

Communication Systems

M. Tech. (Electronics & Communication Engineering)

Curriculum Structure

Specialization: Communication systems

Program Outcomes (POs)

Students are expected to demonstrate

- a. Ability to apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.
- b. Ability to identify, formulate and solve engineering problems in the broad areas like Systems Design using communication and networking platforms and tools. Explore recent developments in areas like optical communication, satellite communication, wireless communication, networking, RF-microwave, antennas, measurements and standards in communication.
- c. Ability to understand and use different software tools for Design, Analysis and Verification in the domain of communication and networking. System results are obtained through progressive steps such as Design entry, Synthesis, Functional and Timing Simulation.
- d. Ability to design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.
- e. Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

CSPC01 Advanced Digital Signal Processing(Common to signal processing)

Teaching Scheme

Lectures: 3 hrs./week

Instruction Hours/week : 3(L)

Credits : 3

Sessional Marks : 40

Semester-end Examination : 60

Course Outcomes:

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

- To understand theory of different filters and algorithms
- To understand theory of multirate DSP, solve numerical problems and write algorithms
- To understand theory of prediction and solution of normal equations
- To know applications of DSP at block level.

Syllabus Contents:

Unit 1

Multi rate DSP, Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in subband coding.

Unit 2

Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Unit 3

Adaptive Filters, Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm

Unit 4

Estimation of Spectra from Finite-Duration Observations of Signals. Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum-Variance Spectral Estimation, Eigenanalysis Algorithms for Spectrum Estimation.

Unit 5

Application of DSP & Multi rate DSP, Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications

References:

- 1.J.G.Proakis and D.G.Manolakis“Digital signal processing: Principles, Algorithm and Applications”, 4th Edition, Prentice Hall, 2007.
- 2.N. J. Fliege, “Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets”, 1st Edition, John Wiley and Sons Ltd, 1999.
- 3.Bruce W. Suter, “Multirate and Wavelet Signal Processing”,1st Edition, Academic Press, 1997.
- 4.M. H. Hayes, “Statistical Digital Signal Processing and Modeling”, John Wiley & Sons Inc., 2002.
- 5.S.Haykin, “Adaptive Filter Theory”, 4th Edition, Prentice Hall, 2001.
- 6.D.G.Manolakis, V.K. Ingle and S.M.Kogon, “Statistical and Adaptive Signal Processing”, McGraw Hill, 2000.

CSPC02 Wireless and Mobile Communication

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

Course Outcomes:

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

- Design appropriate mobile communication systems.
- Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques
- Distinguish various multiple-access techniques for mobile communications e.g. FDMA, TDMA, CDMA, and their advantages and disadvantages.
- Analyze path loss and interference for wireless telephony and their influences on a mobile-communication system's performance.
- Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology
- Understanding upcoming technologies like 3G, 4G etc.

Syllabus Contents:

Unit 1

Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment. GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM. 2.5 G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE.

Unit 2

Spectral efficiency analysis based on calculations for Multiple access technologies: TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas. Wireless network planning (Link budget and power spectrum calculations)

Unit 3

Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

Unit 4

Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

Unit 5

Code Division Multiple Access: Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.

Higher Generation Cellular Standards: 3G Standards: evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G

References:

- 1.V.K.Garg, J.E.Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.
- 2.V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.
- 3.T.S.Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI, 2002.
- 4.William C.Y.Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.
- 5.Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Boston, London, 1997.

Program Elective : 1 CSPC11 DSP Architecture (Common to signal processing)

Teaching Scheme

Instruction Hours/week : 3(L)

Sessional Marks : 40

Credits : 3

Semester-end Examination : 60

Course Outcomes:

- At the end of this course, students will be able to
- Identify and formalize architectural level characterization of P-DSP hardware
- Ability to design, programming (assembly and C), and testing code using Code Composer Studio environment
- Deployment of DSP hardware for Control, Audio and Video Signal processing applications
- Understanding of major areas and challenges in DSP based embedded systems

Syllabus Contents:

Unit 1

Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point Computations, Special Architectures Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

Unit 2

Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments

TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family, TMS320C25 –Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

Unit 3

VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing Modes, Replacement of MAC unit by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed C and Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.

Unit 4

Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware, Concept of threads, introduction to P-thread, mutex and similar concepts, heterogeneous and homogenous multi-core systems, Shared Memory parallel programming –OpenMP approach of parallel programming, PRAGMA directives, OpenMP Constructs for work sharing like for loop, sections, TI TMS320C6678 (Eight Core subsystem).

Unit 5

FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor, High Performance Computing using P-DSP: Preliminaries of HPC, MPI, OpenMP, multicore DSP as HPC infrastructure.

References:

- 1.M. Sasikumar, D. Shikhare, Ravi Prakash, “Introduction to Parallel Processing”, 1st Edition, PHI, 2006.
- 2.Fayez Gebali, “Algorithms and Parallel Computing”, 1st Edition, John Wiley & Sons, 2011
- 3.Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, DrorMaydan, Jeff McDonald, “Parallel Programming in OpenMP”, 1st Edition, Morgan Kaufman, 2000.
- 4.Ann Melnichuk, Long Talk, “Multicore Embedded systems”, 1st Edition, CRC Press, 2010.
- 5.Wayne Wolf, “High Performance Embedded Computing: Architectures, Applications and Methodologies”, 1st Edition, Morgan Kaufman, 2006.
- 6.E.S.Gopi, “Algorithmic Collections for Digital Signal Processing Applications Using MATLAB”, 1st Edition, Springer Netherlands, 2007.

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

Course Outcomes:

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

- Contribute in the areas of optical network and WDM network design.
- Implement simple optical network and understand further technology developments for future enhanced network.

Syllabus Contents:

Unit 1

SONET/SDH: optical transport network, IP, routing and forwarding, multiprotocol label switching.

WDM network elements: optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

Unit 2

Control and management: network management functions, optical layer services and interfacing, performance and fault management, configuration management, optical safety.

Unit 3

Network Survivability: protection in SONET/SDH & client layer, optical layer protection schemes

Unit 4

WDM network design: LTD and RWA problems, dimensioning wavelength routing networks, statistical dimensioning models.

Unit 5

Access networks: Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds, Introduction to PON, GPON, AON.

References:

1. Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3rd edition, 2010.
2. C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE, 2001.

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

Course Outcomes:

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

- Characterize and apply probabilistic techniques in modern decision systems, such as information systems, receivers, filtering and statistical operations.
- Demonstrate mathematical modelling and problem solving using such models.
- Comparatively evolve key results developed in this course for applications to signal processing, communications systems.
- Develop frameworks based in probabilistic and stochastic themes for modelling and analysis of various systems involving functionalities in decision making, statistical inference, estimation and detection.

Syllabus Contents:

Unit 1

Review of random variables: Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebaychef inequality theorem, Central Limit theorem, Discrete & Continuous Random Variables.

Random process: Expectations, Moments, Ergodicity, Discrete-Time Random Processes Stationary process, autocorrelation and auto covariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

Unit 2

Random signal modelling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications, Linear System with random input, Forward and Backward Predictions, Levinson Durbin Algorithm.

Unit 3

Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing.

Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test, Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate, Multiple Parameter Estimation Best Linear Unbiased Estimator, Least-Square Estimation Recursive Least-Square Estimator.

Unit 4

Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic signals.

Information Theory and Source Coding: Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shannon Fano, Arithmetic, Adaptive coding, RLE, LZW Data compaction, LZ-77, LZ-78. Discrete Memoryless channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.

Unit 5

Application of Information Theory: Group, Ring & Field, Vector, GF addition, multiplication rules. Introduction to BCH codes, Primitive elements, Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes, & Decoder, Reed-Solomon codes & Decoder, Implementation of Reed-Solomon encoders and decoders.

References:

1. Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw-Hill, 2002.
2. D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.
3. Mourad Barkat, "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.
4. R.G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968.
5. F. J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New York, North-Holland, 1977.
6. Rosen K.H, "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.

Program Elective 2: CSPE21 Cognitive Radio

Teaching Scheme

Instruction Hours/week : 3(L)

Sessional Marks : 40

Credits : 3

Semester-end Examination : 60

Course Outcomes:

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

- Understand the fundamental concepts of cognitive radio networks.
- Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it.
- Understand technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies
- Understand fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimisation techniques for better spectrum exploitation.

Syllabus Contents:

Unit 1

Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Unit 2

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

Unit 3

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.

Unit 4

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Unit 5

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).

Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross-layer design for cognitive radio networks.

References:

1. Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.
2. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.
3. Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.
4. Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.
5. Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer, 2009.
6. Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.

Program Elective 2: CSPE22 Voice and Data Networks(Common to signal processing)

Instruction Hours/week : 3(L)

Credits : 3

Sessional Marks : 40

Semester-end Examination : 60

Course Outcomes:

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

- Protocol, algorithms, trade-offs rationale.
- Routing, transport, DNS resolutions
- Network extensions and next generation architectures.

Syllabus Contents:

Unit 1

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

Unit 2

Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Unit 3

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

Unit 4

Queuing Models of Networks , Traffic Models , Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks,

Unit 5

Inter-networking, Bridging, Global Internet, IP protocol and addressing , Sub netting , Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit/ Fast Recovery, Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks, Network Calculus, Packet Scheduling Algorithms.

References:

- 1.D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.
- 2.L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufman, 2011.
- 3.Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach", 1st Edition, Morgan Kaufman, 2004.
4. Walrand, "Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.
5. Leonard Kleinrock, "Queueing Systems, Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.
6. Aaron Kershenbaum, Telecommunication Network Design Algorithms, McGraw Hill, 1993.
7. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 1987

Program Elective 2: CSPE23 Wireless Sensor Networks

Teaching Scheme

Instruction Hours/week : 3(L)

Credits : 3

Course Outcomes:

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

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details of different types of sensors and select right type of sensor for various applications.
- Understand radio standards and communication protocols to be used for wireless sensor network based systems and application.
- Use operating systems and programming languages for wireless sensor nodes, performance of wireless sensor networks systems and platforms.
- Handle special issues related to sensors like energy conservation and security challenges.

Syllabus Contents:

Unit 1

Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Unit 2

Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Unit 3

Overview of sensor network protocols (details of atleast 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Unit 4

Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

Unit 5

Specialized features: Energy preservation and efficiency; security challenges; fault-tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

References:

- 1.H. Karl and A. Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, India, 2012.

- 2.C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, “Wireless Sensor Networks”, Springer Verlag, 1st Indian reprint, 2010.
- 3.F. Zhao and L. Guibas, “Wireless Sensor Networks: An Information Processing Approach”, Morgan Kaufmann, 1st Indian reprint, 2013.
- 4.YingshuLi, MyT. Thai, Weili Wu, “Wireless sensor Network and Applications”, Springer series on signals and communication technology, 2008.

CSCP01 Lab 1 : Advanced Digital Signal Processing lab (Common to signal Processing)

Teaching Scheme

Instruction Hours/week : 4(P)
Sessional Marks : 40

Credits : 2
Semester-end Examination : 60

Course Outcomes:

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

- Design different digital filters in software
- Apply various transforms in time and frequency
- Perform decimation and interpolation

List of Assignments:

1. Basic Signal Representation
2. Correlation Auto And Cross
3. Stability Using Hurwitz Routh Criteria
4. Sampling FFT Of Input Sequence
5. Butterworth Low pass And High pass Filter Design
6. Chebychev Type I,II Filter
7. State Space Matrix from Differential Equation
8. Normal Equation Using Levinson Durbin
9. ecimation And Interpolation Using Rationale Factors
10. Maximally Decimated Analysis DFT Filter
11. Cascade Digital IIR Filter Realization
12. Convolution And M Fold Decimation &PSD Estimator
13. Estimation Of PSD
14. Inverse Z Transform
15. Group Delay Calculation
16. Separation Of T/F
17. Parallel Realization of IIR filter

CSCP02 Lab 2: Wireless and Mobile Communication Laboratory

Teaching Scheme

Instruction Hours/week : 4(P)
Sessional Marks : 40

Credits : 2
Semester-end Examination : 60

Course Outcomes:

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

- Understanding Cellular concepts, GSM and CDMA networks
- To study GSM handset by experimentation and fault insertion techniques
- Understating of 3G communication system by means of various AT commands usage in GSM
- Understanding CDMA concept using DSSS kit
- To learn, understand and develop concepts of Software Radio in real time environment

List of Assignments:

1. Understanding Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, multi path environment, Coverage and Capacity issues using communication software.
2. Knowing GSM and CDMA architecture, network concepts, call management, call setup, call release, Security and Power Control, Handoff Process and types, Rake Receiver etc.
3. Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
4. To study transmitters and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.
5. To study various GSM AT Commands their use and developing new application using it. Understating of 3G Communication System with features like; transmission of voice and videocalls, SMS, MMS, TCP/IP, HTTP, GPS and File system by AT Commands in 3G network.
6. Study of DSSS technique for CDMA, observe effect of variation of types of PN codes, chip rate, spreading factor, processing gain on performance.
7. To learn and develop concepts of Software Radio in real time environment by studying the building blocks like Base band and RF section, convolution encoder, Interleaver and De-Interleaver.
8. To study and analyze different modulation techniques in time and frequency domain using SDR kit.

PGPC 01 Research Methodology and IPR

Instruction Hours/week : 2(L)

Credits : 2

Sessional Marks : 40

Semester-end Examination : 60

UNIT I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT. Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.

8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

Course Outcomes:

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

1. understand research problem formulation.
2. analyze research related information
3. follow research ethics
4. understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. understand that when IPR would take such important place in growth of individuals & nation, it is needless to emphasize the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

PGPA11 ENGLISH FOR RESEARCH PAPER WRITING

Instruction Hours/week : 2(L)

Credits : -

Sessional Marks : -

Semester-end Examination : -

Course objectives:

Students will be able to

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT II

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT III

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

UNIT IV

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

References :

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

PGPA12 DISASTER MANAGEMENT

Instruction Hours/week : 2(L)
Sessional Marks : -

Credits :-
Semester-end Examination :-

Course Objectives:

Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

UNIT I

Introduction

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; natural and Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II

Repercussions Of Disasters And Hazards

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Manmade disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III

Disaster Preparedness And Management Preparedness

Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT IV

Risk Assessment Disaster Risk

Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

UNIT V

Disaster Mitigation Meaning

Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

References:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.), " Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L. , Disaster Administration And Management Text And Case Studies” ,Deep &Deep Publication Pvt. Ltd., New Delhi.

PGPA 13 SANSKRIT FOR TECHNICAL KNOWLEDGE

Instruction Hours/week : 2(L)
Sessional Marks : -

Credits : -
Semester-end Examination : -

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

UNIT I

Alphabets in Sanskrit, Past/Present/Future Tense

UNIT II

Simple Sentences Order

UNIT III

Introduction of roots

UNIT IV

Technical information about Sanskrit Literature

UNIT V

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

References:

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Outcomes:

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

PGPA14 VALUE EDUCATION

Instruction Hours/week : 2(L)

Sessional Marks : -

Credits :-

Semester-end Examination :-

Course Objectives:

Students will be able to

1. understand value of education and self- development
2. imbibe good values in students
3. know about the importance of character

UNIT I

values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT II

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature ,Discipline

UNIT III

Personality - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking. Free from anger, Dignity of labour.

UNIT IV

Behavior Development, Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT V

Character and Competence, Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

References:

1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

Course outcomes:

Students will be able to

- 1.Knowledge of self-development
- 2.Learn the importance of Human values
- 3.Developing the overall personality

Semester II

CSPC03 Antennas and Radiating Systems

Teaching Scheme

Instruction Hours/week : 3(L)

Sessional Marks : 40

Credits : 3

Semester-end Examination :60

Course Outcomes:

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

- Compute the far field distance, radiation pattern and gain of an antenna for given current distribution.
- Estimate the input impedance, efficiency and ease of match for antennas.
- Compute the array factor for an array of identical antennas.
- Design antennas and antenna arrays for various desired radiation pattern characteristics.

Syllabus Contents:

Unit 1

Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas, Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna.

Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.

Unit 2

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects.

Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non uniform current.

Unit 3

Linear Arrays: Two element array, N Element array: Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.

Unit 4

Aperture Antennas: Huygen's Field Equivalence principle, radiation equations, Rectangular Aperture, Circular Aperture.

Horn Antennas: E-Plane, H-plane Sectoral horns, Pyramidal and Conical horns.

Unit 5

Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis, Rectangular Patch, Circular Patch, Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO.

References:

1. Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.
2. John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", Tata McGraw-Hill, 2002.
3. R.C. Johnson and H. Jasik, "Antenna Engineering hand book", Mc-Graw Hill, 1984.
4. I.J. Bhal and P. Bhartia, "Micro-strip antennas", Artech house, 1980.

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination :60

Course Outcomes:

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

- Understand advanced concepts in Communication Networking.
- Design and develop protocols for Communication Networks.
- Understand the mechanisms in Quality of Service in networking.
- Optimise the Network Design

Syllabus Contents:

Unit 1

Overview of Internet-Concepts, challenges and history. Overview of -ATM. TCP/IP Congestion and Flow Control in Internet-Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.

Unit 2

Real Time Communications over Internet. Adaptive applications. Latency and throughput issues. Integrated Services Model (intServ). Resource reservation in Internet. RSVP. Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP). Leaky bucket algorithm and its properties.

Unit 3

Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design. Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic.;; Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management.

Unit 4

IP address lookup-challenges. Packet classification algorithms and Flow Identification-Grid of Tries, Cross producting and controlled prefix expansion algorithms. Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework.

Unit 5

IPV4, IPV6, IP tunnelling, IPswitching and MPLS, Overview of IP over ATM and its evolution to IP switching. MPLS architecture and framework. MPLS Protocols. Traffic engineering issues in MPLS.

References:

1. Jean Wairand and Pravin Varaiya, "High Performance Communications Networks", 2nd edition, 2000.
2. Jean Le Boudec and Patrick Thiran, "Network Calculus A Theory of Deterministic Queueing Systems for the Internet", Springer Verlag, 2001.
3. Zhang Wang, "Internet QoS", Morgan Kaufman, 2001.
4. Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach", Morgan Kaufman Publishers, 2004.
5. George Kesidis, "ATM Network Performance", Kluwer Academic, Research Papers, 2005.

Program Elective 3 : CSPE31 Satellite Communication

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination :60

Course Outcomes:

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

- Visualize the architecture of satellite systems as a means of high speed, high range communication system.
- State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes.
- Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

Syllabus Contents:

Unit 1:Architecture of Satellite Communication System: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks.

Unit 2:Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.

Unit 3:Satellite sub-systems: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit

control system (AOCS), Communication sub-system, power sub-systems, antenna sub-system.

Unit 4: Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Unit 5: Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.

Modulation and Multiple Access Schemes used in satellite communication. Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO. GPS.

References:

1. Timothy Pratt and Others, "Satellite Communications", Wiley India, 2nd edition, 2010.
2. S. K. Raman, "Fundamentals of Satellite Communication", Pearson Education India, 2011.
Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.
3. Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008.

Program Elective 3: CSPE32 IOT and Applications (Common to Signal processing)

Teaching Scheme

Instruction Hours/week : 3(L)

Sessional Marks : 40

Credits : 3

Semester-end Examination : 60

Course Outcomes:

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

- Understand the concept of IOT and M2M
- Study IOT architecture and applications in various fields
- Study the security and privacy issues in IOT.

Syllabus Contents:

Unit 1

IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions,

IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

References:

- 1.Vijay Madiseti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
- 2.Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1stEdition, Apress Publications, 2013.
- 3.CunoPfister, “Getting Started with the Internet of Things”, O Reilly Media, 2011.

Program Elective 3: CSPE 33 RF and Microwave Circuit Design

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination :60

Course Outcomes:

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

- Understand the behaviour of RF passive components and model active components.
- Perform transmission line analysis.
- Demonstrate use of Smith Chart for high frequency circuit design.
- Justify the choice/selection of components from the design aspects.
- Contribute in the areas of RF circuit design.

Syllabus Contents:

Unit 1

Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.

Unit 2

Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.

Unit 3

Nonlinearity And Time Variance Inter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

Unit 4

Microwave Semiconductor Devices And Modeling: PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.

Unit 5

Amplifiers Design: Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

References:

1. Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", AuthorHouse, 2009.
2. D.M. Pozar, "Microwave engineering", Wiley, 4th edition, 2011.
3. R. Ludwig and P. Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.
4. G.D. Vendelin, A.M. Pavo, U. L. Rohde, "Microwave Circuit Design Using Linear And Non Linear Techniques", John Wiley 1990.
5. S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.
Radmanesh, "RF and Microwave Electronics Illustrated", Pearson Education, 2004.

PROGRAM ELECTIVE 4 : CSPE41 Markov Chains and Queueing Systems

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination :60

Course Outcomes:

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

- Understand Markov Chains and regenerative processes used in modelling a wide variety of systems and phenomena.
- Model a system as queuing system with some aspect of the queue governed by a random process.
- Understand telecommunication systems modelling using Markov chains with special emphasis on developing queuing models.

Syllabus Contents:

Unit 1:Introduction: Review of basic probability, properties of nonnegative random variables, laws of large numbers and the Central Limit Theorem.

Unit 2:Renewal Processes: Basic definitions, recurrence times, rewards and renewal reward theorem, point processes, Poisson process, Walds equation, Blackwell's theorem.

Unit 3:Discrete time Markov chains: definitions and properties, matrix representation, Perron-Frobenius theory.

Unit 4:Continuous time Markov chains: basic definitions, Q-matrix, birth-death processes, quasi birth death processes.;Embedded Markov processes, semi Markov processes, reversible Markov chains, Random walks.

Unit 5:Fundamental queuing results: Little's theorem, invariance of the mean delay, Conservation law.

Markovian queues: Jackson and BCMP networks, numerical Algorithms. M/G/1 & G/M/1 queues and G/G/1 queues,Advanced queuing models: priority, vacation and retrials in queues.

References:

- 1.Cliffs, "Stochastic Modelling and the Theory Queues", Prentice Hall, 1989.
P.Bremaud, "Markov Chains", Springer-Verlag, 1999.
- 2.E.Seneta, "Non Negative Matrices and Markov Chains", Springer Series in Statistics, Springer,1981.
- 3.R.Gallager, "Discrete Stochastic Processes", Kluwer Academic Press, 1996. L.Kleinrock, "Queuing Systems", vols I and II, John Wiley and Sons 1976.

Program Elective 4: CSPE42 Pattern Recognition and Machine Learning (Common to Signal Processing)

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination :60

Course Outcomes:

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

- Study the parametric and linear models for classification
- Design neural network and SVM for classification
- Develop machine independent and unsupervised learning techniques.

Syllabus Contents:

Unit 1

Introduction to Pattern Recognition: Problems, applications, design cycle, learning and adaptation, examples, Probability Distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis

Unit 2

Linear models: Linear Models for Regression, linear regression, logistic regression Linear Models for Classification

Unit 3

Neural Network: perceptron, multi-layer perceptron, back propagation algorithm, error surfaces, practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep Learning

Unit 4

Linear discriminant functions - decision surfaces, two-category, multi-category, minimum-squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

Unit 5

Algorithm independent machine learning – lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers

Unsupervised learning and clustering – k-means clustering, fuzzy k-means clustering, hierarchical clustering

References:

1. Richard O. Duda, Peter E. Hart, David G. Stork, “Pattern Classification”, 2nd Edition John Wiley & Sons, 2001.
2. Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, “The Elements of Statistical Learning”, 2nd Edition, Springer, 2009.
3. C. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination :60

Course Outcomes:

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

- Understand advanced concepts in Programmable Networks.
- Understand Software Defined Networking, an emerging Internet architectural framework.
- Implement the main concepts, architectures, algorithms, protocols and applications in SDN and NFV.

Syllabus Contents:

Unit 1

Introduction to Programmable Networks, History and Evolution of Software Defined Networking (SDN), Fundamental Characteristics of SDN, Separation of Control Plane and Data Plane, Active Networking.

Unit 2

Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the basics of Open Flow protocol.

Network Virtualization: Concepts, Applications, Existing Network Virtualization Framework, Mininet A simulation environment for SDN.

Unit 3

Control Plane: Overview, Existing SDN Controllers including Floodlight and Open Day light projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts. Data Plane: Software-based and Hardware-based; Programmable Network Hardware.

Unit 4

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs. Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.

Unit 5

Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies. Use Cases of SDNs: Data Centers, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.

References:

1. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", O'Reilly Media, August 2013.

2. Paul Goransson, Chuck Black, Timothy Culver. "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Publishers, 2016.
3. Fei Hu, "Network Innovation through OpenFlow and SDN: Principles and Design", CRC Press, 2014.
4. Vivek Tiwari, "SDN and OpenFlow for Beginners", Amazon Digital Services, Inc., ASIN: , 2013.
5. Nick Feamster, Jennifer Rexford and Ellen Zegura, "The Road to SDN: An Intellectual History of Programmable Networks" ACM CCR April 2014.
6. Open Networking Foundation (ONF) Documents, <https://www.opennetworking.org>, 2015. OpenFlow standards, <http://www.openflow.org>, 2015.

CSCP03 Antennas and Radiating Systems Laboratory

Teaching Scheme

Instruction Hours/week : 4(P)

Credits : 2

Sessional Marks : 40

Semester-end Examination :60

Course Outcomes:

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

- Determine specifications, design, construct and test antenna.
- Explore and use tools for designing, analyzing and testing antennas. These tools include Antenna design and analysis software, network analyzers, spectrum analyzers, and antenna pattern measurement techniques.

List of Assignments:

1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
3. Simulation of quarter wave, full wave antenna and comparison of their parameters.
4. Simulation of monopole antenna with and without ground plane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
6. Simulation of a half wave dipole antenna array.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.
9. Case study.

CSCP 04:Advanced Communication Networks Laboratory

Teaching Scheme

Instruction Hours/week : 4(P)

Credits : 2

Course Outcomes:

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

- Identify the different types of network devices and their functions within a network.
- Understand and build the skills of sub-netting and routing mechanisms.
- Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation.

List of Assignments:

1. Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.
2. Linux Network Configuration.
 - a. Configuring NIC's IP Address.
 - b. Determining IP Address and MAC Address using if-config command.
 - c. Changing IP Address using if-config.
 - d. Static IP Address and Configuration by Editing.
 - e. Determining IP Address using DHCP.
 - f. Configuring Hostname in /etc/hosts file.
3. Design TCP iterative Client and Server application to reverse the given input sentence.
4. Design a TCP concurrent Server to convert a given text into upper case using multiplexing system call "select".
5. Design UDP Client Server to transfer a file.
6. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.
 - a. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.
7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.

8. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb. Use a TFTP client and repeat the experiment.
9. Signaling and QoS of labeled paths using RSVP in MPLS.
10. Find shortest paths through provider network for RSVP and BGP.
11. Understand configuration, forwarding tables, and debugging of MPLS.

PGPA 21 CONSTITUTION OF INDIA

Instruction Hours/week : 2(L)

Sessional Marks : -

Credits : -

Semester-end Examination : -

Course Objectives:

Students will be able to:

1. understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I

History and philosophy of the Indian Constitution

History -Drafting Committee, (Composition & Working) - Preamble - Salient Features

UNIT II

Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III

Organs of Governance: Parliament - Composition - Qualifications and Disqualifications - Powers and Functions, Executive President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions

UNIT IV

Local Administration:

District's Administration Head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

UNIT V

Election Commission: Election Commission: Role and Functioning - Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to discuss:

1. the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. the passage of the Hindu Code Bill of 1956.

PGPA 22 PEDAGOGY STUDIES

Instruction Hours/week : 2(L)

Credits : -

Sessional Marks : -

Semester-end Examination : -

Course Objectives:

Students will be able to:

1. review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. identify critical evidence gaps to guide the development.

UNIT I

Introduction and Methodology:

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.

UNIT II

Thematic overview:

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT III

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT V

Research gaps and future directions:

Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

References:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, *Compare*, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, *Journal of Curriculum Studies*, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? *International Journal Educational Development*, 33 (3): 272-282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign. 7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

PGPA 23 STRESS MANAGEMENT BY YOGA

Instruction Hours/week : 2(L)

Credits : -

Sessional Marks : -

Semester-end Examination : -

Course Objectives:

1. To achieve overall health of body and mind
2. To overcome stress

UNIT I

- Definitions of Eight parts of yog. (Ashtanga)

UNIT II

Yam - Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT III

Niyam - Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT IV

Asan - Various yog poses and their benefits for mind & body

UNIT V

Pranayam - Regularization of breathing techniques and its effects-Types of pranayam 8

References:

1. 'Yogic Asanas for Group Training-Part-I' :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

PGPA 24 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Instruction Hours/week : 2(L)

Sessional Marks : -

Credits :-

Semester-end Examination : -

Course Objectives :

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

UNIT I

Neetisatakam-Holistic development of personality

Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) - Verses- 26,28,63,65 (virtue)

UNIT II

Verses- 52,53,59 (don't's) - Verses- 71,73,75,78 (do's)

UNIT III

Approach to day to day work and duties.

Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48- Chapter 3-Verses 13, 21, 27, 35 - Chapter 6-Verses 5,13,17, 23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT IV

Statements of basic knowledge.

Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 - Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT V

Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17 - Chapter 3-Verses 36,37,42 Chapter 4 - Verses 18, 38,39 - Chapter18 – Verses 37,38,63.

References :

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata 2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes :

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- 2.The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students

CSMP 01:Mini Project

Teaching Scheme:

Instruction Hours/week : 4(P)

Sessional Marks : 100

Credits : 2

Semester-end Examination :-

Course Outcomes:

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

- Understand of contemporary / emerging technology for various processes and systems.
- Share knowledge effectively in oral and written form and formulate documents.

Syllabus Contents:

The students are required to search / gather the material / information on a specific a topic comprehend it and present / discuss in the class.

Semester III

Program Elective 5 : CSPE 51 Remote Sensing

Teaching Scheme

Instruction Hours/week : 3(L)

Sessional Marks : 40

Credits : 3

Semester-end Examination :60

Course Outcomes:

At the end of this course, students shall be able to

- Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles
- Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling.

Syllabus Contents:

Unit 1

Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing-Effects of Atmosphere-Scattering-Different types-Absorption-Atmospheric window-Energy interaction with surface features –Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.

Data Acquisition: Types of Platforms-different types of aircrafts-Manned and Unmanned space crafts-sun synchronous and geo synchronous satellites –Types and characteristics of different platforms –LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRDetc.

Unit 2

Photographic products, B/W,color, color IR film and their characteristics –resolving power of lens and film - Optomechanical electro optical sensors –across track and along track scanners-multispectral scanners and thermal scanners–geometric characteristics of scanner imagery - calibration of thermal scanners.

Unit 3

Scattering System: Microwave scatterometry, types of RADAR –SLAR –resolution –range and azimuth –real aperture and synthetic aperture RADAR. Characteristics of Microwave images topographic effect-different types of Remote Sensing platforms –airborne and space

borne sensors -ERS, JERS, RADARSAT, RISAT -Scatterometer, Altimeter-LiDAR remote sensing, principles, applications.

Unit 4

Thermal And Hyper Spectral Remote Sensing: Sensors characteristics-principle of spectroscopy-imaging spectroscopy–field conditions, compound spectral curve, Spectral library, radiative models, processing procedures, derivative spectrometry, thermal remote sensing –thermal sensors, principles, thermal data processing, applications.

Unit 5

Data Analysis: Resolution–Spatial, Spectral, Radiometric and temporal resolution-signal to noise ratio-data products and their characteristics-visual and digital interpretation–Basic principles of data processing –Radiometric correction–Image enhancement–Image classification–Principles of LiDAR, Aerial Laser Terrain Mapping.

References:

- 1.Lillesand.T.M. and Kiefer.R.W,“Remote Sensing and Image interpretation”, 6thEdition, John Wiley & Sons, 2000.
- 2.John R. Jensen, “Introductory Digital Image Processing: A Remote Sensing Perspective”, 2nd Edition, Prentice Hall,1995.
- 3.Richards, John A., Jia, Xiuping, “Remote Sensing Digital Image Analysis”, 5th Edition, Springer-Verlag Berlin Heidelberg, 2013.
- 4.Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group, 1984.
- 5.Charles Elachi, Jakob J. van Zyl, “Introduction to The Physicsand Techniques of Remote Sensing”, 2nd Edition, Wiley Serie, 2006.
- 6.Sabins, F.F.Jr, “Remote Sensing Principles and Image Interpretation”, 3rd Edition, W.H.Freeman & Co, 1978

Program Elective 5:CSPE52 High Performance Networks

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination :60

Course Outcomes:

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

- Apply knowledge of mathematics, probability, and statistics to model and analyze some networking protocols.
- Design, implement, and analyze computer networks.

- Identify, formulate, and solve network engineering problems.
- Show knowledge of contemporary issues in high performance computer networks. Use techniques, skills, and modern networking tools necessary for engineering practice.

Syllabus Contents:

Unit 1: Types of Networks, Network design issues, Data in support of network design. Network design tools, protocols and architecture. Streaming stored Audio and Video, Best effort service, protocols for real time interactive applications, Beyond best effort, scheduling and policing mechanism, integrated services, and RSVP-differentiated services.

Unit 2: VoIP system architecture, protocol hierarchy, Structure of a voice endpoint, Protocols for the transport of voice media over IP networks. Providing IP quality of service for voice, signaling protocols for VoIP, PSTN gateways, VoIP applications.

Unit 3: VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

Unit 4: Traffic Modeling: Little's theorem, Need for modeling, Poisson modeling, Non-poisson models, Network performance evaluation.

Unit 5: Network Security and Management: Principles of cryptography, Authentication, integrity, key distribution and certification, Access control and fire walls, attacks and counter measures, security in many layers.

Infrastructure for network management, The internet standard management framework – SMI, MIB, SNMP, Security and administration, ASN.1.

References:

1. Kershenbaum A., "Telecommunications Network Design Algorithms", Tata McGraw Hill, 1993.
2. Larry Peterson & Bruce David, "Computer Networks: A System Approach", Morgan Kaufmann, 2003.
3. Douskalis B., "IP Telephony: The Integration of Robust VoIP Services", Pearson Ed. Asia, 2000.
4. Warland J., Varaiya P., "High-Performance Communication Networks", Morgan Kaufmann, 1996.
5. Stallings W., "High-Speed Networks: TCP/IP and ATM Design Principles", Prentice Hall, 1998.
6. Leon Garcia, Widjaja, "Communication networks", TMH 7th reprint 2002.
7. William Stallings, "Network security, essentials", Pearson education Asia publication, 4th Edition, 2011.

Program Elective 5: CSPE53 MIMO Systems

Teaching Scheme

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination :60

Course Outcomes:

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

- Understand channel modelling and propagation, MIMO Capacity, space-time coding.
- MIMO receivers, MIMO for multi-carrier systems (e.g. MIMO-OFDM), multi-user communications, multi-user MIMO.
- Understand cooperative and coordinated multi-cell MIMO, introduction to MIMO in 4G (LTE, LTE-Advanced, WiMAX).
- Perform Mathematical modelling and analysis of MIMO systems.

Syllabus Contents:

Unit 1:

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems.

Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation

Unit 2:

The generic MIMO problem, Singular Value Decomposition, Eigenvalues and eigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Pre-distortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of pre-coding and combining, Channel state information.

Unit 3

:Codebooks for MIMO, Beamforming, Beamforming principles, Increased spectrum efficiency, Interference cancellation, Switched beamformer, Adaptive beamformer, Narrowband beamformer, Wideband beamformer

Unit 4:

Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models

Unit 5:

Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative

channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

References:

- 1.Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design",Academic Press, 1st edition, 2010.
- 2.Mohinder Janakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004.

OPEN ELECTIVES

PGOE 11 Business Analytics

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

UNIT I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT II

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics technology.

UNIT III

Organization Structures of Business analytics, Team management, Management Issues, designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining

Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear optimization.

UNIT IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carlo Simulation using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.
Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

References:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education.

Course outcomes:

Students will demonstrate

1. knowledge of data analytics.
2. the ability of think critically in making decisions based on data and deep analytics.
3. the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4. the ability to translate data into clear, actionable insights.

PGOE 12 Industrial Safety

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

UNIT I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards,
types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

References:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

PGOE 13 Operations Research

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

UNIT I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II

Formulation of a LPP - Graphical solution revised simplex method- duality theory - dual Simplex method - sensitivity analysis - parametric programming

UNIT III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Course Outcomes:

At the end of the course, the student should be able to

1. apply the dynamic programming to solve problems of discrete and continuous variables.
2. apply the concept of non-linear programming
3. carry out sensitivity analysis
4. model the real world problem and simulate it.

PGOE 14 Cost Management of Engineering Projects

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

UNIT I

Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents, Project team: Role of each member. Importance Project site: Data required with significance.

UNIT III

Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning,

UNIT IV

Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

PGOE 15 Composite Materials

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

UNIT-I:

INTRODUCTION: Definition - Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II:

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III:

Manufacturing of Metal Matrix Composites: Casting - Solid State diffusion technique, Cladding - Hot isostatic pressing. Properties and applications. **Manufacturing of Ceramic Matrix Composites:** Liquid Metal Infiltration - Liquid phase sintering. **Manufacturing of Carbon - Carbon composites:** Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs - hand layup method - Autoclave method -

Filament winding method - Compression moulding - Reaction injection moulding. Properties and applications.

UNIT – V:

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first ply failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

References:

1. Material Science and Technology - Vol 13 - Composites by R.W.Cahn - VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials - K.K.Chawla.
5. Composite Materials Science and Applications - Deborah D.L. Chung.
6. Composite Materials Design and Applications - Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

PGOE 16 Waste to Energy

Instruction Hours/week : 3(L)
Sessional Marks : 40

Credits : 3
Semester-end Examination : 60

UNIT I

Introduction to Energy from Waste: Classification of waste as fuel - Agro based, Forest residue, Industrial waste - MSW - Conversion devices - Incinerators, gasifiers, digestors

UNIT II

Biomass Pyrolysis: Pyrolysis - Types, slow fast - Manufacture of charcoal - Methods - Yields and application - Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III

Biomass Gasification: Gasifiers - Fixed bed system - Downdraft and updraft gasifiers - Fluidized bed gasifiers - Design, construction and

operation - Gasifier burner arrangement for thermal heating - Gasifier engine arrangement and electrical power - Equilibrium and kinetic consideration in gasifier operation.

UNIT IV

Biomass Combustion: Biomass stoves - Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, design, construction and operation - Operation of all the above biomass combustors.

UNIT V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants - Applications - Alcohol production from biomass - Bio diesel production Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

(Dissertation) Dissertation Phase – I and Phase - II

Teaching Scheme

Instruction Hours/week : 20 & 32(P)

Sessional Marks : 100 & 40

Credits : 10 &16

Semester-end Examination :- &60

Course Outcomes:

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

-
- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.

- Ability to present the findings of their technical solution in a written report.
- Presenting the work in International/ National conference or reputed journals.

Syllabus Contents:

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

- Experimental verification / Proof of concept.
- Design, fabrication, testing of Communication System.
- The viva-voce examination will be based on the above report and work.

Guidelines for Dissertation Phase – I and II at M. Tech. (Electronics):

- As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
- The dissertation may be carried out preferably in-house i.e. department's laboratories and centers OR in industry allotted through department's T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.
- Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.
- During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.
- Phase – II evaluation: Guide along with appointed external examiner shall assess the
- progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work.