

**ELECTRONICS AND COMMUNICATION ENGINEERING
DEPARTMENT**

M.TECH. DIGITAL COMMUNICATION

**Course of Study & Scheme of Examination
2016-17**



**Maulana Azad National Institute of Technology,
Bhopal**

SCHEME**M.TECH. IN DIGITAL COMMUNICATION****SEMESTER: I**

Course No.	Subject Name	Scheme of Studies Per Week			Distributio n of Credit
		L	T	P	Total
DC- 511	Signal Theory	3	0	0	3
DC- 512	Advanced Digital Communication	3	0	0	3
DC- 513	Optical Communication	3	0	0	3
	Department Elective - 1	3	0	0	3
	Department Elective - 2	3	0	0	3
	Open Elective - 1	3	0	0	3
DC-514	Advanced Communication Lab	0	0	3	2
DC-515	Seminar I	0	0	3	2
	TOTAL				22

SEMESTER: II

Course No.	Subject Name	Scheme of Studies Per Week			Distribution of Credit
		L	T	P	Total
DC- 521	D.S. P. & Its Applications	3	0	0	3
DC- 522	Detection and Estimation Theory	3	0	0	3
DC- 523	Digital Image Processing	3	0	0	3
	Department Elective - 3	3	0	0	3
	Department Elective - 4	3	0	0	3
	Open Elective - 2	3	0	0	3
DC- 524	System Design Lab.	0	0	3	2
DC- 525	Seminar II	0	0	3	2
	TOTAL				22

ELECTIVE SUBJECTS FOR SEMESTER: I and II

(Department Elective) DE (Two DE per Semester)	DC-531 Mobile Communication DC-532 Optical Network DC-533 Video Signal Processing DC-534 Statistical Signal processing DC-535 Data Communication Network DC-536 Satellite Communication DC-537 Modern Telecom Switching Systems DC-538 Data Compression & Cryptography DC-539 Wireless Communication
(Open Elective) OE (One OE per Semester)	DC-551 Microwave Communication DC-552 Optimization Techniques DC-553 Queuing Theory DC 554 Biomedical Signal Processing DC-555 Internet Technology DC 556 Selected Topics in Communication DC-557 Fuzzy Logic DC-558 Neural Networks DC-559 Biometric Systems

SYLLABUS

DC- 511 SIGNAL THEORY

Representation of deterministic signals: Orthogonal representation of signals. Dimensionality of signal spaces. Construction of orthogonal basis functions. Time-bandwidth relationship: RMS duration and bandwidth, uncertainty relations. Random Processes : Definition and Classification, stochastic integrals, Fourier transforms of random processes, stationary and non-stationary processes, correlation functions. Special random processes (white Gaussian noise, Wiener-Levy processes, shot-noise processes, Markov processes). Optimum Filtering: Matched filters for deterministic signals in white and coloured Gaussian noise. Wiener filters for random signals in white and coloured Gaussian noise. Discrete and continuous time filters.

References:

1. Populis, "Random Variavles and Random Process".
2. H.L. Van Trees, " Detection, Estimation and Modulation".

DC-512 ADVANCED DIGITAL COMMUNICATION

Digital Modulation Schemes. Information measures. Source coding. Channel Coding Theorems, Nyquist Criterion to tackle ISI & channel equalization, partial response signalling. M-ary modulation systems, error probability calculations. Digital Transmission over Band limited Channels. Spread spectrum systems.

References:

1. A B Carlson, "Communication. Systems" . Tata Mc Graw Hill, 2000.
2. B P Lathi, "Modern Digital & Analog Communication" ,Willey2000.
3. John G. Proakis, "Digital Communications".
4. B. Sklar "Digital Communication".

DC-513 OPTICAL COMMUNICATION

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model. Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

Optical sources - LEDs and Lasers, Photo-detectors - pin-detectors, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties. Optical switches - coupled mode analysis of directional couplers, electro-optic switches. Nonlinear effects in fiber optic links, group velocity dispersion and soliton based communication. Optical amplifiers - EDFA, Raman amplifier, and WDM systems.

References :

1. Fibre Optic communication, J.Keiser, McGraw-Hill, 2nd Ed. 1992.
2. Nonlinear fibre optics, Academic Press, G.Agrawal 2nd Ed. 1994.

DC-521 D.S. P. & ITS APPLICATIONS

Discrete Time Signals, Discrete systems: attributes, Z-Transform, Analysis of LSI systems, Frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform algorithm, Implementation of Discrete Time Systems. Design of FIR & IIR Digital filters. Parametric and non-parametric spectral estimation. Introduction to multirate signal processing. Application of DSP to Speech and Radar signal processing.

References:

1. A.V Oppenheim and R.W Schaffer, "Discrete Time signal processing" (2nd edition) , Prentice Hall
2. S. Mitra, "Digital Signal Processing using MATLAB", 2nd Edition.
3. Proakis, "Int. to Digital Signal Processing" , Maxwell Mcmillan.

DC-522 DETECTION & ESTIMATION THEORY

Review of random variables and random processes, response of linear systems to random inputs, special class of random processes; signal detection, minimum mean square error filtering, estimation of parameters of random process.

Reference:

1. Ralph D. Hippenstiel , “Detection Theory”, CRC press.
2. H.L. Van Tree, “Detection Estimation and Modulation Theory-Part-II”, John Wiley & Sons.
3. K. Sam Shanmugham and Arthur M. Breipohl, “Random Signals: Detection, Estimation and Data Analysis”, , BS Publications.

DC-523 DIGITAL IMAGE PROCESSING

Digital Image Fundamentals, Image Enhancement, Image denoising, Image segmentation, Image Compression, Digital water marking, object recognition, medical image processing, face recognition, fingerprint recognition, signature recognition, iris recognition, image fusion.

Reference:

1. Gonzalez and Woods, " Digital Image Processing", 2nd edition Prentice Hall.
2. Jain, Anil K., Ross, Arun A., Nandakumar, Karthik , "Introduction to Biometrics", springer publication

DC-531 MOBILE COMMUNICATION

Cellular Concept: Cell Area, Signals Strength and Cell Parameters, Capacity of a Cell, Frequency Reuse, Co channel Interference, Cell Splitting, Cell Sectoring. Multiple Radio Access: Multiple Radio Access Protocols, Contention Based Protocols. Multiple Division Techniques For traffic Channel: Concept and Model for Multiple Divisions, Modulation Techniques. Traffic Channel Allocation, Mobile Communication Systems: Cellular System Infrastructure, Registration, Handoff Parameters and Underlying Support, Roaming Support, Multicasting. Existing Wireless Systems: AMPS- characteristics, Operation, General Working; GSM- GSM frequency Band, GSM LMN, Objectives, Services, Interfaces; IMT-2000 –International Spectrum Allocation, Services Provided By 3rd Generation Cellular Systems, Harmonized 3G Systems. Next Generation Cellular Technology 4G, 5G: Evolution, Objectives, Advantages and Limitation Of 4G And 5G Network Technology Over 3G, Applications, 4G Technologies, 5G Technologies, Smart Antenna Technique.

References:

1. Dharma Prakash Agrawal and Qing-An Zeng, "Introduction to Wireless and Mobile System".
2. Vijay K. Garg and Joseph E. Wilkes, "Principles and Applications of GSM",.
3. Gottapu Sasibhushana Ra, "Mobile Cellular Communication".

DC 532 OPTICAL NETWORK

Interconnection networks; Networks: Introduction to computer data networks, ISO-OSI models, SDH, SONET; Fiber-optic LAN architectures and protocols- ring, star and bus architectures, DQDB, FDDI; High speed bus protocols-, WDM Network design - Lightpath Topology, All Optical Networks.

References:

1. William Stalling "High Sped Networks & Internet ", 2nd edition, Pearson Education
2. Rajiv Ramaswamy and Kumar N. Sivarajan, "Optical Networks", 2nd Edition, Morgan Kaufmann Publishers (Elsevier)

DC-533 VIDEO SIGNAL PROCESSING

Basics of Video , Analog Video signal, Composite video signal, Video Formation, Horizontal and vertical synchronization, Spatial and Temporal resolution, Video signal standards: NTSC, SECAM, PAL, Video signal BW requirement, Digital Video Processing , Analysis and synthesis of Video Signal, Colour Signal Generation and coding, Video display, Video camera, Video Coding, Motion Analysis and Motion Compensation, Motion compensated filtering, Motion Estimation techniques, Optical flow methods, Block based methods, Bayesian method, Video Coding standards, Video compression standards: H2.61, MPEG 1, MPEG 2 .

References

1. A M Tekalp, "Digital Video Processing", PH Publication.
2. Y Q. Shi, H Sun, "Image and Video Compression for Multimedia Engineering", CRC Press.
3. J W Woods, "Multi-Dimensional, Signal, Image and Video Processing and Coding" Academic Press

DC-534 STATISTICAL SIGNAL PROCESSING

Statistical characterization and analysis of signals, ideas of estimation, optimal linear filtering, geometric ideas, autocorrelation matrices and their properties, eigenanalysis, linear prediction, KL-expansion, factorization of autocorrelation matrices, Kalman filtering, least-squares filtering, adaptive filtering theory, LMS, RLS, and other algorithms, Singular Value Decomposition, SVD, fundamentals of array signal processing.

References:

1. Kay, Steven M, "Fundamentals of Statistical Signal Processing". (1993), Prentice Hall.
2. Boaz Porat, "Digital Processing of Random Signals: Theory and Methods", Dover Publications, Inc., 2008.
3. Symon Hakin, "Adaptive signal processing".

DC-535 DATA COMMUNICATION NETWORK

OSI and TCP/IP reference models, circuit, message, packet and hybrid switching, ISDN, B-ISDN, ATM network, transmission media used in physical layer, Line coding: Uni-polar, Bi-polar, RZ, NRZ, Manchester and Differential Manchester codes, LAN, MAN and WAN, LAN protocols, IEEE standards for LAN , Functions of Data link layer – Framing, Error control, Flow Control, Sliding window protocols, Medium Access control (MAC) sub layer: MAC protocols: ALOHA, Slotted ALOHA, Token bus, Token Ring, Round Robin, CSMA/CA, Bit mapped protocol, Carrier Sense Multiple Access (CSMA): Collision Avoidance, Collision Detection, p-Persistent, 1-Persistent, Non-Persistent spectrum sensing, Ethernet frame, Network Layer, logical addressing (i.e. IPv4 addresses and header), Routing algorithms, Least cost routing algorithms: Dijkstra and Bellman Ford algorithms., Elements of transport protocols, Data security and cryptography techniques, access management in application layer, virtual terminals. Study of standard networks.

Assignment: Website development using HTML, Java script.

Reference:

1. William Stallings, “Data and Computer Communications”, (Pearson Education), , 7th Edition
2. Dimitris Bertsekas and Robert Galliger, “Data Networks”, (PHI), 2nd Edition
3. Tanenbaum, “Computer Networks”, (Prentice Hall),4th Edition

DC-536 SATELLITE COMMUNICATION

Introduction, History of Satellites, Classification of Satellite Based of Application, Altitude, Availability, Frequency Allocation, Kepler's Law, Elements of Orbital Mechanics, Equation of Motion, Tracking And Orbital Determination, Satellite System, parameters and Elements of Communication Satellite Design, RF Link Design, Composite Link Design, Losses at Earth Station, Cosmic and ionospheric Losses, Atmospheric Losses, Rain Loss, C/N Ratio.

Multiple Access Techniques: FDMA, TDMA, CDMA, Beam Switching and satellite switched TDMA, Spread Spectrum Techniques (Also called CDMA), Comparison of Multiple Access Technique. Satellite Transponders: Function of Transponder, Transponder Implementation, Transmission Impairments. Earth Stations: Introduction, Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface

References:

1. D. Roddy, "Satellite Communication", (3/e), Mc Graw-Hill,2001.
2. T.Pratt & C.W. Bostain , "Satellite Communication", Willey 2000.
3. W L. Pritchard, HG. Suyderhoud, RA. Nelson, "Satellite Communication System Engineering".

DC-537 MODERN TELECOM SWITCHING SYSTEMS

Electronic space Division switching- Stored program control (SPC), switching matrices, multistage switching, enhance services photonic switching. Time Division switching: - Time division space, and time switching, multiplexed switching, combination switching, T-S, T-S-T, switching n-stage combination switching, PBX switching, PBX networking, digital PBX. Traffic load, Grade of service, Erlang formulas, blocking modeling switching systems, blocking model. Subscriber Loop, Dialing Systems - Switching hierarchy & routing, Transmission plan, numbering plan, charging plan, signaling technique. Digital subscriber lines, DSL, ADSL etc, WLL, FIL, wireless for local telephone services. Integrated services digital network.

References

1. Thaigrajan, "Telecomm. Switching systems & networks"- PHI .
2. Taub & Schilling, "Comm. System", Mc Graw Hill.
3. James Martin, "Telecomm. & the Computers", PHI.

DC-538 DATA COMPRESSION & CRYPTOGRAPHY

Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes. Introduction to security attacks, services and mechanism, Classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, steganography, Stream and block ciphers.

References:

1. Khalid Sayood, "Introduction to Data Compression" , Morgan Kaufmann Publishers.
2. William Stallings, "Cryptography and Network Security: Principles and Practice", , Pearson Education.
3. Behrouz A. Frouzan, "Cryptography and Network Security", TMH.

DC539 WIRELESS COMMUNICATION

Multiple Access and Channels: Orthogonal Frequency Division Multiplexing (OFDM), OFDMA, Fading channels, Multiple Input and Multiple Output (MIMO).

Mobile Adhoc Network(MANet) : Infrastructure less network, Medium access Protocols for MANet, Routing Protocols, Wireless Sensor Networks: Distributed Sensing Nodes, Power saving medium access protocols, IEEE 808.15.4, Network attacks mitigation in MANet.

Cognitive Radio Network (CRN): Spectrum Sensing Techniques: Energy Detector, Cyclostationary Detector, Matched Filter Detector, Radio Identification Detector, Cyclo-Energy Detector etc. Cooperative spectrum Sensing: Data and Decision cooperative spectrum sensing, Fusion Center, Spectrum Allocation Techniques, Network attacks mitigation in CRN, IEEE 802.22 (WRAN).

Wireless Access Networks: WLAN, IEEE 802.11, WiMAX, IEEE 802.16, LTE, Ultra Wide-Band (UWB).

References:

1. "Wireless Communications:Principles and Practice", by T.S. Rappaport, Prentice Hall publication.
2. "Introduction to Wireless and Mobile Systems", by [Dharma Prakash Agrawal](#), [Qing-An Zeng](#), Cengage Learning publication.
3. "Ad Hoc Networking", by [Perkins](#), Pearson publication, 2008 Edition
4. "Ad Hoc Mobile Wireless Networks", by Sudhir K. Sarkar, T.G. Basavraj, C. Puttamadappa, CRC publication.
5. "A survey of spectrum sensing algorithms for cognitive radio Applications", Tevfik Yucek, Huseyin Arslan, IEEE communications survey & tutorials, vol. 11, no. 1, 2009, pp. 116-129.
6. "Cyclo-energy detector for spectrum sensing in cognitive radio", Lei Yang, Zhe Chen, Fuliang Yin, International Journal of Electronics and Communications (AEÜ), 66 (2012), pp. 89-92.
7. "Wireless and Cellular Communications", by William C.Y. Lee, McGRAW-HILL Publication.

DC-551 MICROWAVE COMMUNICATION

Microwave radio system: Transmitter & receivers block diagram, FM microwave repeater, protection scything microwave terminal station, repeater station. Microwave links: Block diagram path characteristics, system gain, free space path loss E/N ratio. Microwave digital communication block diagram, regeneration repeater, digital modulation & demodulation at microwave frequencies analog & digital multiplying, line codes. Local microwave distribution system. Propagation of microwave : line of sight, duct propagation as Troposcatter links.

Reference Books:

1. W Tomasi, " Advance Electronic Comm System.", PHI.
2. Roy Blake Thomsar, "Electronic Comm. Systems". II Edition
3. Kemealy & Dakis, "Electronic Comm." TMH.

DC-552 OPTIMIZATION TECHNIQUES

Motivation. mathematical review , matrix factorizations, sets and sequences, convex sets and functions, linear programming and simplex method, Weierstrass' theorem, Karush Kuhn Tucker optimality conditions, algorithms, convergence, unconstrained optimization, Line search methods, method of multidimensional search, steepest descent methods, Simplex algorithm, Gradient Search Methos, Newton's method, modifications to Newton's method , trust region methods, conjugate gradient methods, quasi-Newton's methods. constrained optimization, penalty and barrier function methods, augmented Lagrangian methods, polynomial time algorithm for linear programming, successive linear programming, successive quadratic programming.

References :

1. R. Fletcher, "Practical Optimization". (2nd Edition) John Wiley & Sons, New York, 1987.
2. M.S.Bazaraa, H.D.Sherali and C.Shetty, " Nonlinear Programming, Theory and Algorithms" ,John Wiley and Sons, New York, 1993.

DC-553 QUEUING THEORY

Queuing Models: Data Traffic Characteristic: Poisson process; Birth-Death Processes: Markov Chain Models; M/M/1 Queues: Delay and Little's Formula; M/M/S/K Queues: Average Queue Length, Delay and Waiting Time, Blocking Probability; M/G/1 Queues- Imbedded Markov Chains, Pollaczek-Kinchin Transform Formula, Delay Formula Using Residual Service Time, Network of Queues and Jackson's Theorem Queuing Theory: Introduction, Queuing system, Elements of a Queuing System, Operating Characteristics of Queuing system, Probability distributions in Queuing system, Probability distributions in Queuing systems, Distribution of arrivals, Distribution of Inter – arrival times, Distribution of Departures, Distribution of Service Times, classification of Queuing Models, Definition of transient and steady states, Poisson Queuing systems.

References:

1. Kishor S. Trivedi, "Probability & Statistics with Reliability, Queuing, and Computer Science Applications", Prentice Hall of India Pvt. Ltd., 2000.
2. Donald Gross , Carl M. Harris, "Fundamentals of Queuing Theory", Wiley Series in Probability and Statistics

DC 554 - BIOMEDICAL SIGNAL PROCESSING

Introduction to biomedical signals, Biomedical image modalities; X-ray, Computed Tomography, Magnetic resonance, Ultra-sonography. Histopathology images, Image formats, compression of medical images, noise removal in medical, images, computer aided diagnostic, Feature extraction based image processing systems, Statistical measurement based image processing systems, Medical image processing in frequency domain, Texture analysis, shape analysis, Fractal based analysis.

References:

1. G.R. Sinha, bhagwati charan patel, "Medical image processing" PHI Learning Pvt. Ltd., 20 Jan-2014.
2. Thomas M. Deserno, "Biomedical Image Processing" Springer Science & Business Media, 2011.
3. M. Rangayyan, "Biomedical Image Analysis" Rangaraj, CRC Press, 2004.
4. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition by CRC Press, 2016.
5. Mark Haidekker, John, "Advanced Biomedical Image Analysis" Wiley & Sons, 2011.
6. Sergio Cerutti, Carlo Marchesi, "Advanced Methods of Biomedical Signal Processing", John Wiley & Sons, 2011.

DC-555 INTERNET TECHNOLOGY

Internetworking: - Concept, Architecture and Protocols. IP Addressing scheme, Routers and IP addressing principles, IP Datagrams and Datagram forwarding. IP encapsulation. Fragmentation and reassemble, IPv6- motivation, frame format and addressing. Internet Control Message Protocol:-Introduction and usage for testing reachability, route tracking, MTU determination, TCP introduction, application, segment format. Domain name system:- Introduction, DNS Client server Model, Server hierarchy, server architectures, optimization of DNS performance, DNS entry types, electronic mail paradigm, message format, SMTP, Mail Gateways, Mailbox access, FTP commands, Filename translation examples, TFTP, NFS, DHCP, VoIP.Client-server interaction, Browser architecture, CGI, Java techniques for Dynamic Web documents, Network Management: - SNMP, NMS. Network security (IPsec).Assignment: Android application development.

References-

1. D.E. Comer, "Computer Networks and Internet".
2. Coleman & Dyson, "Internet".
3. Mani Subramanian, "Network Management: Principles and Practice".

DC 556 SELECTED TOPICS IN COMMUNICATION

Software Defined Radio/ Cognitive Radio Networks: Introduction, need of cognitive radio, Challenges, requirements, Network Architectures.

Spectrum sensing techniques: Energy detector, Matched filter detector, cyclostationary detector, Hybrid Detectors, cooperative detector (centralized, distributed and fusion centre). Spectrum Management: Spectrum analysis, decision, mobility, handoff, sharing techniques. Upper layer issues: Routing challenges, Transport layer challenges. Security issues in cooperative cognitive radio networks.

Chaos Communication: Introduction of Chaos theory, Chaotic Systems, Chaotic Dynamics, Synchronization of Chaos, Control of Chaos , Optical chaos Communication.

References:

1. J. H. Reed, "Software radio: a modern approach to radio engineering".
2. Ian f. Akildiz, Won-Yeol Lee, Mehmet c. Vuran, Shantidev Mohanty, "Next generation/Dynamicspectrum access/ cognitive radiowireless networks".
3. Research articals and papers.

DC-557 FUZZY LOGIC

Introduction to fuzzy set theory, Classical sets and fuzzy sets, classical relations and fuzzy relations, membership functions, Fuzzification and Defuzzification, Development of membership functions, Fuzzy logic and Fuzzy systems, Decision making with fuzzy information, Fuzzy clustering, classification and pattern recognition, Fuzzy arithmetic, Engineering Applications of Fuzzy systems.

References:

1. Timothy J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition , WILEY Publications 2010.
2. George J. Klir, Bo Yuan, "Fuzzy Sets and Fuzzy Logic: Theory and applications", Prentice Hall, 1995,
3. Chandra Mohan, "An Introduction to Fuzzy Set Theory and Fuzzy Logic", MV Learning, 2015
4. Kazuo Tanaka, "An Introduction to Fuzzy Logic for Practical Applications" , Springer, 1996

DC-558 NEURAL NETWORKS

Historical concepts of artificial neural networks, artificial neurons, neural networks and architectures, supervised and unsupervised learning methods, Radial Basis Function (RBF) neural networks, Recurrent Neural Networks(RNN),Hopfield neural networks, Adaptive resonance theory, Self organizing feature maps, Neural networks and soft computing paradigm, Engineering applications of Neural network, Neural network hardware.

References:

1. Simon Haykin, “ Neural Networks: A Comprehensive Foundations”, MacMillan Publishing Company, 1994
2. Satish Kumar, “ Neural Networks: A Classroom Approach”, McGraw Hill Education, 2004
3. Mohamad Hassoun, “Fundamentals of Artificial Neural Networks”, MIT Press, 2003

DC 559 - BIOMETRIC SYSTEMS

Introduction to biometric signals, Types of biometric signals, Bio-indicators, Biomarkers, Algorithms for fingerprint identification and analysis, face recognition techniques, Iris pattern analysis, Retina identification systems, Signature verification., Infrared identification of faces and body parts, Automatic gait recognition, DNA based identification, Multimode biometrics, [3D Face Recognition](#), [Speaker Verification](#), Hidden Biometrics, Classification Techniques for Biometrics, Biometrics in Forensics.

References:

1. Jacob Scharcanski, Hugo Proença, Eliza Du, "Signal and Image Processing for Biometrics Signal and Image Processing for Biometrics" Springer Science & Business Media, 2014.
2. James L. Wayman, Anil Jain, Davide Maltoni, Dario Maio, "Biometric Systems: Technology, Design and Performance Evaluation" Springer Science & Business Media, 2005.
3. Anil Jain, Ruud Bolle, Sharath Pankanti "Biometrics: Personal Identification in Networked Society" Springer Science & Business Media, 2006.

LABS

DC-514 ADVANCED COMMUNICATION LAB

Development of algorithms related to modelling and simulation of various communication related problems.

DC-524 DESIGN LAB

Designing and analysis of algorithms using MATLAB , LABView related to Signal processing.