I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

Ref. No. : IKGPTU/Reg/N/

Dated :

NOTIFICATION

Sub: **Regarding Pre-Ph.D Course work.**

This is for information of all concerned that Pre-Ph.D course work from 2016-17 will be conducted in the IKGPTU main campus Kapurthala in regular mode. The PhD course work will consists of minimum 15 credits. The structure of the course work is as under.

Sr. No.	Nature of course	Name of course	Credits	Remarks
1.	Core	1.Research Methodology	4	The syllabus of RM should be formulated faculty wise such as Engineering, Science, Management/ Humanities and Life sciences
		2.Subject related theory paper	4	Discipline specific related to advancements in theoretical methods for research
		3. Presentation	3	Discipline specific
2.	Interdisciplinary	4. Elective	4	From list of subjects from allied fields
	Total Minimum credits		**15**	

-Sd-
Registrar

Endorsement No: IKGPTU/REG/N/ 4244-4251 Dated: 22.08.2016

1. Secretary to Vice Chancellor: For kind information of Vice Chancellor
2. Dean (P&D)
3. Dean (RIC)
4. Dean (Academics)
5. Finance Officer
6. Controller of Examination
7. DR (Computers): For uploading on website
8. File Copy

Head
Department of Electronics & Communication Engineering
IK Gujral Punjab Technical University
Main Campus, Kapurthala (Punjab)-144603

Registrar 22/8/16

I. K. Gujral Punjab Technical University, Jalandhar
Jalandhar Kapurthala Highway, Near Pushpa Gujral Science City, Kapurthala - 144 603
Ph. No. 01822 - 662521, 662501 Fax No. : 01822-255506, 662526, Email : revistrar@ptu.ac.in

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

Ref. No. : IKGPTU/Reg/NF/ 169

Dated : 23.06.2021

NOTIFICATION

Sub: Introduction of two credit course "Research and Publication Ethics (RPE).

I.K. Gujral Pujnab Technical University, Jalandhar has introduced a mandatory two credit course on "Research and Publication Ethics (RPE) for all Ph.D students in their pre-registration course work from January 2021 onwards. The course content/ structure as per UGC guidelines (letter No.D.O.No.F.1-1/2018 (Journal/CARE) dated December 2019) has been included in Ph.D. course work. The details are as follows:

Research and Publication Ethics (RPE)
(2 Credits)

1. Course structure

- The course comprises of six modules listed in table below. Each module has 4-5 units.

Modules	Unit title	Teaching hours
Theory		
RPE 01	Philosophy and Ethics	4
RPE 02	Scientific Conduct	4
RPE 03	Publication Ethics	7
Practice		
RPE 04	Open Access Publishing	4
RPE 05	Publication Misconduct	4
RPE 06	Database and Research Metrics	7
	Total	**30**

Syllabus (as suggested by UGC)

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Main Campus, Kapurthala (Punjab)-144603

THEORY

- **RPE 01: PHILOSOPHY AND ETHICS (3hrs.)**

1. Introduction to Philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral Philosophy, nature of moral judgements and reactions

- **RPE 02: SCIENTIFIC CONDUCT (5hrs.)**

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing.
5. Selective reporting and misrepresentation of data

- **RPE 03: PUBLICATION ETHICS (7hrs.)**

1. Publication Ethics: definition, introduction, and importance
2. Best practices/standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types.
5. Violation of publication ethics, authorship, and contributorship
6. Identification of publication misconduct, complaints and appeals
7. Predatory publishers and journals

PRACTICE

- **RPE 04: OPEN ACCESS PUBLISHING (4hrs.)**

1. Open access publications and initiatives
2. **SHERPA/RoMEO online resource to check publisher copyright & self–archiving policies.**
3. Software tool to identify predatory publications developed by SPPU.
4. Journal finder/journal suggestion tool viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

- **RPE 05: PUBLICATION MISCONDUCT (4hrs.)**

A. Group Discussion (2hrs.)

1. Subject specific ethical issues, FFP, authorship
2. Conflicts of interest
3. Complaints and appeals: examples and fraud from India and abroad

Head
Department of Electronics & Communication Engineering
IK Gujral Punjab Technical University
Main Campus, Kapurthala (Punjab)-144603

B. Software tools (2hrs.)

Use of plagiarism software like Turnitin, Urkund, and other open-source software tools.

- **RPE 06: DATABASES AND RESEARCH METRICS (7hrs.)**

A. Databases (4hrs.)

1. Indexing databases
2. Citation databases: Web of Science, Scopus, etc.

B. Research Metrics (3hrs.)

1. Impact Factor of journal as per Citation Report, SNIP, SJR, IPP, Cite Score
2. Metrics: h-index, g-index, I10 index, altmetrics

2. Course Work Structure – 17 Credits

All candidates admitted to Ph.D programme shall be required to complete the Ph.D course work, proposed by the Supervisor keeping in view the candidate's areas of research in the University Teaching Department. Pre Ph.D course work will be **17 credits and shall be offered on regular** basis at IKGTU campus.

Structure of course work is as under:

Sr. No.	Nature of Course	Name of Course	Credits	Remarks
1	Core	1. Research Methodology	4	The syllabus of RM should be formulated faculty wise such as Engineering, Sciences, Management/ Humanities and Life Sciences
		2. Subject Related theory paper	4	Discipline specific related to Advancements in theoretical methods for research.
		3. Presentation	3	Discipline specific
2.	Interdisciplinary	4. Elective	4	From list of Subjects from allied fields
3.	Research and Publication Ethics (RPE)	5. Research and Publication Ethics (RPE)	2	As Per UGC
	Total Minimum credits		**17**	

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Department of Electronics & Communication Engineering
IK Gujral Punjab Technical University
Main Campus, Kapurthala (Punjab)-144603

a. The candidate will have to clear Courses within the first two semesters as per the programme of the Department.

b. Direct fellowship awardees or candidates registered for Ph.D. during the middle of the semester will take up course work in the following semester

c. The syllabus for the Pre-Ph.D. course work, not covered in the ongoing PG curriculum, will be drawn by the Board of Studies or RAC subject to the approval by BoS and highest academic body of the University.

d. An Attendance less than the mandatory 75% (including 10% attendance benefit on medical grounds) in the course work shall attract cut in the scholarship /fellowship.

3. Applicability:

It is decided that the 17 credit course work will be applicable to all students which are enrolled from January 2021 onwards.

(Sandeep Kumar Kazal)
Registrar

Endst. No. IKGPTU/Reg/NF/170-174 **Dated:**23**.06.2021**

A copy is forwarded to the following officers for information please.

1. Vice Chancellor Secretariat: For Information of Vice Chancellor
2. Dean (R&D)
3. Director (Main Campus): To inform all Deputy Dean (Faculty), HoDs (Teaching) and In-charge, Constituent Campuses
4. Director/Principal, Autonomous College
5. Incharge (ITS): For upload of notice in the Notice Board of University website and Ph.D admissions link also.

(Sandeep Kumar Kazal)
Registrar

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Main Campus, Kapurthala (Punjab)-144603

Pre Ph.D. Course in Electronics and Communication Engineering
Schematic and Syllabus

Sr. no.	Nature of Course	Name of course	Credits	Remarks
1.	Core	Research Methodology	4	The syllabus of RM should be formulated faculty wise
		Discipline Specific subjects	4	1.Advanced Wireless Communication 2.Advanced Communication Systems 3.Advanced Digital Signal processing 4.Real time concepts for Embedded systems 5. Radiating systems 6. Microwave and Millimeter wave circuits 7. RF & Microwave System Design 8. Image and Video Processing 9. Bio-Medical Signal Processing 10. MOS Circuit Design 11. Low Power VLSI Circuits 12. Advanced Data Communication 13. Coding Theory and Techniques 14. Optical Communication Technology 15. Optical Networks.
		Presentation	3	Discipline specific
2.	Interdisciplinary	Elective	4	From list of subjects from allied fields 1.Internetworking 2. MEMS 3. Network Security and Cryptography 4. Adhoc Wireless and Sensor Netwroks 5. Mobile Computing Technologies 6. Data Warehousing and Data Mining 7. Neural Networks and Fuzzy Logic 8. Mathematical Foundations of Computer Networks 9. Sensors for Ranging and Imaging
3.	Research and Publication Ethics	Research and Publication Ethics (RPE)	2	As per UGC guidelines
	Total Minimum credits		**15**	

Paper Title: Research Presentation

L T P
0 0 3

Research Scholar will have to present a seminar based upon his/her research area. Performance of the scholar and participation in seminar will be taken into consideration.

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IK Gujral Punjab Technical University
Main Campus, Kapurthala (Punjab)-144603

PROGRAMME OUTCOMES

1. Understand the key concepts, terminologies in the field of Electronics and Communication Engineering. Survey the available literature to discover a list of problems occurring in society in the field of Electronics and Communication.
2. Develop ability to critically analyse the problem, formulate the innovative framework to find the solution for it.
3. Review the literature, write survey and research articles.
4. Analyse and evaluate the gaps in the existing literature and gather new insights into it.
5. Find alternative solution to the problem which is economically feasible, socially acceptable and environment-friendly.
6. Develop the research design, conduct experiments, gather results- analyse and interpret them through technical knowledge to come to a valid conclusion.
7. Learn coding skills for modelling and error debugging and handling. Use latest engineering methods and software tools for problem solving.
8. Communicate effectively with peers and higher authorities both orally and in-writing in academic as well as industrial environment.
9. Familiar with ongoing research areas, technologies, electronic products and gadgets.
10. Engage in life-long learning as a means of enhancing knowledge and skills for continuous professional advancement.

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Pre Ph.D. Course in Electronics and Communication Engineering
Research Methodology

L	T	P
4	0	0

CO1: Identify and discuss the role and importance of research in the social sciences.
CO 2: Identify and discuss the issues and concepts salient to the research process.
CO 3: Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
CO4: Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

1. Introduction Research Methodology: Definition of Research, Need of Research, Concept and steps of Research Methodology , Uses of Research Methodology, Research Techniques. Reviewing Literature: Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.
2. Identifying and defining research problem: Locating. Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them.
3. List of important journals in Electronics and Communication Engineering, impact factor, research articles, research papers, reviews, scientific popular articles, process of reviewing, literature review, Identification and formulation of problem, Research design, Sampling techniques, Data Collection, Statistical and sensitive analysis of data, Interpretation of result.
4. Research reports and Thesis writing: Introduction: Structure and components of scientific reports, types of report, developing research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, word processing tools such as Latex Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.
5. Statistical Methods of Analysis: Descriptive statistics: Meaning, graphical representations. mean, range and standard deviation, characteristics and uses of normal curve. Inferential statistics: t-test. Chi-square tests. Correlation (rank difference and product moment), ANOVA (one way).
6. Research ethics, IPR and publishing Ethics: ethical issues. IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Books:
1. C.R. Kothari, "Research Methodology – Methods and Techniques", Wiley Eastern Ltd 2009.
2. Richard I. Levin, David S. Rubin, Statistics for Management (7th Edition), Pearson Education India.
3. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan," Management Research Methodology: Integration of Methods and Techniques, Pearson, 2006 4. S.P Gupta,"Statistical Methods", Sultan Chand & Sons, 2006.
4. Probability and Statistics in Engineering, Hines, Montgomery, Goldsman and Borror, 4th ed, 2003, John Wiley & Sons.
5. B.L. Wadehra, Law relating to patents, trademarks, copyright designs and geographical indications, Universal Law Publishing, 2014.

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Pre Ph.D. Course in Electronics and Communication Engineering
Advanced Wireless Communication

L	T	P
4	0	0

CO1: To understand the wireless channel characteristics and its statistical models. Review of necessary mathematical tools, e.g., probability theory, optimization theory, information theory.
CO 2: To be well versed with the popular wireless communications technologies, e.g., CDMA, OFDM, MIMO.
CO 3: To understand the achievable capacity of digital communications over time-varying fading channels.
CO 4: To be able to understand modern multi-antenna systems, i.e., MIMO and related transmitter and receiver structures.
CO5: To be able to formulate adaptive power and rate control in OFDM and MIMO systems.

1. REVIEW OF FUNDAMENTALS OF WIRELESS COMMUNICATION: MULTIPATH FADING, MULTIPATH CHANNEL MODELS, CAPACITY OF WIRELESS CHANNELS.
2. PERFORMANCES OF DIGITAL MODULATION OVER WIRELESS CHANNELS: AGWN CHANNELS SIGNAL TO NOISE POWER RATIO AND BIT/SYMBOL ENERGY, ERROR PROBABILITY FOR BPSK, QPSK, MPSK,MPAM, MQAM- THEIR COMPARISION.
3. MULTICARRIER MODULATION: DATA TRANSMISSION USING MULTIPLE CARRIERS, MULTICARRIER MODULATUION WITH OVERLAPPING SUBCHANNELS, MITIGATION OF SUBCARRIER FADING, DISCRETE IMPLEMENTATION OF MULTICARRIER MODULATION, CHALLENGES IN MULTICARRIER SYSTEMS.
4. INTRODUCTION TO WIRELESS OFDM: OFDM PRINCIPLES, SYSTEM MODEL, GENERATION OF SUB CARRIER USING IFFT, GUARD TIME, CYCLIC EXTENSION, WINDOWING, OFDM PARAMETERS, OFDM SIGNAL PROCESSING, COHERENT AND DIFFERENTIAL DETECTION
5. OFDMA: FREQUENCY HOPPING IN OFDMA, DIFFERENCE BETWEEN OFDMA AND MC-CDMA, OFDMA SYSTEM DESCRIPTION-CHANNEL CODING, FREQUENCY SYNCHRONIZATION, INITIAL MODULATION TIMING ANF FREQUENCY OFFSET SYNCHRONIZATION ACCURACY, RANDOM FREQUENCY HOPPING OPERATION, APPLICATIONS OF OFDMA.

Books:
1. A.Goldsmith, "Wireless Communications, Cambridge Univ. Press, 2005.
2. R.Vannee and R.Prasad, "OFDM for Wireless Multimedia Communication, Artech House, 2000.
3. M.Engels, Wireless OFDM systems, Klumer Academic Publishers, 2002.
4. Raj Pandya,"Mobile and personal Communication Systems and services", PHI
5. Theodore S. Rappaport, 'Wireless Communications Principles & Practice', PHI,2007
6. J.W. Mark & W. Jhuang, 'Wireless Communications & Networking', PHI,2006

Advanced Communication Systems

L	T	P
4	0	0

CO1: 1. Analyze the design parameters of a single and multi-carrier communication system.
CO 2: Use mathematical tools to analyze the performance of communication systems.
CO 3: Use probability theory and stochastic processes in communication system applications.
CO 4: Learn synchronization and adaptive equalization techniques.

1. Introduction Introduction to communications systems, analog and digital communication systems, Applications of communication systems.
2. Digital Communication Introduction, Digital Modulation techniques, BPSK, QPSK, PCM, DPCM, Delta Modulation, Digital Transmission and Transmission Impairments.
3. Optical Networks WDM, TDM, Telecommunication Infrastructure, Switching, 3G systems, SONET, SDH, Architecture of Optical Transport Network, Link Management Protocols, Solutions.
4. Satellite Communication Basic Transmission Theory, System Noise Temperature and G/T Ratio, Design Of Down Links, Domestic Satellite Systems Using Small Earth Stations, Uplink Design, Design Of Satellite Link For Specified (C/N). Multiple Access Techniques, Frequency Division Multiple Access (FDMA), TDMA, CDMA, Estimating Channel Requirements, Practical Demand Access Systems, Random Access, Multiple Access With On Board Processing. VSAT
5. Mobile Communications Mobile telephone service, Transmission protocols, Introduction to GSM, GPRS, CDMA, Switching techniques, Fading, Quality of service (QOS).

Books:
1. Advanced Communication Systems - by Wayne Tomasi; Pearson.
2. Digital Communication - by Proakis; PHI
3. Optical Networks - by Uyless Black; Pearson
4. Satellite Communication - by Timothy Pratt; Addison Wesley.
5. Related IEEE/IEE publications

Pre Ph.D. Course in Electronics and Communication Engineering
Advanced Digital Signal Processing

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CO1: State sampling theorem and reproduce a discrete-time signal from an analog signal; acquire knowledge of multi rate digital signal processing, STFT and wavelets.
CO 2: Classify systems based on linearity, causality, shift-variance, stability criteria and represent transfer function of the selected system.
CO 3: Evaluate system response of a system using Z-transform, convolution methods, frequency transformation technique, DFT, DIF-FFT or DIT-FFT algorithm, window techniques.
CO 4: DesignFIR and IIR filters used as electronic filter, digital filter, mechanical filter, distributed element filter, waveguide filter, crystal filter, optical filter, acoustic filter, etc.
CO5: Construct (structure) and recommend environment-friendly filter for real- time applications.

1. Transformations: Review of Z-Transform, Solution of Linear Difference Equations, Fourier series and Fourier Transform, Discrete Fourier Transform, Radix-2 FFT. Introduction to Radix-4 and Split Radix FFT, Discrete Cosine Transform, DCT as Orthogonal Transform, Walsh Transform, Hadamard Transform, Wavelet Transform.
2. Digital Filters: FIR Filter Design: Filter Specifications, Coefficient Calculation Methods-Window method, Optimal method, Frequency Sampling method. Realization Structures, Finite Word Length Effects.IIR Filter Design: Specifications, Coefficient Calculation methods- Pole-Zero Placement method, Impulse Invariant method, Matched Z-Transform method, Bilinear Z Transformation method, Use of BZT and Classical Analog Filters to design IIR Filters. Realization Structures, Finite Word Length Effects.
3. Multirate Digital Signal Processing: Sampling Rate Alteration Devices, Multirate Structures for sampling rate conversion, Multistage design of Decimator and Interpolator, The Polyphase Decomposition, Arbitrary Rate Sampling Rate Converter, Filter Banks, QMF banks, Multilevel Filter Banks, Sub-band Coding, Discrete Wavelet Transform.
4. Linear Prediction and Optimum Linear Filters: Forward and Backward Linear Prediction, Properties of Linear Prediction-Error Filters, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.
5. Adaptive Digital Filters: Concepts of Adaptive Filtering, LMS Adaptive Algorithm, Recursive Least Squares Algorithm, Applications.
6. DSP Chips: Introduction to fixed point and floating point processors, ADSP21xx and TMS320Cxx- Architecture, Memory, Addressing Modes, Interrupts, Applications. Comparison of ADSP21xx and TMS320Cxx series.

Books:

1. "Digital Signal Processing: A Practical Approach", by Ifeacher & Jervis, -Pearson Education.
2. "Digital Signal Processing: Principles, Algorithms and Applications", by Proakis & Manolakis, 4e, -Pearson Education.
3. "Digital Signal Processing", by S.K.Mitra, -Tata-Mcgraw Hill.
4. "Discrete Time Signal Processing", Oppenheim & Schafer. PHI.
5. "Fundamentals of Digital Signal Processing using MATLAB", by Robert J. Schilling & Sndra L. Harris. -CENGAGE Learning.
6. "Digital Signal Processing", by Salivahanan, Vallavaraj & Gnanapriya, - Tata-Mcgraw Hill

Pre Ph.D. Course in Electronics and Communication Engineering
Real Time Concepts for Embedded Systems

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L	T	P
4	0	0

CO1: Describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
CO 2: Make use of the enabling technologies for implementing embedded systems with emphasis on Microcontrollers from various vendors and the techniques for programming their integrated peripherals.
CO 3: Understand the interdisciplinary nature of various application fields of Embedded Systems.

1. Introduction: Examples of Embedded Systems, Definition of Embedded Systems, Architecture of Embedded Systems, Real- Time Embedded Systems , Design Issues and Current Trends for Embedded Systems Hard versus soft Real- Time Systems: Jobs and Processes, Release Times, Deadlines and Timing Constraints, Hard and Soft Timing Constraints, Hard Real Time Systems, Soft Real Time Systems.
2. Reference Model of Real – Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency, Functional Parameters- pre-emptivity of jobs, criticality of jobs, Resource Parameters of Jobs and Parameters of Resources, Scheduling Hierarchy- Scheduler and Schedules, Feasibility, Optimality and Performance Measures.
3. Classification of Real Time Scheduling Approaches: Clock- Driven Approach, Weighted Round- Robin Approach, Priority- Driven Approach, Dynamic versus Static Systems, Effective Release Times and Deadlines, optimality of the EDF and LST algorithms, Non optimality of the EDF and LST algorithms, Challenges in validating timing constraints in priority –driven systems Off-line versus On-line Scheduling.
4. Clock-Driven Scheduling : Notations and Assumptions, Static, Timer -Driven Scheduler, General Structure of Cyclic Schedules, Cyclic Executives, Improving the Average Response Time of Aperiodic Jobs, Scheduling Sporadic Jobs-Acceptance test ,EDF Scheduling of accepted jobs and implementation, Pros and Cons of Clock Driven Scheduling.
5. Priority-Driven Scheduling of Periodic Tasks: Static Assumption, Fixed Priority v/s Dynamic Priority Algorithms, schedulability test for the EDF algorithm, a schedulability test for fixed priority tasks with short response times-time demand analysis, schedulability test for fixed priority tasks with arbitrary response times: busy intervals, general schedulability test, sufficient schedulability conditions for RM & DM algorithms: schedulable utilization of the RM algorithm for tasks with Di=pi, schedulable utilization of fixed priority tasks with arbitrary relative deadlines.
6. Real-Time Operating Systems: Overview- Threads and Tasks, The Kernel, Time Services and Scheduling Mechanisms- Time Services, Scheduling Mechanisms, Other Basic Operating System Functions- Communication and Synchronization, Event Notification and Software Interrupt, Memory Management, I/O and Networking.

BOOKS:
1. Real Time Systems – By Jane W.S.Liu -Low Price Edition , Pearson Education Asia
2. Real-Time Concepts for Embedded Systems - Qing Li with Caroline Yao published by CMP Books

Pre Ph.D. Course in Electronics and Communication Engineering
Radiating Systems

L	T	P
4	0	0

CO1: Define various antenna parameters and analyze radiation patterns of antennas.
CO 2: Analyze radiation patterns of antennas.
CO 3: Illustrate techniques for antenna parameter measurements.
CO 4: To understand the various applications of antennas and discuss radio wave propagation.

1. Basics Concepts Of Radiation: Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-Current distribution of Antennas, Impedance concept-Balanced to Unbalanced transformer.
2. Radiation from Apertures Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinets principle, Geometrical theory of diffraction, Reflector antennas, and Design considerations - Slot antennas.
3. Synthesis of Array Antennas Types of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array patterns, Continuous aperture sources, Antenna synthesis techniques.
4. Micro Strip Antennas Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Micro-strip dipole, Microstrip arrays.
5. EMI/EMC/Antenna Measurements: Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Traveling Wave antenna, Antenna measurement and instrumentation, Amplitude and Phase measurement, Gain, Directivity, Impedance and polarization measurement. Antenna range, Design and Evaluation.

BOOKS

1. Kraus.J.D.,"Antennas"II Edition, John wiley and Sons.
2. Balanis.A, "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 1982
3. RF System Design, Peter Kinget Bell Laboratories, Lucent Technologies Murray Hill.
4. Practical RF system design, Wiley-IEEE, 2003 - Technology & Engineering

Pre Ph.D. Course in Electronics and Communication Engineering
Microwave and Millimeter Wave Circuits

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L	T	P
4	0	0

CO1: State the concept of MMIC and MM-wave technology along with their fabrication techniques.
CO 2: Comprehensive knowledge of the passive circuit elements for microwave and MM-wave technology.
CO 3: Enhance skills of different measurement techniques for microwave and MM-wave technology.
CO 4: Design systems and its application for microwave and MM-wave technology.

1. Analysis of Microwave Circuits: Introduction, Microwave Components – E-plane Tee, Hplane Tee, Magic Tee, Directional Coupler, Isolator, Circulator & their Scattering.
2. Transformers & Resonators: Parameters, Impedance Transformers – Quarter wave Transformers, Microwave Resonators – Rectangular and Cylindrical Resonators.
3. Filters And Periodic Structures: Design of Narrow Band Low Pass, Band Pass and High Pass Filters, Maximally flat and Chebyshev Designs, Introduction to Periodic Structures, Floquet's Theorem, Circuit Theory Analysis of Infinite and Terminated Structures.
4. Obstacles In Wave Guides: Introduction, Posts in Waveguides, Diaphragms in Waveguides, Waveguide Junctions, Waveguide Feeds, Excitation of Apertures.
5. Millimeter Wave Circuits: Wave Propagation in micro-strip lines, Discontinues in Microstrips, Parallel Coupled lines, Power Dividers and Directional Couplers, Microwave and Millimeter Wave Integrated Circuits.

BOOKS

1. Roger F. Harrington, "Time-Harmonic Electromagnetic Fields", Mc graw-hill
2. Robert E Collin, "Foundation For Microwave Engineering", Mc Graw-Hill.
3. Cam Nguyun, "Analysis Methods for RF, Microwave, and Millimeter-Wave Planar Transmission Line Structures".

L	T	P
4	0	0

CO1: Analyze, evaluate, design and solve complex technical problems using modern tools.
CO 2: Carry out research and innovation in the core areas like RF Circuit analysis, sub-system design and Wireless Communication.
CO 3: Demonstrate the skills required in Defense, Microwave and RF communication sectors and adapt to the technological changes through lifelong learning for global acceptance.

1. Introduction: Importance of RF and Microwave Concepts and Applications- and UnitsFrequency Spectrum, RF and Microwave Circuit Design, Dimensions - RF Behavior of Passive Components: High Frequency Resistors, High Frequency Capacitors, High Frequency Inductors, General Introduction, Types of Transmission Lines-Equivalent Circuit representation.
2. The Smith Chart: Introduction, Derivation of Smith Chart, Description of two types of smith chart, Z-Y Smith chart, Distributed Circuit Applications, Lumped Element Circuit Applications. SINGLE AND MULTIPORT NETWORKS: Basic Definitions, Interconnecting Networks.
3. Scattering Parameters: Scattering Parameters: Definition, Meaning, Chain Scattering Matrix, Conversion between S and Z-parameters, Signal Flow Chart Modeling.
4. Stability and Gain Considerations – RF Design RF Source, Transducer Power Gain, Additional Power Relations-Stability Considerations: Stability Circles, Unconditional Stability, and Stabilization Methods-Unilateral and Bilateral Design for Constant Gain- Noise Figure Circles- Constant VSWR Circles.
5. RF Filters, Amplifiers And Oscillators Design Generalization-Basic Resonator and Filter Configurations: Low Pass, High Pass, Band Pass and Band Stop type Filters-Filter Implementation using Unit Element and Kuroda's Identities Transformations. Introduction, Types and Characteristics of Amplifiers, Small Signal Amplifiers, Design of different types of amplifiers (NBA, HGA, MGA, LNA, MNA, BBA), Design of Large Signal Amplifiers Oscillator vs Amplifier Design, Design procedure of Transistor Oscillators.

BOOKS

1. Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition.
2. Reinhold Ludwig and Powel Bretchko," RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition.\
3. Devendra K. Misra, "Radio Frequency and Microwave Communication Circuits – Analysis and Design "John Wiley & Sons, Inc.
4. Jon B. Hagen, "Radio Frequency Electronics ", Cambridge university press, Cambridge, 1996.
5. James Hardy, "High Frequency Circuit Design ", Resto Publishing Co., New York, 1979.

L	T	P
4	0	0

CO1: Review the fundamental concepts of a digital image processing system.
CO 2: Analyze images in the frequency domain using various transforms.
CO 3: Evaluate the techniques for image enhancement and image restoration and categorize various compression techniques.
CO 4: Interpret Image compression standards and Interpret image segmentation and representation techniques.

1. Fundamentals of Image processing and Image Transforms: Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms.
2. Image Processing Techniques: Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region based segmentation.
3. Image Compression Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards.
4. Basic Steps of Video Processing: Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations.
5. 2-D Motion Estimation: Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

BOOKS

1. Gonzalez and Woods , "Digital Image Processing", 3rd edition , Pearson
2. Yao wang, Joem Ostarmann and Ya – quin Zhang, "Video processing and communication", 1st edition, PHI.
3. M. Tekalp, "Digital video Processing", Prentice Hall International

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CO1: The student will be able to model a biomedical system.
CO 2: The student will be able to understand various methods of acquiring bio signals.
CO 3: The student will be able to understand various sources of bio signal distortions and its remedial techniques.
CO 4: The students will be able to analyze ECG and EEG signal with characteristic feature points.
CO5: The student will have a basic understanding of diagnosing bio-signals and classifying them.

1. Introduction To Biomedical Signals - Examples of Biomedical signals - ECG, EEG, EMG etc., Tasks in Biomedical Signal Processing - Computer Aided Diagnosis. Origin of bio potentials - Review of linear systems - Fourier Transform and Time Frequency Analysis (Wavelet) of biomedical signals- Processing of Random & Stochastic signals – spectral estimation – Properties and effects of noise in biomedical instruments - Filtering in biomedical instruments.
2. Concurrent, Coupled and Correlated Processes - Illustration with case studies – Adaptive and optimal filtering - Modeling of Biomedical signals - Detection of biomedical signals in noise -removal of artifacts of one signal embedded in another -Maternal-Fetal ECG - Musclecontraction interference. Event detection - case studies with ECG & EEG - Independent component Analysis - Cocktail party problem applied to EEG signals - Classification of biomedical signals.
3. Cardio Vascular Applications : Basic ECG - Electrical Activity of the heart- ECG data acquisition – ECG parameters & their estimation - Use of multi-scale analysis for ECG parameters estimation - Noise & Artifacts- ECG Signal Processing: Baseline Wandering, Power line interference, Muscle noise filtering – QRS detection - Arrhythmia analysis
4. Data Compression: Lossless & Lossy- Heart Rate Variability – Time Domain measures - Heart Rhythm representation - Spectral analysis of heart rate variability - interaction with other physiological signals.
5. Neurological Applications: The electroencephalogram - EEG rhythms & waveform - categorization of EEG activity - recording techniques - EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models – Non-linear modeling of EEG - artifacts in EEG & their characteristics and processing – Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis – correlation analysis of EEG channels - coherence analysis of EEG channels.

BOOKS

1. D.C.Reddy ,"Biomedical Signal Processing: Principles and techniques" ,Tata McGraw Hill, New Delhi, 2005
2. Willis J Tompkins , Biomedical Signal Processing -, ED, Prentice – Hall, 1993
3. R. Rangayan, "Biomedical Signal Analysis", Wiley 2002. 2. Bruce, "Biomedical Signal Processing & Signal Modeling," Wiley, 2001

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MOS Circuit Design

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CO1: Understand the basic physics of semiconductor devices and the basics theory of PN junction.
CO 2: Understand the basic theory of MOS transistors and Understand the basic steps of fabrication.
CO 3: Learn the basics theory of Crystal Growth and Wafer Preparation.
CO 4: Study the Epitaxy, Diffusion, Oxidation, Lithography and Etching and understand the basic theory of Nano-Fabrication.

1. Introduction: Classification of CMOS digital circuits and Circuit design, Overview of VLSI design methodologies, VLSI design flow, Design hierarchy and concepts, VLSI design styles, Design quality, Packing technology, CAD technology, Fabrication process flow, CMOS nwell process, layout design rules.
2. MOS Transistor and Circuit Modeling: MOS structure, MOS system under external bias, structure and operation of MOS transistor, MOSFET current-voltage characteristics, MOSFET scaling and small-geometry effects, MOSFET capacitances, Modeling of MOS transistor using SPICE.
3. MOS Inverter static characteristics and Interconnect Effects: Introduction, ResistiveLoad Inverter, Inverter with n-type MOSFET load, CMOS Inverter, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitics, Calculation of Interconnect Delay, Switching Power Dissipation of CMOS Inverters.
4. Combinational and Sequential MOS logic Circuits: Introduction, MOS logic circuits with depletion nMOS loads, CMOS logic Circuits, Complex logic circuits, CMOS transmission gates (Pass gates), Behavior of bi-stable elements, SR latch circuit, clocked latch and flipflop circuits, CMOS D-latch and Edge-triggered flip-flop.
5. Dynamic logic Circuits: Basic principles of pass transistor circuits, voltage bootstrapping, synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, Highperformance dynamic CMOS circuits.

BOOKS

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits" TMH 2003
2. Neil H. E. Weste and David. Harris Ayan Banerjee., "CMOS VLSI Design" - Pearson Education, 1999.
3. Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits" Pearson Education, 2003
4. Uyemura, "Introduction to VLSI Circuits and Systems" Wiley-India, 2006.
5. Wayne Wolf, "Modern VLSI Design ", 2nd Edition, Prentice Hall, 1998.
6. Kamran Ehraghian, Dauglas A. Pucknell and Sholeh Eshraghiam, "Essentials of VLSI Circuits and Systems" – PHI, EEE, 2005 Edition.

SIMULATION BOOK 1. Etienne Sicard, Sonia Delmas Bendhia, "Basics of CMOS Cell Design", TMH, EEE, 2005.

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CO1: Capability to recognize advanced issues in VLSI systems, specific to the deep-submicron silicon technologies.
CO 2: Students able to understand deep submicron CMOS technology and digital CMOS design styles.
CO 3: To design chips used for battery-powered systems and high-performance circuits.

1. Introduction: Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches.
2. Device & Technology Impact on Low Power: Dynamic dissipation in CMOS, Transistor sizing& gate oxide thickness, Impact of technology Scaling, Technology & Device innovation.
3. Simulation Power analysis: SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems, Monte Carlo simulation.
4. Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.
5. Low Power Circuit's: Transistor and gate sizing, network restructuring and Reorganization. Special Flip Flops & Latches design, high capacitance nodes, low power digital cells library.
6. Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, precomputation logic.
7. Low power Architecture & Systems: Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components.
8. Low power Clock Distribution: Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

BOOKS

1. Gary K. Yeap, "Practical Low Power Digital VLSI Design", KAP, 2002
2. Rabaey, Pedram, "Low Power Design Methodologies" Kluwer Academic
3. Kaushik Roy, Sharat Prasad, "Low-Power CMOS VLSI Circuit Design" Wiley, 2000
4. Yeo, "CMOS/BiCMOS ULSI Low Voltage Low Power" Pearson Education

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CO1: Understand different modulation schemes and concepts of data communication.
CO 2: Understand various error detection and correction schemes, network topologies and protocols.
CO 3: Understand various types of switching, multiplexing and access techniques.
CO 4: Develop the complete understanding of the data communication and networking.

1. Digital Modulation: Introduction, Information Capacity Bits, Bit Rate, Baud, and M-ARY Coding, ASK, FSK, PSK, QAM, BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.
2.Basic Concepts of Data Communications, Interfaces and Modems: Data Communication Components, Networks, Distributed Processing, Network Criteria- Applications, Protocols and Standards, Standards Organizations- Regulatory Agencies, Line Configuration- Point-to-point Multipoint, Topology- Mesh- Star- Tree- Bus- Ring- Hybrid Topologies, Transmission Modes Simplex- Half duplex- Full Duplex, Categories of Networks- LAN, MAN, WAN and Internetworking, Digital Data Transmission- Parallel and Serial, DTE- DCE Interface- Data Terminal Equipment, Data Circuit- Terminating Equipment, Standards EIA 232 Interface, Other Interface Standards, Modems- Transmission Rates.
3. Error Detection and Correction: Types of Errors- Single- Bit Error, CRC (Cyclic Redundancy Check)- Performance, Checksum, Error Correction- Single-Bit Error Correction, Hamming Code. Data link Control: Stop and Wait, Sliding Window Protocols. Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocol-Binary Synchronous Communication (BSC) - BSC Frames- Data Transparency, Bit Oriented Protocols – HDLC, Link Access Protocols.
4. Switching: Circuit Switching- Space Division Switches- Time Division Switches- TDM Bus Space and Time Division Switching Combinations- Public Switched Telephone Network, Packet Switching, Circuit Switched Connection Versus Virtual Circuit Connection, Message Switching.
5. Multiplexing: Time Division Multiplexing (TDM), Synchronous Time Division Multiplexing, Digital Hierarchy, Statistical Time Division Multiplexing. Multiple Access: Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Detection (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization- Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), - Code - Division Multiple Access (CDMA).

BOOKS:

1. Data Communication and Computer Networking - B. A.Forouzan, 3rded., 2008, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5 ed., 2008, PEI.
3. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
4. Data and Computer Communications - William Stallings, 8thed., 2007, PHI.
5. Data Communication and Tele Processing Systems - T. Housely, 2ndEdition, 2008, BSP.
6. Data Communications and Computer Networks- Brijendra Singh, 2nded., 2005, PHI.
7. Telecommunication System Engineering – Roger L. Freeman, 4/ed., Wiley-Interscience, John Wiley & Sons, 2004.

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Coding Theory and Techniques

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CO1: Design the channel performance using Information theory.
CO 2: Comprehend various error control code properties and apply linear block codes for error detection and correction.
CO 3: Apply convolution codes for performance analysis & cyclic codes for error detection and correction.
CO 4: Design BCH & RS codes for Channel performance improvement against burst errors.

1. Coding for Reliable Digital Transmission and storage: Mathematical model of Information, A Logarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies. Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system
2. Cyclic codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.
3. Convolutional codes: Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.
4. Burst –Error-Correcting codes: Decoding of Signle-Burst error Correcting Cyclic codes, Single-Burst-Error-Correcting Cyclic codes, Burst-Error-Correcting Convoulutional Codes, Bounds on Burst Error-Correcting Capability, Interleaved Cyclic and Convolutional Codes , Phased-Burst –Error-Correcting Cyclic and Convolutional codes.
5. BCH code- Definition, Minimum distance and BCH Bounds, Decoding Procedure for BCH Codes- Syndrome Computation and Iterative Algorithms, Error Location Polynomials and Numbers for single and double error correction

TEXT BOOKS:

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc.
2. Error Correcting Coding Theory-Man Young Rhee- 1989, McGraw-Hill Publishing.
3. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.
4. Information Theory, Coding and Cryptography – Ranjan Bose, 2ndEdition, 2009, TMH

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CO1: Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.
CO 2: Estimate the losses and analyze the propagation characteristics of an optical signal in different types of fibers.
CO 3: Describe the principles of optical sources and power launching-coupling methods.
CO 4: Compare the characteristics of fiber optic receivers and Design a fiber optic link based on budgets.

1. Signal propagation in Optical Fibers Geometrical Optics approach and Wave Theory approach, Loss and Bandwidth, Chromatic Dispersion, Non Linear effects- Stimulated Brillouin and Stimulated Raman Scattering, Propagation in a Non-Linear Medium, Self Phase Modulation and Cross Phase Modulation, Four Wave Mixing, Principle of Solitons.
2. Fiber Optic Components for Communication & Networking Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters, High Channel Count Multiplexer Architectures, Optical Amplifiers, Direct and External Modulation Transmitters, Pump Sources for Amplifiers, Optical Switches and Wavelength Converters.
3. Modulation and Demodulation Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duobinary, Single Side Band and Multilevel Schemes, Ideal and Practical receivers for Demodulation, Bit Error Rates, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.
4. Transmission System Engineering System Model, Power Penalty in Transmitter and Receiver, Optical Amplifiers, Crosstalk and Reduction of Crosstalk, Cascaded Filters, Dispersion Limitations and Compensation Techniques.
5. Fiber Non-linearities and System Design Considerations Limitation in High Speed and WDM Systems due to Non-linearities in Fibers, Wavelength Stabilization against Temperature Variations, Overall System Design considerations – Fiber Dispersion, Modulation, Non-Linear Effects, Wavelengths, All Optical Networks.

BOOKS:
1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2 ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
3. Optical Fiber Communications – Gerd Keiser, 3 ed., 2000, McGraw Hill. REFERENCES:
4. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2 ed., 2000, PE.
5. Fiber Optics Communication – Harold Kolimbris, 2 ed., 2004, PEI
6. Optical Networks: Third Generation Transport Systems – Uyless Black, 2 ed., 2009, PEI
7. Optical Fiber Communications – Govind Agarwal, 2 ed., 2004, TMH.

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CO1: Recognize and evaluate the performance of various enabling technologies used in modern optical networks.

CO 2: Evaluate different WDM network topologies including broadcast-and-select and wavelength routing networks.

CO 3: Design virtual WDM network topologies.

CO 4: Analyze Photonic packet switching networks and time domain optical networking approaches.

1. Client Layers of Optical Networks SONET / SDH – Multiplexing, Frame Structure, Physical Layer, Infrastructure, ATM – Functions, Adaptation layers, QoS, Flow Control Signaling and Routing, IP – Routing, QoS, MPLS, Storage Area Networks – ESCON, Fiber Channel, HIPPI, Gigabit Ethernet.

2. WDM network Elements and Design Optical Line Terminals and Amplifiers, Add/Drop Multiplexers, Optical Cross Connects, Cost trade-offs in Network Design, LTD and RWA Problems, Dimensioning – Wavelength Routing Networks, Statistical and Maximum Load Dimensioning Models.

3. Network Control and Management Network Management Functions, Optical Layer Services and Interfacing, Layers within Optical Layer, Multivendor Interoperability, Performance and Fault Management, Configuration Management, Optical Safety.

4. Network Survivability Basic Concepts of Survivability, Protection in SONET/SDH Links and Rings, Protection in IP Networks, Optical Layer Protection – Service Classes, Protection Schemes, Interworking between Layers. Access Networks and Photonic Packet Switching Network Architecture, Enhanced HFC, FTTC, Photonic Packet Switching – OTDM, Synchronization, Header Processing, Buffering, Burst Switching, Test Beds.

BOOKS:

1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2 ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
2. WDM Optical Networks: Concepts, Design and Algorithms – C. Siva Rama Murthy and Mohan Guruswamy 2 ed., 2003, PEI.
3. Optical Networks: Third Generation Transport Systems – Uyless Black, 2 ed., 2009, PEI.
4. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2 ed., 2000, PE.
5. Fiber Optics Communication – Harold Kolimbris, 2 ed., 2004, PEI.
6. Networks – Timothy S. Ramteke, 2 ed., 2004, PEI.
7. Optical Fiber Communications – Govind Agarwal, 2 ed., 2004, TMH.

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering

Internetworking

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CO 1: To develop an understanding of computer networking basics.
CO 2: To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
CO 3: Internetworking architectural infrastructure in application.

1. Internetworking concepts: Principles of Internetworking, Connectionless Internetworking, Application level Interconnections, Network level Interconnection, Properties of the Internet, Internet Architecture, Wired LANS, Wireless LANs, Point-to-Point WANs, Switched WANs, Connecting Devices, TCP/IP Protocol Suite. IP Address: Classful Addressing: Introduction, Classful Addressing, Other Issues, Sub-netting and Super-netting IP Address: Classless Addressing: - Variable length Blocks, Sub-netting, Address Allocation. Delivery, Forwarding, and Routing of IP Packets: Delivery, Forwarding, Routing, Structure of Router. ARP and RARP:ARP, ARP Package, RARP.
2. Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum, IP V.6. Transmission Control Protocol (TCP): TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Flow Control, Error Control, Congestion Control, TCP Times. Stream Control Transmission Protocol (SCTP): SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control. Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP. Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/ Time Out Freezing, Selective Retransmission, Transaction Oriented TCP.
3. Unicast Routing Protocols (RIP, OSPF, and BGP: Intra and Inter-domain Routing, Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP. Multicasting and Multicast Routing Protocols: Unicast - Multicast- Broadcast, Multicast Applications, Multicast Routing, Multicast Link State Routing: MOSPF, Multicast Distance Vector: DVMRP.
4. Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, and DNS in the internet. Remote Login TELNET:- Concept, Network Virtual Terminal (NVT). File Transfer FTP and TFTP: File Transfer Protocol (FTP). Electronic Mail: SMTP and POP. Network Management-SNMP: Concept, Management Components. World Wide Web- HTTP Architecture. Multimedia: Digitizing Audio and Video, Network security, security in the internet firewalls. Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice Over IP. Network Security, Security in the Internet, Firewalls.

BOOKS:

1. TCP/IP Protocol Suite- Behrouz A. Forouzan, Third Edition, TMH
2. Internetworking with TCP/IP Comer 3 rd edition PHI
3. High performance TCP/IP Networking- Mahbub Hassan, Raj Jain, PHI, 2005
4. Data Communications & Networking – B.A. Forouzan – 2ndEdition – TMH
5. High Speed Networks and Internets- William Stallings, Pearson Education, 2002.

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Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Micro Electromechanical Systems

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CO1: Students will explain MEMS Technology, Present, Future and Challenges.
CO 2: Students will be able to explain micro sensors, micro-actuators, their types and applications.
CO 3: Students will be able to explain about fabrication processes for producing micro-sensors and actuators. They will also be able to apply Reliability, and Failure Analysis Testing.

1. Introduction, basic structures of MEM devices – (Canti-Levers, Fixed Beams diaphragms). Broad Response of Micro electromechanical systems (MEMS) to Mechanical (Force, pressure etc.) Thermal, Electrical, optical and magnetic stimuli, compatibility of MEMS from the point of power dissipation, leakage etc.
2. Review of mechanical concepts like stress, strain, bending moment, deflection curve. Differential equations describing the deflection under concentrated force, distributed force, distributed force, deflection curves for canti-levers- fixed beam. Electrostatic excitation – columbic force between the fixed and moving electrodes. Deflection with voltage in C.L. Deflection Vs Voltage curve, critical fringe field – field calculations using Laplace equation. Discussion on the approximate solutions – transient response of the MEMS.
3. Two terminal MEMS - capacitance Vs voltage Curve – variable capacitor. Applications of variable capacitors. Two terminal MEM structures. Three terminal MEM structures – controlled variable capacitors – MEM as a switch and possible applications.
4. MEM circuits & structures for simple GATES- AND, OR, NAND, NOR, Exclusive OR<simple MEM configurations for flip-flops triggering applications to counters, converters. Applications for analog circuits like frequency converters, wave shaping. RF Switches for modulation. MEM Transducers for pressure, force temperature. Optical MEMS.
5. MEM Technologies: Silicon based MEMS- process flow – brief account of various processes and layers like fixed layer, moving layers spacers etc., and etching technologies. Metal Based MEMS: Thin and thick film technologies for MEMS. Process flow and description of the processes. Status of MEMS in the current electronics scenario.

BOOKS:
1. MEMS Theory, Design and Technology - GABRIEL. M.Review, R.F.,2003, John wiley & Sons.
2. Strength of Materials –Thimo Shenko, 2000, CBS publishers & Distributors.
3. MEMS and NEMS, Systems Devices; and Structures - Servey E.Lyshevski, 2002, CRC Press.
4. Sensor Technology and Devices - Ristic L. (Ed) , 1994, Artech House, London

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Network Security and Cryptography

L	T	P
4	0	0

CO1: To understand basics of Cryptography and Network Security.
CO 2: To be able to secure a message over insecure channel by various means.
CO 3: To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
CO 4: To understand various protocols for network security to protect against the threats in the networks.

1. Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.
2. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. Conventional Encryption:Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation. Public Key Cryptography:Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.
3. Number theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms. Message authentication and Hash functions:Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.
4. Hash and Mac Algorithms: MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, X.509 directory Authentication service.Electronic Mail Security: Pretty Good Privacy, S/MIME.
5. IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms : Intruders, Viruses and Related threats. Fire Walls : Fire wall Design Principles, Trusted systems.

BOOK:
1. Cryptography and Network Security: Principles and Practice - William Stallings, 2000, PE.
2. Principles of Network and Systems Administration, Mark Burgess,John Wielly.

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Pre Ph.D. Course in Electronics and Communication Engineering
Adhoc Wireless and Sensor Networks

L	T	P
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CO1: Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks.
CO 2: Describe the MAC protocol issues of ad hoc networks and describe routing protocols for ad hoc wireless networks with respect to TCP design issues.
CO 3: Explain the concepts of network architecture and MAC layer protocol for WSN.
CO4: Discuss the WSN routing issues by considering QoS measurements.

1. Wireless LANS and PANS: Introduction, Fundamentals of WLANS, IEEE 802.11 Standard, HIPERLAN Standard, Bluetooth, Home RF. Wireless Internet: Wireless Internet, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web Over Wireless.
2. AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet. MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.
3. ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols. Transport layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.
4. QUALITY OF SERVICE: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks. ENERGY MANAGEMENT: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.
5. WIRELESS SENSOR NETWORKS: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

BOOKS: 1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control Jagannathan Sarangapani, CRC Press.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Mobile Computing Technologies

L	T	P
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CO1: Define mobile technologies in terms of hardware, software, and communications.
CO2: Utilize mobile computing nomenclature to describe and analyze existing mobile computing frameworks and architectures.
CO3: Evaluate the effectiveness of different mobile computing frameworks.

1. Introduction to Mobile Computing Architecture Mobile Computing – Middleware and Gateways – Application and Services – Developing Mobile Computing Applications – Security in Mobile Computing – Architecture for Mobile Computing – Three Tier Architecture – Design considerations for Mobile Computing – Mobile Computing through Internet – Making existing Applications Mobile Enabled. Cellular Technologies: GSM, GPS, GPRS, CDMA and 3G Bluetooth – Radio Frequency Identification – Wireless Broadband – Mobile IP – Internet Protocol Version 6 (IPv6) – Java Card – GSM Architecture – GSM Entities – Call Routing in GSM – PLMN Interfaces – GSM addresses and Identifiers – Network aspects in GSM – Authentication and Security – Mobile computing over SMS – GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations – Data Services in GPRS – Applications for GPRS – Limitations of GPRS.
2. Wireless Application Protocol (WAP) and Wireless LAN WAP – MMS – Wireless LAN Advantages – IEEE 802.11 Standards – Wireless LAN Architecture – Mobility in wireless LAN Intelligent Networks and Interworking Introduction – Fundamentals of Call processing – Intelligence in the Networks – SS#7 Signaling – IN Conceptual Model (INCM) – softswitch – Programmable Networks – Technologies and Interfaces for IN
3. Client Programming, Palm OS, Symbian OS, Win CE Architecture Introduction – Moving beyond the Desktop – A Peek under the Hood: Hardware Overview – Mobile phones – PDA – Design Constraints in Applications for Handheld Devices – Palm OS architecture – Application Development – Multimedia – Symbian OS Architecture – Applications for Symbian, Different flavors of Windows CE -Windows CE Architecture J2ME JAVA in the Handset – The Three-prong approach to JAVA Everywhere – JAVA 2 Micro Edition (J2ME) technology – Programming for CLDC – GUI in MIDP – UI Design Issues – Multimedia – Record Management System
4. Voice over Internet Protocol and Convergence Voice over IP- H.323 Framework for Voice over IP – Session Initiation Protocol – Comparision between H.323 and SIP – Real Time protocols – Convergence Technologies – Call Routing – Voice over IP Applications – IP multimedia subsystem (IMS) – Mobile VoIP Security Issues in Mobile Computing Introduction – Information Security – Security Techniques and Algorithms – Security Protocols – Public Key Infrastructure – Trust – Security Models – Security frameworks for Mobile Environment

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BOOKS: 1. Mobile Computing – Technology, Applications and Service Creation – Asoke K Talukder, Roopa R Yavagal, 2009, TATA McGraw Hill
2. Mobile Communications – Jochen Schiller – 2nd Edition – Pearson Education
3. The CDMA 2000 System for Mobile Communications – Vieri Vaughi, Alexander Damn Jaonvic – Pearson
4. ADALESTEIN : Fundamentals of Mobile & Parvasive Computing, 2008, TMH.

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Data Warehousing and Data Mining

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CO1: Be familiar with mathematical foundations of data mining tools.
CO2: Understand and implement classical models and algorithms in data warehouses and data minin.
CO3: Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
CO4: Master data mining techniques in various applications like social, scientific and environmental context.
CO5: Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

1. Introduction: Introduction to RDBMS, Data Warehouse, Transactional Databases, Data Mining Functionalities, Interestingness of pattern, classification of data mining system, major issues
2. Data Warehouse and OLAP: Difference from traditional databases, Multidimensional data model, Schema for Multi dimensional model, measures, concept hierarchies, OLAP operations, starnet query model, Data Warehouse architecture, ROLAP, MOLAP, HOLAP, Data Warehouse Implementation, Data Cube, Metadata Repositories, OLAM
3. Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept hierarchy generation
4. Data Mining Architecture: Data Mining primitives, Task relevant data, interestingness measures, presentation and visualization of patterns, Data Mining Architecture, Concept Description, Data Generalization and Summarization, Attributed oriented induction, Analytical characterization, Mining class comparisons,
5. Association Rules: Association rules mining, Mining Association rules from single level, multilevel transaction databases, multi dimensional relational databases and data warehouses, Correlational analysis, Constraint based association mining
6. Classification and Clustering: Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Cluster analysis, Types of data in clustering, categorization of clustering methods

Books:
1. Data Mining: Concepts and Techniques By J.Han and M. Kamber By Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition

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2. Data Mining Introductory and Advance Topics By Dunham, Pearson Education, Latest Edition

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Neural Networks and Fuzzy Logic

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CO1: Comprehend the concepts of feed forward neural networks.
CO2: Analyze the various feedback networks.
CO3: Understand the concept of fuzziness involved in various systems and fuzzy set theory.
CO4: Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
CO5: Analyze the application of fuzzy logic control to real time systems.

1. Fundamentals of Neural Networks: Introduction, Biological Neurons and Memory, Structure & Function of a single Neuron, Artificial Neural Networks (ANN). Typical Application of ANN - Classification, Clustering, Pattern Recognition, Function Approximation. Basic approach of the working of ANN – Training, Learning and Generalization.
2. Supervised Learning: Single-layer Networks, Linear Separability, handling linearly non-separable sets. Training algorithm. Error correction & gradient decent rules. Multi-layer network- Architecture, Back Propagation Algorithm (BPA) – Various parameters and their selection, Applications, Feedforward Network, Radial- Basis Function (RBF) network & its learning strategies.
3. Unsupervised Learning: Winner-takes all Networks, Hamming Networks. Adaptive Resonance Theory, Kohonen's, Self-organizing Maps.
Neurodynamical models: Stability of Equilibrium states, Hopfield Network, Brain-state-in-aBox network, Bidirectional associative memories.
4. Fuzzy Logic: Basic concepts of Fuzzy Logic, Fuzzy vs. Crisp set Linguistic variables, membership functions, operations of fuzzy sets, Crisp relations, Fuzzy relations, Approximate reasoning, fuzzy IF-THEN rules, variable inference, techniques, defuzzification techniques, Fuzzy rule based systems. Applications of fuzzy logic.

Books:
1. Satish Kumar,"Neural Network : A classroom approach".
2. Jacek M.Zurada," Artificial Neural Networks".
3. Simon Haykin," Artifical Neural Network".
4. Rajasekaran & Pai,"Neural networks, Fuzzy logic and genetic algorithms".
5. Hagan, Demuth & Beale,"Neural Network Design.".
6. T. J. Ross," Fuzzy logic with engineering applications"

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering

Mathematical Foundations of Computer Networks

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Course Outcomes:

CO1. Know how to represent various statements using quantifiers, relations, functions, permutations and combinations, groups, graphs and trees.

CO2. Use logical notations to formulate and reason about fundamental mathematical concepts such as sets, relations, functions and algebraic structures.

CO3. Analyse the growth of functions and real world problems using various concepts like recurrence relations, graph coloring, etc.

CO4. Apply mathematical logic to solve problems, pigeonhole principle to solve real time problems.

CO5. Model and solve real world problems using graphs and trees.

1. Basic algorithms on directed graphs, weighted shortest paths.

2. Networks and routing algebras - fixed-point equations, sequential algorithm to solve the fixed-point equations, generalized distance-vector and link-state routing protocols.

3. Applications to quality-of service intra-domain routing and to policy-based inter-domain routing in the Internet.

4. Network flows - flows and residual networks, Max-flow Min-cut theorem, Ford Fulkerson method and Edmonds-Karp algorithm.

5. Network calculus- Min-plus calculus: integrals and convolutions, Arrival curves and token buckets; service curves and schedulers, Applications to integrated and differentiated services in the Internet.

Books:

1. Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein. Introduction to algorithms, 2th edition. The MIT Press 2001 [Chapter VI]

2. Jorgen Bang-Jensen and Gregory Gutin. Digraphs: theory, algorithms and applications. Springer, 2002 [Section 7.3 and 9.5]

3. J. L. Sobrinho, An algebraic theory of dynamic network routing, IEEE/ACM Transactions on Networking, 13(5), October 2005.

4. Jean-Yves Le Boudec and Patrick Thiran. Network calculus. Springer, 2006. [Chapter 1, 2, and 3]

Inter Disciplinary course

Pre Ph.D. Course in Electronics and Communication Engineering
Sensors For Ranging and Imaging

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1. Introduction to sensing Introduction, brief history of sensing, Passive infrared sensing, sensor systems, frequency band allocations for the electromagnetic spectrum, acoustic spectrum

2. Active Ranging and Imaging Sensors Overview, Pulsed Time-of-Flight Operation, Pulsed Range Measurement, Other Methods to Measure Range, the Radar Range Equation, The Acoustic Range Equation, Range Measurement Radar for a Cruise Imaging Techniques, Range –Gate limited 2D Image Construction, Beam width limited 3D Image Construction, The Lidar Range Equation, Lidar System Performance, Digital Terrain Models, Airborne Lidar Hydrography, 3D Imaging, Acoustic Imaging, Lidar Locust Tracker

3. Target and Clutter Characteristics Introduction, Target cross –section, Radar cross-sections(RCS),RCS of Simple shapes, Radar cross section of complex Targets , Effect of Target, RCS of living creatures, fluctuations in Radar Cross-section, Radar Stealth, Target cross section in Infrared, Acoustic Target Crosssection, clutter, Orepass Radar Development, Detecting Targets in clutter, Target Detection with Air Surveillance Radar

4. Tracking Moving Targets Tracking While Scan, The Coherent Pulsed Tracking Radar, Range-Gated Pulsed Doppler Tracking, Coordinate Frames, Antenna Mounts and servo systems, On-Axis Tracking, Tracking in Cartesian Space, fire Control Radar

5. Radio Frequency Identification Tags and Transponders Principles of Operation, History, Secondary Surveillance Radar, RFID Systems, other Applications, Technical Challenges, Harmonic Radar

Book

1. Introduction to Sensors for Ranging and Imaging, Dr.Graham Brooker, Yes Dee Publishing Pvt. Ltd ,2012.
2. Introduction to Remote sensing , James B Campbell, Third Edition, Taylor and Francis
3. Principles of Remote sensing, ITC Educational Text Book Series 2
4. Introduction to sensor systems,Shahen A. Hovanessian
5. Space Mission Analysis and Design James R. Wertz,Wiley J. Larson, 1999