures:**
   Block diagram representation, equivalent structures, Basic FIR structures, Basic IIR structures, all pass filters, IIR tapped cascaded lattice structures

5. **Digital Filter design:**

IIR Filter design- Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Spectral transformations, FIR filter design using Windowing techniques, Frequency Sampling Techniques, Computer aided Design

6. **Algorithm implementation and Applications :**
   Computation of DFT, FFT algorithms, Decimation in Time and frequency domain, Different algorithms, radix n algorithm, Application of Filters in Audio processing, Telecommunication and Radar signal processing

Text/Reference Books:

1. Oppenheim, Schafer, Digital Signal Processing, PHI
2. Oppenheim, Schafer, Discrete Time Signal Processing, PHI
3. S.K.Mitra, Digital Signal Processing-A computer based approach, TMH, 2002
4. Ifeachor, Jarvis, Digital Signal Processing-A practical Approach, Pearson

Course Code-2	**Control Systems**	**3L:0T:0P**	**3 credits**

Course Objectives:

- To learn modelling of a physical system and express its internal dynamics and input-output relationships by means of block diagrams, mathematical model and transfer functions.
- To understand the relationships between the parameters of a control system and its stability, accuracy, transient behaviour.
- Able to determine the stability of a system and parameter ranges for a desired degree of stability using algebraic and frequency domain methods.
- Understanding concept of controllers like P, PD, PI, or PID controller based on the transient and steady state response criteria.

Course Outcomes:

After successfully completing the course students will be able to:

- Model a physical system and express its internal dynamics and input-output relationships by means of block diagrams, mathematical model and transfer functions.
- Understand and explain the relationships between the parameters of a control system and its stability, accuracy, transient behaviour.
- Identify the parameters that the system is sensitive to. Determine the stability of a system and parameter ranges for a desired degree of stability.
- Plot the Bode, Nyquist, Root Locus diagrams for a given control system and identify the parameters and carry out the stability analysis.
- Determine the frequency response of a control system and use it to evaluate or adjust the relative stability,
- Design a P, PD, PI, or PID controller based on the transient and steady state response criteria.
- Model and analyse the control systems using state space analysis.

Course Syllabus:

Introduction to Control Systems

Definition, history, elements of control systems, examples of control systems, open loop and closed loop control systems, effect of feedback on overall gain, parameter variations, external disturbances or noise and control over system dynamics, regenerative feedback, linear versus nonlinear control systems, time- invariant versus time-varying systems, SISO and MIMO systems.

Laplace Transform

Properties, transfer function, poles and zeros.

Mathematical Modelling of Dynamic Systems

Introduction, canonical form of feedback control systems, transfer function and impulse response, differential equations and transfer functions of physical systems such as mechanical, electrical, electromechanical, thermal, pneumatic and liquid-level systems, analogous systems: force-voltage, force-current and torque-current analogies, linearization of nonlinear mathematical models, block diagram representation of control system, rules and reduction techniques, signal flow graph: elements, definition, properties, Masons gain formula, application of gain formula to block diagrams.

Time-Domain Analysis of Control Systems

Standard test signals, transient response, error and error constants, time response of first and second order systems and transient response specifications, effect of adding poles and zeros to transfer functions, dominant poles of transfer function, basic control actions and response of control systems, effects of integral and derivative control action on system performance. Control system compensators: elements of lead and lag compensation, elements of Proportional-Integral-Derivative (PID) control.

Stability of Linear Control systems

Concept of stability, BIBO stability: condition, zero-input and asymptotic stability, Hurwitz stability criterion, Routh-Hurwitz criterion in detail, relative stability analysis, Root-locus technique: introduction, basic properties of the root loci, general rules for constructing root loci, root-locus analysis of control systems.

Frequency Domain Analysis

Frequency response of closed loop systems, frequency domain specifications of the prototype second order system, correlation between time and frequency response, polar plots, Bode plots, phase and gain margin, stability analysis with Bode plot, Log magnitude versus Phase plots. Nyquist stability criterion: Mathematical preliminaries, stability and relative stability analysis.

State Variable Analysis and Design

Concept of state, state variable, and state model, state model for linear continuous time system, diagonalisation, solution of state equation, concept of controllability and observability.

Text/Reference Books :

2. K. Ogata, Modern Control Engineering, Fourth edition, Pearson Education India, 2002.
3. B.C. Kuo, Automatic Control Systems, Seventh Edition, Prentice–Hall of India, 2000.
4. Norman S. Nise, Control systems Engineering, Third Edition, John Wiley and Sons Inc., Singapore, 2001.
5. R.C. Dorf and R.H. Bishop, Modern Control Systems, Eighth edition, Addison-Wesley, 1999.
6. I.J. Nagrath and M. Gopal, Control Systems Engineering, Third Edition, New age International Publishers, India, 2001.

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Course Code-3	Electromagnetic Engineering	3L:0T:0P	3 credits

Course Objectives:

- To understand three dimensional geometry.
- To get the knowledge, communication takes place using electric and magnetic fields through free space.
- To understand the electric field and magnetic field.
- To get the knowledge of electric and magnetic field are propagated in free space and changes with respect to distance.
- To study the different theorems useful for signal propagation, like divergence theorem, Stokes's Theorem.
- To get the knowledge of different laws useful for propagation of signal in free space, like Gauss's law, Faraday's law, Coulomb's law, etc.
- To understand when charge moves there is change in energy and potential. To understand field component changes when medium changed.
- To study and understand how Maxwell's equation useful for communication.
- To understand the wave motion in free space and perfect dielectric

Course Outcomes:

After successfully completing the course students will be able to:

- Understanding the vector fields E, D, H & B.
- Cleared the Concepts Divergence and Stokes theorem
- Get an idea of the concepts: Work done, Potential, Potential gradient and dipole
- Get the idea of the terms Conductors, Dielectrics, boundary conditions and capacitance
- Understanding of Poisson's and Laplace's equations
- Get knowledge about Time Varying Field and Maxwell's Equations
- Get an idea of Uniform Plane Wave used for propagation

Course Syllabus:

Vector Analysis

Dot product, cross product, **c**oordinate systems, and transformations

Coulomb's Law and Electric Field Intensity

The experimental law of Coulomb, electric field intensity of point charge, field due to a continuous volume charge distribution, field of line charge, field of sheet of charge, streamlines and sketches of fields.

Electric Flux Density, Gauss's Law, and Divergence

Electric flux density, Gauss's law, applications of Gauss's law, divergence, Maxwell's first equation, vector operator and divergence theorem.

Energy and Potential

Energy expended in moving a point charge in electric field, line integral, definition of potential difference and potential, potential field of a point charge and system of charges, potential gradient, the dipole, energy density in the electrostatic field.

Conductors, Dielectrics and Capacitance

Current and current density, continuity of current, conductor properties and boundary conditions, boundary conditions for perfect dielectric materials, capacitance .

Poisson's and Laplace Equations

Poisson's and Laplace's equations, example of the solution of Laplace's and Poisson's equation.

Steady Magnetic Field

Biot-Savart law, Ampere's circuital law, Curl, Stoke's theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials.

Magnetic Forces, Materials and Inductance

Force on a moving charge, force between differential current elements.

Time Varying Field and Maxwell's Equations Faraday's law, displacement current, Maxwell's equations in point form and integral form.

Uniform Plane Wave

Wave motion in free space and perfect dielectric.

Text/Reference Books:

1. W.H. Hayt, Engineering Electromagnetics, Tata McGraw Hill.
2. R. K. Shevgaonkar, Electromagnetic Waves, McGraw Hill, 2005 3. M.A. Wazed Miah, Fundamentals of Electromagnetics, Tata McGraw Hill.
5. N. Narayanrao, Basic Electromagnetic with Application, PHI.
6. J.D. Kraus, Electromagnetics, McGraw Hill.

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Course Code-4	Communication Engineering	3L:0T:2P	4 credits

Course Objectives:

- Knowledge about the theory of random process statistical averages of random process.
- Knowledge about principles and techniques of modern communication systems.
- To understand behavior of analog and digital communication system in presence of noise.
- Analyze the analog-to-digital conversion process with emphasis on Nyquist Sampling
- Criteria.
- To improve the system performance by using Matched filter.

Course Outcomes:

After successfully completing the course students will be able to:

- Understand the random process by the perceptive of channel noise.
- Analyze behavior of analog communication system in presence of channel noise.
- Analyze effect of channel noise on the analog communication system.
- Design the Optimum Filter like Matched Filter to optimize the detector performance.

Random Variable

Bivariate distributions and functions of two random variables, joint moments and characteristic functions, conditional distributions and expected values.

Random Processes

Mathematical definition of a random process, Stationary processes, mean, correlation and covariance functions, Ergodic processes, Transmission of a random process through a linear time invariant filter, power spectral density, Gaussian random process.

Noise Analysis

Gaussian Noise, narrowband noise, representation of narrowband noise in terms of in-phase and quadrature components, representation of narrowband noise in terms of envelope and phase components, sine wave plus narrow band noise.

Analog System In presence of Noise

Noise in CW modulation systems, noise in linear receivers using coherent detection, noise in AM receivers using envelope detection, noise in FM receivers.

Digital System In presence of Noise

Sampling process, quantization process, PCM. Noise considerations in PCM system. Limitations and modification of PCM, Delta modulation, Linear prediction, differential pulse code modulation, Adaptive DPCM.

Baseband Pulse Transmission: Matched filter, error rate due to noise, inter-symbol interference, Nyqiest's criteria for distortionless baseband binary transmission, correlative level coding, base band M-ary PAM transmission, digital subscriber lines, optimum linear receiver, adaptive equalization.

Text/References Books:

1. Papoulis, A. and Pillai, S.U., "Probability, Random Variables and Stochastic Processes", Tata McGraw-Hill 2002.
2. Haykin S., "Communications Systems", 4th Ed., John Wiley and Sons, 2001.
3. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
4. Lathi, B.P. and Ding, Z., "Modern Digital and Analog Communication Systems", Intl. 4th Ed., Oxford University Press 2009.

List of experiments

1. Validity of central limit theorem
2. Comparison of the noise performance of various analog modulation schemes.
3. Sampling, quantization encoding and decoding of PCM.
4. Evaluate the performance of Uniform Quantizer when used to quantize uniformly distributed samples, Gaussian distributed samples and speech samples

5. Evaluate the performance of Non-Uniform Quantizer when used to quantize a speech sample.
6. Validation of delta modulation and adaptive delta modulation.
7. Linear adaptive prediction of signal.
8. Eye pattern to study effect of ISI.

Course Code-5.1	Professional Elective-I 5.1 Biomedical Signal Processing	3L:0T:2P	4 credits

5.1 Biomedical Signal Processing
Course Objectives:

- To understand basic of various Biomedical signals.
- To study origin and characteristics of most commonly used biomedical signals, including ECG, EEG, evoked potential, and EMG.
- To understand sources and characteristics of noise and artifacts in bio signals.
- To understand use of bio signal for simple diagnosis, patient monitoring and physiological investigation.
- To explore the research in biomedical signal processing.
- To explore application of established engineering methods to complex biomedical signals problems.

Course Outcomes:

After successfully completing the course students will be able to:

- Model a biomedical system.
- Understand various methods of acquiring bio signals.
- Understand various sources of bio signal distortions and its remedial techniques.
- Analyze ECG, EEG and PCG signal.
- Have basic understanding of diagnosing bio-signals and classifying them by detecting various parameters.

Course Syllabus:

Unit I:

Review of Signals and Systems, Discrete and continuous Random variables, Probability distribution and density functions. Gaussian and Rayleigh density functions, Correlation between random variables. Stationary random process, Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.

Unit II:

Data Compression Techniques: Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Hoffman coding, vector quantisation, DCT and the K L transform.

Unit III:

Cardiological Signal Processing: Pre-processing. QRS Detection Methods. Rhythm analysis. Arrhythmia detection Algorithms. Automated ECG Analysis. ECG Pattern Recognition. Heart rate variability analysis.

Unit IV:

Adaptive Noise Canceling: Principles of Adaptive Noise Canceling. Adaptive Noise Canceling with the LMS adaptation Algorithm. Noise Canceling Method to Enhance ECG Monitoring. Fetal ECG Monitoring. Signal Averaging, polishing–mean and trend removal, Prony's method. Linear prediction. Yule–walker(Y–W) equations.

Unit V:

Neurological Signal Processing: Modeling of EEG Signals. Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive(A.R.) modeling of seizure EEG. Sleep Stage analysis. Inverse Filtering. Least squares and polynomial modeling.

Unit VI:

Original Prony's Method. Prony's Method based on the Least Squares Estimate. Analysis of Evoked Potentials and PCG. Analysis of non-stationary processes: examples using Wavelet analysis .

Text Books

1. Rangaraj M. Rangayyan – Biomedical Signal Analysis. IEEE Press, 2001.
2. D.C.Reddy, Biomedical Signal Processing- principles and techniques, Tata McGraw-Hill, 2005.
3. Biomedical Digital Signal Processing, Willis J.Tompkins, PHI,
4. Weitkunat R, Digital Bio signal Processing, Elsevier, 1991.
5. Akay M , Biomedical Signal Processing, Academic: Press 1994

Course Code-5.2	Professional Elective-I Machine Learning	3L:0T:2P	4 credits

Course Objectives:

1. Understanding Human learning aspects.
2. Understanding primitives in learning process by computer.
3. Understanding nature of problems solved with Machine Learning.

Course Outcomes :

1. Students will be able to model the learning primitives.
2. Students will be able to build the learning model.
3. Student will be able to tackle real world problems in the domain of Data Mining, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

Course Syllabus:

UNIT – I INTRODUCTION TO MACHINE LEARNING 7 Hours

Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types, Feature Construction and Transformation, Feature Selection.

UNIT – II CLASSIFICATION AND REGRESSION 8 Hours

Classification: Binary Classification- Assessing Classification performance, Class probability Estimation Assessing class probability Estimates, Multiclass Classification. Regression: Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression. Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.

UNIT – III LINEAR MODELS 7 Hours

Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non-Linearity.

UNIT – IV LOGIC BASED AND ALGEBRAIC MODELS 6 Hours

Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering, Rule Based Models: Rule learning for subgroup discovery, Association rule mining. Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees.

UNIT – V PROBABILISTIC MODELS 6 Hours Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models.

UNIT – VI TRENDS IN MACHINE LEARNING 8 Hours

Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.

Text/Reference Books:

1. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. C. M. Bishop : Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
4. Ethem Alpaydin : Introduction to Machine Learning, PHI 2nd Edition-2013.
3. Parag Kulkarni : Reinforcement and Systematic Machine Learning for Decision Making, Wiley IEEE Press, Edition July 2012

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Course Code-5.3	**Professional Elective-I Computer Organization**	**3L:0T:2P**	**4 credits**

Course Objectives:

- To understand the structure, function and characteristics of computer systems.
- To understand the design of the various functional units and components of digital computers.
- To identify the elements of modern instructions sets and explain their impact on processor design.
- To explain the function of each element of a memory hierarchy, identify and compare different methods for computer I/O.
- To compare simple computer architectures and organizations based on established performance metrics.

Course Outcomes:

On completion of the course, student will be able to–

- Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.
- Analyze the principles of computer architecture using examples drawn from commercially available computers.
- Evaluate various design alternatives in processor organization

Course Syllabus:

Unit I Computer Evolution and Performance 09 Hours

Computer Organization and Architecture, Structure and Function, Evolution (a brief history) of computers, Designing for Performance, Evolution of Intel processor architecture- 4 bit to 64 bit, performance assessment. A top level view of Computer function and interconnection Computer Components, Computer Function, Interconnection structure, bus interconnection,

Computer Arithmetic- The Arithmetic and Logic Unit, addition and subtraction of signed numbers, design of adder and fast adder, carry look ahead addition, multiplication of positive numbers, signed operand multiplication, booths algorithm, fast multiplication, integer division. Floating point representation and operations – IEEE standard, arithmetic operations, guard bits and truncation.

Unit II Computer Memory System 09 Hours
Characteristics of memory system, The memory hierarchy. Cache Memory- Cache memory principles, Elements of cache design- cache address, size, mapping functions, replacement algorithms, write policy, line size, number of cache, one level and two level cache, performance characteristics of two level cache- locality & operations. Case Study- PentiumIV cache organization. Internal Memory- semiconductor main memory, advanced DRAM organization. External Memory- Hard Disk organization, RAID- level 1 to level 6.

Unit III Input and Output System 09 Hours
External devices, I/O modules- Module function and I/O module structure, Programmed I/Ooverview, I/O commands, I/O instructions, Interrupt driven I/O- interrupt processing, design issues. Case Study- Study of Programmable Interrupt Controller Intel 82C59A in brief. Direct Memory Access- drawbacks of programmed and interrupt driven I/O, DMA functions, Case Study- DMA Controller Intel 8237A-study in brief, I/O channels and processors- evolution and characteristics, The external Interface- Thunderbolt and Infinite Band. Unit IV Instruction Sets 09 Hours Characteristics and Functions- machine instruction characteristics, types of operands, Case Study-Intel 8086, Types of operations- data transfer, arithmetic, logical, conversion, input-output, system control, and transfer of control, Case Study-Intel 8086 operation types. Addressing modes and Formats- Addressing modes- immediate, direct, indirect, register, register indirect, displacement and stack, Case Study-8086 addressing modes, Instruction Formats-instruction length, allocation of bits, variable length instructions. Case Study- 8086 instruction formats.

Unit V Processor Organization 09 Hours
Processor organization, Register organization- user visible registers, control and status registers, Case Study- register organization of microprocessor 8086. Instruction Cycle- The machine cycle and Data flow. Instruction Pipelining- Pipelining Strategy, pipeline performance, pipeline hazards, dealing with branches, Case Study- pipelining in Pentium. Instruction level parallelism and superscalar processors- Super scalar verses super pipelined, constraints, Design Issues-instruction level and machine parallelism, Instruction issue policy, register renaming, machine parallelism, branch prediction, superscalar execution and implementation. Case study- Pentium IV.

Unit VI Basic Processing Unit 09 Hours
Fundamental Concepts- register transfer, performing arithmetic or logic operations, fetching a word from memory, storing a word in memory, Execution of a complete instruction- branch instructions, Hardwired control, Micro-programmed control- micro instructions, micro program sequencing, wide branch addressing, microinstruction with next address field, pre-fetching microinstructions and emulation.

Text/Reference Books:
1. W. Stallings, ―Computer Organization and Architecture: Designing for performance‖, Pearson Education/ Prentice Hall of India, 2003, ISBN 978-93-325-1870-4, 7 th Edition.
2. Zaky S, Hamacher, ―Computer Organization‖, 5th Edition, McGraw-Hill Publications, 2001, ISBN- 978-1-25-900537-5, 5th Edition.

3. John P Hays, ―Computer Architecture and Organization‖, McGraw-Hill Publication, 1998, ISBN:978-1-25-902856-4, 3rd Edition.
4. Miles Murdocca and Vincent Heuring, ―Computer Architecture and Organization- an integrated approach, Wiley India Pvt. Ltd, ISBN:978-81-265-1198-3, 2nd Edition
5. A. Tanenbaum, ―Structured Computer Organization‖, Prentice Hall of India, 1991 ISBN: 81 – 203 – 1553 – 7, 4th Edition

Course Code-5.1	**Economics and Management**	**3L:0T:0P**	**3credits**

Course Outcomes:

The course is intended to provide basic understanding of Economics and Management to engineering students with following aspects:

- To impart knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions.
- To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing.

Course Syllabus:

1. Introduction to Economics:

Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply, Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity

2: Theory of production:

Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical

1. Markets

Markets; meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly), National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income.

2. Basic economic problems

Basic economic problems; Poverty-meaning, absolute & relative poverty, causes, measures to reduce Unemployment: meaning, types, causes, remedies, Inflation; meaning, types, causes, measures to control

3. Money

Money; meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools, Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.

4. Introduction to Management

Introduction to Management; Definitions, Nature, scope, Management & administration, skill, types and roles of managers, Management Principles; Scientific principles, Administrative principles, Maslow's Hierarchy of needs theory

5. Functions of Management

Functions of Management; Planning, Organizing, Staffing, Directing, Controlling (meaning, nature and importance)
Organizational Structures; meaning, principles of organization, types-formal and informal, line, line & staff, matrix, hybrid (explanation with merits and demerits), span of control, departmentalization.

6. Introduction to Marketing management

Introduction to Marketing management; Marketing Mix, concepts of marketing, demand forecasting and methods, market segmentation, Introduction to Finance Management; meaning, scope, sources, functions

7. Introduction to Marketing management

Introduction to Marketing management; Marketing Mix, concepts of marketing, demand forecasting and methods, market segmentation, Introduction to Finance Management; meaning, scope, sources, functions

8. Introduction to Production Management

Introduction to Production Management; definitions, objectives, functions, plant layout-types & factors affecting it, plant location- factors affecting it., Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection

Text Books:

1. R.Paneerselvam, Engineering Economics, PHI
2. N Gregory Mankiw, : Principles of Economics, Cenage Education
3. Robbins S.P. and Decenzo David A., Fundamentals of Management: Essential Concepts and Applications, Pearson Education
4. L.M.Prasad, Principles and Practices of Management, Cenage Learning
5. Tripathy and Reddy, Principles of Management

SEM-VI

Course Code-1	**Embedded Systems**	**3L:0T:2P**	**4 credits**

Course Educational Objectives:

- Knowledge of design and development of an embedded system
- Learn architecture of ARM and embedded programming
- Learn interfacing with external devices and programming
- Knowledge of different wired and wireless protocols
- Understanding of RTOS and its use for engineering applications

Course Learning Outcomes:

Upon successful completion of this course, the student will be able to:

- Explain ARM architecture
- Write embedded C programs for ARM
- Identify built-in peripherals and write programs for interfacing of I/O devices
- Design real world problems using the concepts of RTOS .

Course Syllabus:

1. **Introduction to Embedded System:**
   Embedded system definition, Examples, Design metrics, Processor Technologies, IC Technologies, Design Technologies, Custom Single Purpose Processor design: Basic architecture, FSM and FSMD with example, General purpose processor architecture, Classification-GPP, ASIP, DSP
2. **Embedded Firmware Design and Development:**
   Super Loop based Approach, Embedded Operating System based Approach, Embedded Firmware development Languages-Assembly Level based development, High Level Language based Development, Integrated Development Environment, Editor, Assembler, Liker, Loader, Compiler, Cross compiler, Embedded C-Data types, Arithmetic and Logical operations, Brach and Loop operations, Array and Pointers, Character and string, Functions, Pre-processor and Macros, Coding ISRs, Recursive and Re-entrant functions

3. **ARM Processor Architecture and Interfacing**
   ARM Features, detail Architecture, operating modes, LPC-2148 Architecture, GPIO and its interfacing with LED and Key switch with programming, Interrupt structure and its programming

4. **LPC 2148 Interfacing:**
   On chip devices like-Timer/Counter, Watchdog Timer, PWM, RTC, ADC, DAC, Serial Interfacing, Interfacing of Keypad, Relays and Stepper Motor

5. **Communication protocol:**
   LPC 2148 on chip wired communication standards like SPI, I2C, CAN, USB, Interfacing of external wireless communication standards: IrDA, Bluetooth(BLE), WiFi (IEEE802.11), Zigbee, Firewire, RF modules,

6. **Real Time Operating System:**
   Fundamentals of Real Time Operating System (RTOS concepts), Multitasking, Kernel structure, Task Management system, TCB, Scheduling, Inter process communication, Introduction of MUCOS-II

Text Books:

- Frank Vahid, Embedded System, Wiley India, 2002
- Shibu K V, Introduction to Embedded System, TMH, 2017
- Rajkamal, Embedded Systems, TMH, 2008
- Sloss, Symes, Wright, ARM System Developers Guide, Elsevier Morgan Kaufman,2005
- LPC2148 User Manuals and data sheets

Course Code-I1	**Digital Communication**	**3L:0T:2P**	**4 credits**

Course Educational Objectives (CEO):

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise
- and other interferences.
- To understand concept of spread spectrum communication system.

Course Outcomes:

After successfully completing the course students will be able to:

- Understand the principles of digital communications system.
- Explain importance and use of probability and random variables in digital
- communication.
- Characterize communication signal and system.
- Work out the practical and design implementation of different type of encoding and decoding techniques.

- To understand concepts of Information theory and various coding techniques.
- Understand the M-ary communication which is pre-requisites for Digital Communication.

Detection and Estimation Theory

Introduction to detection and estimation problem in communication. Bayes, Neyman-Pearson, maximum likelihood, MAP and minimum probability of error criteria; Bayes, ML and MAP estimation.

Signal Space Analysis

Geometric representation of signal, Conversion of the continuous AWGN channel into a vector channel. Maximum likelihood Decoding. Correlation receiver. Probability of error.

Passband Digital Transmission

Passband Transmission model. Coherent phase-shift keying. Hybrid amplitude/phase modulation schemes. Coherent frequency shift-keying. Detection of signal with unknown phase.

Source Coding

Mathematical models for information sources, a logarithmic measure of information, average mutual information and entropy, information measures for continuous random variables Coding for discrete sources, Coding for discrete memoryless sources, discrete stationary sources, The Lempel-Ziv algorithm, coding for analog sources-optimum quantization, rate distortion function, scalar quantization, vector quantization, Coding techniques for analog sources. Temporal waveform coding, spectral waveform coding, Model based source coding.

Block and Convolution Channel Codes

Channel models and channel capacity, Linear block codes, generator matrix and parity check matrix, some specific linear block codes, cyclic codes, convolutional codes, transfer function, optimum decoding of convolutional codes-Viterbi algorithm distance properties of binary convolutional codes.

Spread Spectrum Techniques

Introduction, PN sequences, direct sequence spread spectrum signals, processing gain, probability of error. Frequency hop spread spectrum signals, applications.

Text/References Books:

5 H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I," John Wiley.

6 Haykin S., "Communications Systems", 4th Ed., John Wiley and Sons, 2001.

7 Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.

8 Lathi, B.P. and Ding, Z., "Modern Digital and Analog Communication Systems", Intl. 4th Ed., Oxford University Press 2009.

List of experiments

1. Evaluate the performance of BPSK modulated wave in presence of noise.
2. Observe the performance of QPSK modulated wave in presence of noise.

3. Validate the performance of QAM modulated wave in presence of noise.
4. Evaluate the performance of FSK modulated wave in presence of noise.
5. Information and entropy computation.
6. Huffman technique to find the codes and the compression ratio
7. Linear block codes encoding and decoding.
8. Cyclic codes encoding and decoding.

Course Code-I1	**Antenna and Wave Propagation**	**3L:0T:2P**	**4 credits**

Course Objectives:

Course Outcomes:

After studying this course the students would be able to:

- Understand the concept of radiation through mathematical formulation
- Plot the characteristics of wire and aperture antennas.
- Develop the performance characteristics of array antenna.
- Measure the antenna parameters and understand its fundamentals.
- Understand the behavior of nature on em wave propagation
- Apply boundary conditions to different media, and formulate uniform plane wave equation, which is the basic of Antenna and wave propagation.

Course Syllabus:

Introduction to Antenna

Resonance of antenna, Types of antenna, radiation mechanism of antenna in single wire, two wire and dipole.

Fundamental Parameters of Antenna

Power density, radiation intensity, radiated power, radiation intensity, gain directivity, efficiency, effective aperture, effective length, band width, polarization, antenna temperature.

Linear Wire and Loop Antennas

Infinitesimal dipole, small dipole, finite length dipole, half length dipole, small circular loop, polygonal loop, ferrite loop.

Antenna Arrays

Types of arrays, two element linear arrays, n-element linear arrays, continuous array, planar arrays.

Different Antennas

Folded dipole, Yagi-Uda antenna, long wire antenna, V antenna, inverted antenna, log periodic antenna, Helical antenna, Horn antenna, lens antenna.

Antenna Measurements

Measurement of impedance, gain, radiation pattern, phase, polarization, directivity, beam width, radiation resistance.

Wave Propagation

Modes of propagation, structure of atmosphere, ground wave propagation, sky wave propagation, duct propagation.

Reference Books:

1. C. A. Balanis, Antenna theory: Analysis and design, Harper and Row Pow.(N.Y.) 2. J.D. Kraus and R. J. Marahefka, Antennas for applications, Tata Mc-Graw Hill Pub.

3. K. D. Prasad., Antenna and wave propagation, Satya Prakashan, New Delhi.

Course Code-I1	**Power Electronics**	**3L:0T:2P**	**4 credits**

Course Objectives:

- To understand construction, switching characteristics and protection of power devices
- To understand protection circuits and triggering circuits for power devices.
- To give an exposure to students of working & analysis of controlled rectifiers, inverters, choppers, AC voltage controllers for different loads.

Course Outcomes:

After successfully completing the course students will be able to

- Understand basic principle of power conversion.

- Design & implement a triggering / gate drive circuit for a power device
- Design & implement protection circuits for power devices.
- Understand, design & analyze different Power electronics converters.
- Utilize power converters in different industrial applications.

Unit I: Overview of Power Electronics and Power Devices 8L

Power Electronic System: Power Electronics Versus linear electronics, scope and applications, Interdisciplinary nature of power electronics, classification of power converters Power MOSFET: Construction, Operation, Static characteristics, switching characteristics, Breakdown voltages, Safe Operating Area, applications IGBT: Construction, Operation, Steady state characteristics, Switching characteristics, Safe operating area, applications, Base drive circuits, for Power MOSFET / IGBT. SCR: Construction, Operation & characteristics, two transistor analogy, different ratings, TRIAC: Construction, Operation & characteristics, applications.

Unit II: Gate drive circuits and Protection circuits for Power Devices 7L

Gate drive Circuits for SCR/TRIAC: Need, requirements, Isolation of Gate and base drives using pulse transformers and opto-coupler, Synchronized UJT triggering for SCR, triggering of SCR/TRIAC using dedicated triggering ICs, TRIAC triggering using DIAC. Typical Gate drive circuits for Power MOSFET / IGBT. Microprocessor based control circuits for power electronics applications. Protection circuits for Power Devices: Cooling and heat sinks. Snubber circuits, reverse recovery transients, supply and load side transients. Voltage protection by selenium diodes and MOVs. Current protections – fusing, fault current with AC source, fault current with DC source.

Unit III: AC-DC power converters 7L

Uncontrolled and controlled rectifiers need and applications Single phase Semi & Full converters for R, R-L loads, Concept of line & forced commutation, Effect of freewheeling diode, Performance parameters, Three phase Semi & Full converters for R and RL load. Design of Control circuit for single phase and three phase controlled rectifiers, Applications of controlled rectifiers.

Unit IV: DC-AC Converters & AC Voltage Controller 7L

DC-AC Converters: Single phase full bridge inverter for R & R-L loads, performance parameters, three phase voltage source inverter for balanced star R load. Variable frequency control of three phase inverters, Need of PWM inverters. Voltage control of Inverters using PWM, three phase PWM inverters. Design of control circuit design for three phase inverters, PWM ICs. AC Voltage Controller: Single phase AC voltage controller with R load.

Unit V: DC-DC converters 7L DC-DC converters: Working principle of step down chopper for R-L load, control strategies. Performance parameters, Buck converter, Buck-Boost converter, 2-

quadrant & 4-quadrant choppers, Applications of choppers, SMPS. Buck regulator e.g. TPS54160, Switching Regulator and characteristics of standard regulator ICs – TPS40200, Low Drop out (LDO) Regulators ICs-TPS 7A4901.

Unit VI: Power Electronics Applications 6L

HVDC transmission system. UPS: ON-line and OFF line UPS with battery AH, back up time, battery charger rating. Power Electronics in Battery Charging Applications, Electronics in Induction heating, Electronic lamp ballast. Power Electronics for Electric drive applications:

Text/ Reference Books::

1. M H Rashid, "Power Electronics – circuits, devices and applications", 3rd edition, Pearson Education.
2. Power Electronics, M.D. Singh & K.B.Khanchandani, TMH
3. Ned Mohan, T. Undeland & W. Robbins, "Power Electronics Converters applications and design" 2nd edition, John Willey & sons, Singapore
4. P.C. Sen, "Modern Power Electronics", S Chand & Co New Delhi
5. Dr. P. S. Bimbhra, "Power Electronics", Khanna Publishers, Delhi.

Course Code-5.1	**Professional Elective-II** **Digital Image Processing**	**3L:0T:2P**	**4 credits**

Course Objectives:

- To learn the fundamental concepts of Digital Image Processing.
- To study basic image processing operations.
- To understand image analysis algorithms.
- To expose students to current applications in the field of digital image processing.

Course Outcomes:

After studying this course, students will be able to:

1. Describe the fundamentals of Image Processing and Image transform techniques.
2. Apply image enhancement technique in frequency and spatial domain
3. Develop and analyze image compression techniques.
4. Demonstrate segmentation algorithms for general image.
5. Apply morphological operations to images/ Improve segmented image output by morphological operations.
6. Design and implement image processing algorithms for real-world problems.

Unit I : Fundamentals of Image Processing 6L

Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Color fundamentals & models – RGB, HSI YIQ.

Unit II: Image Enhancement and Restoration 8L

Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening. Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency domain.Homomorphic filtering. Restoration: Noise models, Restoration using Inverse filtering and Wiener filtering

Unit III: Image Compression 6L

Types of redundancy, Fidelity criteria, Lossless compression – Runlength coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG. Unit

IV: Image Segmentation and Morphological Operations 6L

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative – Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu's Method. Region Growing, Region Splitting and Merging.

V: Morphological Operations: 6L

Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

Unit VI: Representation and Description 6L

Representation – Chain codes, Polygonal approximation, Signatures. Boundary Descriptors – Shape numbers, Fourier Descriptors, Statistical moments. Regional Descriptors – Topological, Texture. Principal Components for Description.

Text Books

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, - Pearson Education

2. S Sridhar, "Digital Image Processing", Oxford University Press.

3. S Jayaraman, S Esakkirajan, T Veerakumar, "Digital Image Processing", Tata McGraw Hill Publication List of Experiments:

Note: Experiments are to be performed using software preferably open source(Python and Open CV).

1. To perform basic operations on images.

2. To perform conversion between color spaces

. 3. To perform histogram equalization.

4. To perform image filtering in spatial domain.

5. To perform image filtering in frequency domain.

6. To perform image restoration.

7. To perform image compression using DCT / Wavelet transform.

8. To perform edge detection using various masks.

9. To perform global and adaptive thresholding.

10. To apply morphological operators on an image.

11. To obtain boundary / regional descriptors of an image.

Course Code-5.1	**Professional Elective-II** **Digital Design with Verilog**	**3L:0T:2P**	**5 credits**

Course Objectives:

- Introduction to combinational logic design.
- Introduction to sequential logic design.
- Introduction to Verilog HDL, Features, Syntax and Modelling styles.
- Design of combinational logic modules using Verilog HDL and Synthesis.
- Design of Sequential logic modules, FSMs using Verilog HDL and verification.

Course Outcomes:

After studying this course the students would be able to

- Use of VLSI design methodologies and apply for design of complex digital systems.
- develop ability to solve a problem with given description and to design combinational logic function.
- design, simulate and synthesize the digital circuits with Verilog HDL.
- Create circuits for given system specifications.
- Students may gain practical experience by designing, modeling, implementing and verifying several digital circuits.

Course Syllabus:

Introduction

Introduction to digital design, analogue Vs. digital, digital devices, electronic aspects of digital design, software aspects of digital design, programmable logic devices, ASICs, PCBs, digital design levels, PLDs, PLAs, Basic components and architecture of FPGA.

Combinational Component Design

Adders: Full adders, Ripple carry adders, carry look ahead adders, pipelined adders, Two's complement binary numbers, Subtractor, ALU, decoder, Encoder, multiplier, comparator, Barrel shifters, multiplier design and its Verilog implementation

Multi-operand addition, sequential multiplication with sign and magnitude, two's complement, partially combinational implementation, MAC, saturating multiplier, truncating multiplier, rectangular multiplier.

Sequential Circuit Design Finite state machine (FSM) models, state diagram, analysis and synthesis of sequential circuits, Verilog implantation of sequential circuits. Registers, shift registers, counters: up/down, register files, SRAM, memory components: FIFO's, RTL design.

Data Path Design

Designing dedicated data path, general datapath design, timing issue, Verilog implementation of datapath.

Control Unit design

Constructing the control unit, stand alone controllers, ASM charts and state action tables, Verilog implementation of control unit. Examples of manual design of dedicated microprocessors.

Text /Reference books:

1. J. F. Wakerly, Digital design- Principles and Practices, Pearson India, Third edition.
2. J. Bhasker, VHDL Primer, Pearson Education Asia, Third edition.
3. W. I. Fletcher, An Engineering Approach to Digital Design, PHI.
4. Samual C. Lee, Digital Circuits and Logic Design, PHI.
5. C. H. Roth Jr., Digital System Design using VHDL, PWS Publishing Company.

Course Code-5.1	Professional Elective-II Smart Sensors	3L:0T:2P	4 credits

Course Objectives:

- Knowledge of basic concepts of smart sensors and principles of micromachining techniques.
- Describe the basics of biosensors used in biomedical engineering and their fabrication techniques.
- Knowledge of Automatic monitoring of Sensor data
- Knowledge of Sensor Communication protocols and Networking
- Discuss Smart Control Mechanism

Course Outcomes:

After studying this course, students will be able to:

- Describe the principle of smart sensors and process of micromachining in development of smart sensors.
- Develop intelligent systems by interfacing the smart sensors to MCUs and DSPs.
- Analyze the use of smart sensors in communication, MEMS and automation.
- Evaluate the standards of smart sensors by the assessment of reliability testing and packaging.
- Discuss the applications of smart sensors in different fields and recent development.
- Sketch the simple models of intelligent instrumentation

Course Syllabus:

Unit I: Smart Sensor Basics:

Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications; Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc , Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being LIN etc, Important Characteristics of Sensors: Determination of the Characteristics, Fundamentals of Biosensors

Unit-II Basics of Smart Sensors and Micromachining:

Introduction, Mechanical-Electronic transitions in sensing, nature of sensors, overview of smart sensing and control systems, integration of micromachining and microelectronics, introduction to micromachining, bulk micromachining, wafer bonding, surface micromachining, other micromachining techniques, Fabrication of Sensor and Smart Sensor: Electrode fabrication:

Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel

Unit-III: Nature of semiconductor sensor outputs:

Sensor output characteristics: Wheatstone Bridge, Piezo-resistivity in Silicon, Semiconductor Sensor definition, Static vs dynamic operations, Other sensing Technologies: Capacitive Sensing, Piezoelectric sensing, The Hall Effect, Chemical Sensors, Improving sensor characteristics, Incremental Optical Encoders, Digital output sensors, Noise/Interference Aspects, Low Power/Low Voltage Sensors, Analysis of Sensitivity improvement

Unit-IV: MCU/DSPs for Sensors

MCUs and DSPs for Sensor: Introduction, MCU control, MCUs for sensor interface, DSP control, Software, tools and support, sensor integration.

Unit-V: Getting Sensor information on MCU

Application of Signal conditioning, Separate vs integrated signal conditioning, Digital to Analogue converters

Unit-VI: Communication for Smart sensors:

Automotive protocols: CAN, LIN etc., Industrial Networks, Protocols on Silicon,
Different Wireless Protocols: Wireless Sensor Network (WSN) and Internet of Things (IoT),
Internet of Things Application Domains, Internet of Things Architecture, Design and development of Security and Privacy Technologies,

Unit VII: Case Studies of Smart Sensors:

Case Study: Design and Implementation of Network for Environmental Condition Monitoring,
Case Study: Building/Office Automation Protocols
Case study: Development of WSN Based Smart Bed for Health Care Application ,
Case study: Study of Smart City and its Design

Text Books:

9. **Randy Frank, "Understanding Smart Sensors", Third Ed., Arctech Publications:**
10. **Krysztof Iniewski, "Smart Sensors for Industrial Applications, CRC Press, 2013**
11. Handbook of Modern Sensors, 2nd Ed. By Jacob Fraden

Course Code-	**Cyber security**	**3L:0T:0P**	**3credits**

Course Objectives:

Course Outcomes:
After completion of this course, students will learn to:

1. Examine secure software development practices.
2. Understand principles of web security.
3. Incorporate approaches for incident analysis and response.
4. Incorporate approaches for risk management and best practices.
5. Understanding of cryptography, how it has evolved, and some key encryption techniques used today.

Develop an understanding of security policies (such as confidentiality, integrity, and availability), as well as protocols to implement such policies

Course Syllabus:

Unit 1: Introduction to Cyber Security

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.

Unit 2: Cyber Security Vulnerabilities and Cyber Security Safeguards

Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

Unit 3: Securing Web Application, Services and Servers

Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

Unit 4: Intrusion Detection and Prevention

Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware

software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

Unit 5: Cryptography and Network Security

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.

Unit 6: Cyberspace and the Law

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.

Unit 7: Cyber Forensics

Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time

Text Books:

Introduction to Cyber Security available at http://uou.ac.in/foundation-course
2. Fundamentals of Information Security http://uou.ac.in/progdetail?pid=CEGCS-17
3. Cyber Security Techniques http://uou.ac.in/progdetail?pid=CEGCS-17
4. Cyber Attacks and Counter Measures: User Perspective http://uou.ac.in/progdetail?pid=CEGCS-17
5. Information System http://uou.ac.in/progdetail?pid=CEGCS-17