Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Department: Electronics and Tele communication Engineering

Rev: Course Structure/00/2021-22

Class: Final Year B. Tech

Semester: VII

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	Credits
ET701	PCC	RF & Microwave Engineering	3	-	-	3	10	10	30	50	100	3
ET702	PCC	Satellite communication	3		-	3	10	10	30	50	100	3
ET703	PEC	Elective-IV	3	-	-	3	10	10	30	50	100	3
ET704	PEC	Elective-V	3	-	-	3	10	10	30	50	100	3
OE715	OEC	Open Elective-III	3	-	-	3	10	10	30	50	100	3
ET705	PCC	RF & Microwave Engineering Laboratory	-	-	2	2	15	15	-	20	50	1
ET706	PCC	Satellite communication Laboratory	-	-	2	2	15	15	-	20	50	1
PRJ06	PROJ	Mega Project Phase -II	-	-	8	8	25	25	-	50	100	4
PRJ07	PROJ	Seminar	-	-	2	2	-	-	-	50	50	1
HMS09	HSMC	Values & Ethics	1	-	-	1	25	25	-	-	50	Audit
Total			**16**	**-**	**14**	**30**	**130**	**130**	**150**	**390**	**800**	**22**

Elective-IV: A. Wireless communication

B. Artificial Intelligence and Machine Learning

C. Industrial Automation and Control

D. Advanced Digital Signal Processing

Elective-V: A. Random Signal Processing

B. Biomedical Instrumentation

C. Cloud Computing

D. Multimedia System

Open Elective-III

1. Communication Theory

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RF and Microwave Engineering

ET 701	PCC	RF and Microwave Engineering	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Good knowledge of Engineering Fundamentals of Physics and Electromagnetic.

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

CO1	Explain the working of the waveguide.
CO2	Choose a suitable microwave measurement instrument and carry out the required measurements.
CO3	Identify the use of microwave components and devices in microwave applications.
CO4	Explain the working principles of all the microwave tubes
CO5	Illustrate the microwave network analysis.

Course Contents:

Unit No.01 **Microwave Wave Guides** Introduction to Microwaves Engineering: History of Microwaves, Microwave Frequency bands. Applications of Microwave, General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide, Wave guide parameters, Introduction to the coaxial line, rectangular waveguide cavity resonators, Circular waveguide cavity resonators.	[6]
Unit No.02 **Microwave Components** Multi-port junctions: Construction and operation of E-plane, H-plane, Magic Tee, and Directional couplers. Ferrites components: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator, and Circulator. Striplines: Structural details and applications of strip lines, Microstrip lines, Parallel Strip lines, Coplanar Strip lines, and Shielded Strip Lines.	[6]
Unit No.03 **Microwave Measurements** Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S-parameter measurement, frequency measurements, Power measurement, Attenuation measurement, Phase	[6]

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shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement.	
Unit No.04 **Microwave Tubes:** Two cavity Klystron: Construction and principle of operation, velocity modulation, and bunching process Applegate diagram. Reflex Klystron: Construction and principle of operation, velocity modulation, and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning. M-type tubes Magnetron: Construction and Principle of operation of 8 cavity cylindrical traveling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications. Slow wave devices Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.	[6]
Unit No.05 **Microwave Solid State Devices:** Varactor Diode, PIN Diode, Schottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode, and TRAPATT diode. Structural details, Principles of operation, various modes, specifications, and applications of all these devices.	[6]
Unit No.06 **Microwave Network Analysis** Introduction and applications of Impedance and Equivalent voltages and currents, Impedance and Admittance matrices, The Transmission (ABCD) matrix Scattering matrix: - Significance, formulation, and properties. S-Matrix calculations for-2 port network junction	[6]
TEXT/REFERENCE BOOKS 1. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010 2. Microwave Devices and circuits- Liao / Pearson Education 3. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka, and Ahmad S Khan, 4thSpecial Indian Edition, McGraw- Hill Education Pvt. Ltd., 2010. 4. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008 5. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015 6. Antennas and Wave Propagation – Harish and Sachidananda: Oxford University Press, 2007.	

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Satellite Communication

ET 702	PCC	Satellite Communication	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Analog Communication & Digital Communication

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

CO1	Explain Orbital aspects involved in satellite communication.
CO2	Illustrate various satellite subsystems.
CO3	Explain and Analyze Link budget calculation.
CO4	Compare Satellite Network System.
CO5	Explain Non Geostationary Satellite Systems.
CO6	Summarize modern applications of Satellite.

Course Contents:

Unit No.01 **Introduction of satellite communication:** Introduction, basic concept of satellite communication, Orbital Mechanics, Lookangle determination, Orbital perturbation, Orbital determination Launchers and Launch vehicles, Orbital effects in communication system performance.	**[6]**
Unit No.02 **Satellite Subsystem:** Introduction, Attitude and control system (AOCS), Telemetry, Tracking, Command and Monitoring, Power systems, Communication subsystem, Satellite antennas, Equipment reliability and space qualification.	**[6]**
Unit No.03 **Satellite Link Design:**	**[6]**

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Introduction, Basic transmission Theory, System Noise Temperature and G/T Ration, Design of Downlinks, Uplink Design, Design of specified C/N: Combining C/N and C/I values in Satellite Links.	
Unit No.04 **Satellite Networks:** Reference architecture for satellite networks, basic characteristics of satellite networks, On-board connectivity with transparent processing, analogue transparent switching, On board connectivity with beam scanning.	**[6]**
Unit No.05 **Low Earth Orbit and Non Geo-Stationary Satellite System:** Introduction, Orbit considerations, Coverage and Frequency Consideration, Delay and Throughput Consideration, Operational NGSO constellation design: Iridium, Teledesic.	**[6]**
Unit No.06 **Satellite Application:** Communication Satellite-Digital DBS TV, Satellite Radio Broadcasting, Navigation Satellite, GPS Position Location Principles, GPS Receivers and codes.	**[6]**

Text Books:

1. Satellite Communications-Timothy Pratt, Charles Bostian, Jeremy Allnut John Wiley &Sons (II Edition)
2. Satellite Communications-Anil k. Maine and VarshaAgaraval, Wiley Publications
3. Satellite Technology Principles and ApplicationsAnil K. Maini and VarshaAgarawal, Wiley Publications, Third Edition
4. Satellite Communication Engineering- Wilbur L. Pritchand, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications.

Reference Books:

1. Satellite Communications- Dennis Roody McGraw Hill Fourth Edition
2. Satellite Communications- Gerard Maral and Michel Bousquet, Wiley Publication (5thEdition)
3. Satellite Communications systems Engineering, 2nd edition- Wilbur L. Pritchard, Henri G.Suyderhoud and Robert A. Nelson.

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Elective-IV

A. Wireless communication

ET 703A	PEC	Wireless communication	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Computer Network

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

CO1	Describe the wireless communication system.
CO2	Explain the basic concepts of basic Cellular System.
CO3	Explain the basics of mobile propagation models.
CO4	Summarize the various multiple access techniques used in wireless communication.
CO5	Describe the Wireless standards and systems.
CO6	Explain the emerging trends in Wireless communication like WiFi, WiMAX, and related issues and challenges.

Course Contents:

Unit No.01: **Introduction to Wireless Communication System:** Evolution of mobile communications, Mobile Radio System around the world, Examples of Wireless communication System, Comparison of Common wireless system, Second generation Cellular Networks, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL), Wireless Local Area network (WLAN).	[6]
Unit No.02: **Cellular Radio Systems:** Basic cellular system, Components and Operation of cellular systems, Analog & Digital cellular systems, Concept of frequency reuse channels, Co-channel interference, Cell splitting.	[6]
Unit No.03:	[6]

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Mobile Radio Propagation Model: Large scale path loss:-Free Space Propagation loss equation, Path-loss of LOS systems, Reflection, Diffraction, Scattering, Indoor and outdoor propagation models.	
Unit No.04: **Mobile Radio Propagation Model, Small Scale Fading:** Small scale multipath propagation, Impulse model for multipath channel, Delay spread, Types of smallscale Fading, Rayleigh and rician distribution.	[6]
Unit No.05: **Multiple Access Techniques:** Introduction, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code division Multiple access (CDMA), Spread Spectrum Multiple Access, Space Division Multiple Access (SDMA), GSM system architecture, GPRS system architecture.	[6]
Unit No.06: **Recent Trends:** Introduction to Wi-Fi, WiMAX, ZigBee Networks, Wireless Adhoc Network and Mobile Portability, Security issues and challenges in a Wireless network.	[6]

Reference Books:

Text Book:

1. Jochen Schiller, Mobile Communications, Pearson, 2008
2. Andreas F Molish , Wireless Communications, 2nd Edition , Wiley India Publications,2013
3. Wireless Communication, Theodore S. Rappaport, Prentic hall.
4. Wireless Communications and Networking, Vijay Garg, Elsevier
5 Wireless digital communication, Kamilo Feher, PHI
6 Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
7. William C Y Lee, Mobile Cellular Telecommunications, 2nd Edition, MGH, 2004.
8. Raj Pandya, —Mobile and Personal Communication systems and servicesǁ, Prentice Hall of India, 2001.

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B. Artificial Intelligence and Machine Learning

ET 703B	PEC	Artificial Intelligence and Machine Learning	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre- Requisites: Basic mathematics concepts to implement in software or systems.
Course Outcomes: At the end of the course, students will be able to:

CO1	Understand the basic concepts of machine learning and some typical applications.
CO2	Understanding how to build and validate models and improve them iteratively.
CO3	Identify and apply suitable intelligent agents for various AI applications.
CO4	Represent a natural language description of statements in logic and apply the inference rules to design Knowledge Based agents.
CO5	Apply a probabilistic model for reasoning under uncertainty.
CO6	Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.

Course Contents:

Unit No.01 **Introduction to Artificial Intelligence** Introduction to AI, Objective of AI, Foundation of AI or Typical Applications, Advantages of AI, Disadvantages of AI, History of Artificial Intelligence, Intelligent Agents, Rationality, Rational Agent, Structure of Intelligent Agents, nature of Environments.	**[6]**
Unit No.02 **Solving Problems by Searching** Introduction, Solving Problems by Searching, Problem solving Agents, Properties of Searching algorithms, Components of Agent System, Operations in problem solving, Searching Algorithms, Uninformed Search and informed search.	**[6]**

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Unit No.03 **Logical Agents** Logical Agents: Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic. First Order Logic: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic.	[6]
Unit No.04 **Knowledge and Reasoning** Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Based Agent, Overview of Propositional Logic, First Order Predicate Logic, Inference in First Order Predicate Logic: Forward and Backward Chaining.	[6]
Unit No.05 **Introduction to ML** Introduction to Machine Learning: History of ML Examples of Machine Learning Applications, Learning Types, ML Life cycle AI & ML, dataset for ML, Data Pre-processing, Training versus Testing, Positive and Negative Class, Cross-validation.	[6]
Unit No.06 **Analysis of Models** Model representation, decision boundary, cost function, gradient descent, regularization, evaluating a hypothesis (Model selection), training/validation/testing procedures, bias/variance, learning curves, Accuracy and Error measures.	[6]

Reference Books:

1. John Kell , Steve Hamm, Smart Machines - IBMs Watson and the Era of Cognitive Computing, Columbia Business School Publishing.
2. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education
3. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
4. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
5. George Lugar, .AI-Structures and Strategies for Complex Problem Solving., 4/e, 2002, Pearson Education.

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C. Industrial Automation and Control

ET 703C	PEC	Industrial Automation and Control	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: PLC

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

CO1	Describe working of various blocks of basic industrial automation system.
CO2	Connect the peripherals with the PLC.
CO3	Use various PLC functions and develop small PLC programs.
CO4	Summarize Distributed control system and SCADA system.
CO5	Use various industrial motor drives for the Industrial Automation.

Course Contents:

Unit No.01 **PLC Basics** Need and benefit of automation PLC system: applications of PLC, PLC modules, I/O module Communication module, PID module Input analog devices, Input digital devices, Output Analog Devices, Output digital devices.	[6]
Unit No.02 **PLC Functions** PLC registers, PLC timer function, PLC counter function, PLC simple arithmetic and logical Functions PLC ladder logic Diagram, Advanced PLC functions like SKIP, MASTER CONTROL RELAY JUMP with non-return, jump with return Sequencer function	[6]
Unit No.03 **PLC Programming and Application** PLC application: Bottling filling plant, Material handling elevator2-axis robot with sequencer	[6]

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Control, Level control, Troubleshooting.	
Unit No.04 **DCS and SCADA** Introduction to DCS, concept of DCS, hierarchy of DCS, Function of each level of DCS, Introduction to supervisory Control, Data Acquisition system (SCADA)SCADA Architecture, Interfacing SCADA with PLC.	[8]
Unit No.05 **Industrial Drives** Induction motor drive, V/F Control, Direct torque control, Stepper motor drives, AC Servo Motor drives, DC Servo motor drives, DC motor drives.	[7]
Text Books: 1. Industrial automation -K.S.Manoj 2.Industrial automation -R.G.jamkar	
Reference Books: 1. Programmable Logic Controllers Principles and applications Webb John W. and Reis A. Ronald PHI, New Delhi, Latest edition 2. Programmable Logic Controllers Bolton W. Elsevier India Pvt. Ltd. New Delhi 3. Programmable Logic Controllers John R Hackworth Pearson education New Delhi, Latest edition 4. Process Control Instrumentation C. D. JOHNSON John Wiley and Son 5. Instrumentation Engineering Handbook LIPTAK Chilton Book Company, Latest edition **6.** Instrumentation Engineering Handbook LIPTAK Chilton Book Company, Latest edition	

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D. Advanced Digital Signal Processing

ET 703D	PEC	**Advanced Digital Signal Processing**	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Mathematics, Digital Signal Processing.
Course Outcomes: At the end of the course, students will be able to:

CO1	Illustrate Multirate DSP systems
CO2	Demonstrate applications of Multirate signal processing.
CO3	Apply linear prediction and filtering techniques to discrete random signals.
CO4	Identify applications of adaptive filters.
CO5	Analyze non parametric power spectrum estimation techniques for random signals.
CO6	Explain parametric power spectrum estimation techniques for random signals.

Course Contents:

Unit No. 01: **Multirate Digital Signal Processing:** Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion. Examples of up-sampling using an All Pass Filter.	[6]
Unit No. 02: **Applications of Multirate signal processing** Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Subband Coding of Speech Signals, Quadrature Mirror Filters, Transmultiplexers, Over Sampling A/D and D/A Conversion.	[6]
Unit No. 03: **Linear prediction and Optimum Linear Filters:** Random signals, Correlation Functions and Power Spectra, Innovations Representation of a Stationary Random Process. Forward and Backward Linear Prediction. Solution of the Normal Equations. The Levinson-Durbin Algorithm. Properties of the Linear Prediction-Error Filters.	[6]
Unit No. 04:	[6]

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Adaptive filters: Applications of Adaptive Filters-Adaptive Channel Equalization, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form FIR filters-The LMS algorithm, Properties of LMS algorithm. Adaptive direct form filters- RLS algorithm.	
Unit No. 05: **Non-Parametric Methods for Power Spectrum Estimation:** Estimation of spectra from finite duration observation of signals, Nonparametric Methods: Bartlett, Welch & Blackman-Tukey methods, Comparison of all Non-Parametric methods	[6]
Unit No. 06: **Parametric Methods for Power Spectrum Estimation:** Autocorrelation & Its Properties, Relation between auto correlation & model parameters, AR Models – Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation, Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms.	[6]

Text Books/ Reference Books:

1. J.G.Proakis & D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms & Applications", 4th Edition, PHI.
2. Alan V Oppenheim & Ronald W Schaffer, "Discrete Time signal processing ", PHI.
3. Emmanuel C. Ifeacher, Barrie. W. Jervis, "DSP – A Practical Approach", 2nd Edition, Pearson Education.
4. S. M. Kay, "Modern spectral Estimation: Theory & Application ", 1988, PHI.
5. P.P.Vaidyanathan, "Multi Rate Systems and Filter Banks", Pearson Education.
6. Kaluri V. Rangarao, Ranjan K. Mallik, "Digital Signal Processing: A Practitioner's Approach", ISBN: 978-0-470-01769-2, 210 pages, November 2006 John Weley.
7. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, "Digital Signal Processing", 2000,TMH

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Elective-V

A. Random Signal Processing

ET 704A	PEC	Random Signal Processing	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Signal and system, probability and statistics.
Course Outcomes: At the end of the course, students will be able to:

CO1	Understand the axiomatic of Probability Theory.
CO2	Characterize probability models and function of random variables.
CO3	Evaluate Probability Mass function with PDF and CDF.
CO4	Understand the concept of random processes and determine covariance and spectral density of stationary random processes.
CO5	Demonstrate the specific applications to Poisson and Gaussian processes.
CO6	Relate Random process to real statistical analysis.

Course Contents:

Unit No.01: **Introduction to Probability** Definitions, scope and history; limitation of classical and relative- frequency- based definitions, Sets, fields, sample space and events; axiomatic definition of probability, Combinatorics: Probability on finite sample spaces, Joint and conditional probabilities, independence, total probability; Bayes' rule and applications.	[6]
Unit No.02: **Theory of Probability and Random Processes** Concept of probability, random variables, random process, power spectral density of a Random process, probability models, statistical averages, central limit theorem, correlation, Linear mean square estimation.	[6]
Unit No.03: **Random Variables**	[6]

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Random Variables: Discrete random variables, probability mass function, probability distribution function, example random variables and distributions continuous random variables, probability density function, probability distribution function, example distributions Joint distributions, functions of one and two random variables, moments of random variables conditional distribution, densities and moments, characteristic functions, Markov, Chebyshev and Chernoff bounds, detection and estimation.	
Unit No.04: **Random vector and distributions** Mean vector, covariance matrix and properties, Some special distributions: Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution, Vector- space representation of random variables, linear independence, inner product, Schwarz Inequality, Elements of estimation theory: linear minimum mean - square error and Orthogonality principle in estimation; Moment - generating and characteristic functions and their applications, Bounds and approximations: Chebysev inequality and Chernoff Bound.	[6]
Unit No 05: **Sequence of random variables and convergence** Almost sure convergence and strong law of large numbers; convergence in mean square sense with examples from parameter estimation; convergence in probability with examples; convergence in distribution, Central limit theorem and its significance.	[6]
Unit No.06: **Random process** Random process: realizations, sample paths, discrete and continuous time processes, examples, Probabilistic structure of a random process; mean, autocorrelation and auto - covariance functions, Stationary: strict - sense stationary (SSS) and wide- sense stationary (WSS) processes, Autocorrelation function of a real WSS process and its properties, cross-correlation function, Ergodicity and its importance.	[6]
Text Books and Reference books: 1. A Papoulis and S. Unnikrishna Pillai, Probability, Random Variables and Stochastic Processes, McGraw Hill. 2. H. Stark and J. W. Woods, Probability and Random Processes with applications to Signal Processing, Pearson Education. 3. T. Veerrajan, "Probability, Statistics and Random Processes", Third Edition, McGraw Hill.	

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B. Biomedical Instrumentation

ET 704B	PEC	Biomedical Instrumentation	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Introduction instruments and their working

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

CO1	Model a biomedical system.
CO2	Understand various methods of acquiring bio signals.
CO3	signal distortions and its remedial techniques.
CO4	Get an Overview of major Devices currently used in medical field.
CO5	The students will have an understanding of analyzing bio-signal and classifying them.
CO6	understand Sources and characteristics of noise and artifacts in bio signals.

Course Contents:

Unit No.01: **Introduction to Biomedical System** Biomedical Instrumentation System, Cell structure, Bio-Cell potential, Concept of Bio-electrodes, Types of Bio-electrodes to measure Bio-signal, Transducers and Sensors to measure Bio signal EEG, ECG, EMG, Respiration, Body temperature, SPO2, and Pulse. Artifacts in Bio signal Acquisition: Noise, Power line, Baseline, Skin Impedance and Motion Artifacts, Techniques to reduce the artifacts.	[6]
Unit No.02: **Cardiovascular System** Introduction to Heart, Physiology and anatomy of Heart, Lead Configurations to acquire ECG, ECG preamplifiers, ECG recorder, Heart Sounds and Murmurs, Phonocardiography.	[6]
Unit No.03: **Nervous System** Nerve Cell and nerve potential, Neural Communication, Brain structure, 10-20 electrode placement for EEG, Types of Montage configuration, Types of EEG signals and its significance, EEG machine, EEG applications for Epilepsy and Sleep apnea.	[6]

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Unit No.04: **Medical Instrumentation** Design of Instrumentation system for ECG acquisition, Isolation Amplifier, Right Leg drive Mechanism, Noise removal techniques using Active Filters, Wiener Filters, Adaptive Filters: Basic Concept, Principle noise cancellation model, removal of periodic events, using adaptive cancellation, adaptive cancellation of maternal ECG from fetal ECG of Interest. Grounding and shielding Concepts.	[8]
Unit No.05: **Analysis of Electrical Activity of Heart** ECG Signal Processing: Removal of Base line and Power line Interference, Muscle noise Filtering, Highlight ECG feature points, QRS detection, ECG classification for normal and abnormal state using Multilayer Perceptron. Use of Multiscale analysis for ECG parameter estimation.	[6]
Unit No.06: **Medical Devices** Introduction To Blood Pressure Measurement (noninvasive), Life saving Devices Pacemakers and Defibrillators, Bedside Monitors, Central Monitoring system, Stress Test System, X Ray, CT scan, Dental instruments.	[4]

Text Books:

1. Joseph J. Carr and John M. Brown, —Introduction to Biomedical Equipment Technologyl, 4th Edition, Prentice Hall, 2000.
2. R. Rangayan, —Biomedical Signal Analysisl, Wiley 2002.
3. R.S.Khandpur, —Handbook of Biomedical Instrumentationl, Tata McGraw Hill, New Delhi, 2003, Edition-II.

Reference Books:

1. John L Semmlow, —Bio-signal and Biomedical Image Processingl, Marcel Dekker
2. Joseph J. Carr and John M. Brown, —Introduction to Biomedical Equipment Technologyl, 4thEdition, Prentice Hall, 2000.

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C. Cloud Computing

ET 704C	PEC	Cloud Computing	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basics of networking and different Types of cloud.

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

CO1	learn how to use Cloud Services.
CO2	Know the Architecture of cloud computing.
CO3	Learn how to use cloud services and storage.
CO4	To have knowledge on the various issues in cloud computing.
CO5	Know the administration and risk factor of cloud computing.
CO6	Know the Adoption in cloud computing.

Course Contents:

Unit No.01: **Introduction to Cloud Computing** Introduction, Evolution of computing developments, Components of cloud computing, computing services delivery models, Parallel v/s distributed computing, Cloud Characteristics Virtualization Introduction and benefits, Implementation levels of Virtualization, Virtualization structure, Virtualization of CPU.	[6]
Unit No.02: **Cloud Computing Architecture** Cloud Architecture, Layered Cloud Architecture Design, NIST Cloud Computing Reference Architecture, Public Private and Hybrid Clouds - IaaS – PaaS – SaaS, Architectural Design Challenges, private versus hybrid cloud.	[6]
Unit No.03: **Cloud services and storage** Services mechanism – Iaas, Paas, SaaS, Database as a service (DBaas), benefits to cloud adoption among users and providers, Levels of business value. Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage.	[6]

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Unit No. 04: **Cloud development and security** Factors for cloud implementation, Cloud network topologies, automation in cloud development, self-services features in cloud development, cloud performance and monitoring, Improving cloud database performance, host security for Saas, host security IaaS, data security threats, cloud data challenges and security.	[6]
Unit No.05: **Administration for cloud and Risk factor** The AAA model, Single sign- on for clouds, SAML, risk in cloud computing, risk assessment and management, Risk of failure and inadequate SLA, risk of malware and internet attack, risk management in cloud, risk in physical infrastructure, risk with software and application licensing.	[6]
Unit No.06: **Adoption of cloud** Benefits of cloud in SMB's, roles and responsibilities towards SMB's, service management capabilities, financial management capabilities, success factor for cloud consumers, Issues with SMB's using cloud services, question for cloud vendor.	[6]

Text Books/ Reference Books:

1. Kailash Jayaswal, Jagannath kallakurchi, Donald j. houde, Dr. deven shah- DT Editorial services "Cloud Computing "2015
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computingl, Tata Mcgraw Hill, 2013.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approachl, Tata Mcgraw Hill, 2009.
4. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009

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D. Multimedia System

ET 704D	PEC	Multimedia System	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: -Computer Organization.

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

CO1	Explain basic concept of multimedia systems.
CO2	Classify different computer fonts and hypertext.
CO3	Illustrate the basic concepts of audio fundamentals and representation.
CO4	Understand the basic image fundamentals and representation and classify the concepts for image compression and file formats.
CO5	Understand the basic concepts of video and animation.
CO6	Understand the basic concept of multimedia authoring.

Course Contents:

Unit No.01: **Introduction to Multimedia Systems -** What is multimedia, History of multimedia, Components of multimedia systems, Web and Internet multimedia applications, Transition from conventional media to digital media.	[6]
Unit No.02: **Computer Fonts and Hypertext:** Usage of text in Multimedia, Families and faces of fonts, Outline fonts, Bitmap fonts, International character sets and hypertext, Digital fonts techniques.	[6]
Unit No.03: **Audio Fundamentals and Representation -** Digitization of sound, Frequency and bandwidth, Decibel system, Data rate, Audio file format, Sound synthesis, MIDI, Wavetable, Compression and transmission of audio on Internet.	[6]
Unit No.04:	[6]

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Image Fundamentals and Representations - Colour Science, Colour, Colour Models, Colour palettes, Dithering, 2D Graphics, Image Compression and File Formats: GIF, JPEG, JPEG 2000, PNG, TIFF, EXIF, PS, PDF, Basic Image Processing, White balance correction, Dynamic range correction, Gamma correction, Photo Retouching.	
Unit No.05: **Video and Animation -** Video Basics, How Video Works, Broadcast Video Standards, Analog video, Digital video, Video Recording and Tape formats, Shooting and Editing Video (Use Adobe Premier for editing), Video Compression and File Formats, Video compression based on motion compensation, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21.	[6]
Unit No.06: **Multimedia Authoring -** Multimedia Authoring Basics, Some Authoring Tools, Macromedia Director & Flash.	[6]
Text Books: 1. Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, 2008. 2. Rajneesh Aggarwal & B. B Tiwari, " Multimedia Systems", Excel Publication, New Delhi, 2007. 3. Li & Drew, "Fundamentals of Multimedia" , Pearson Education, 2009.	
Reference Books: 1. Parekh Ranjan, "Principles of Multimedia", Tata McGraw-Hill, 2007 2. Anirban Mukhopadhyay and Arup Chattopadhyay, "Introduction to Computer Graphics and Multimedia", Second Edition, Vikas Publishing House. 3. An Introduction to Digital Multimedia 2nd Edition, 2013, Jones & Bartlett Learning; 2 edition, ISBN 144968839X-978-1449688394. 4. Vic Costello, "Multimedia Foundations: Core Concepts for Digital Design, 2nd Edition", 2017, T&F/FOCAL PRESS.	

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RF & Microwave Engineering Laboratory

ET 705	PCC	RF & Microwave Engineering Laboratory	0-0-2	1 Credits

Teaching scheme:	**Examination Scheme:**
Practical: 2hrs/week	CA1 :15 Marks CA2 :15 Marks End Semester Oral Exam: 20 Marks

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

CO1	Evaluate the performance of different microwave components.
CO2	Analyze the frequency measurements
CO3	Compare the different characteristics of microwave components.

Experiment List: Minimum 08 experiments should be conducted.

01.	To understand microwave test bench and microwave components and instruments.
02.	To understand the characteristics of Reflex klystron.
03.	To verify the characteristics of the isolator.
04.	To verify the characteristics of the circulator.
05.	To understand the properties of directional couplers.
06.	To understand the characteristics of magic tees.
07.	To study frequency measurement.
08.	To study VSWR measurement.
09.	To understand the characteristics of the attenuator.
10.	To understand the characteristics of the horn antenna.

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Satellite Communication Laboratory

ET 706	PCC	Satellite Communication Laboratory	0-0-2	1 Credits

Teaching scheme:	**Examination Scheme:**
Practical: 2hrs/week	CA1 :15 Marks CA2 :15 Marks End Semester Exam: 20 Marks

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

CO1	Demonstrate principle of satellite communication link & study the change in frequency.
CO2	Measure the analog & digital baseband signal parameters in satellite communication link.
CO3	Experiment with effect of fading, & propagation delay of signal satellite communication link.

Experiment List: Minimum 08 experiments should be conducted

01	To set up an active & passive satellite communication link and study their difference.
02	To study the advantages of satellite communication.
03	To study the communication satellite link design: Process of transmitting a signal to a satellite (UPLINKING), reception of same signal via satellite (DOWN LINKING) and functioning of transponder of a satellite.
04	To measure the base band analog signal parameters in a Satellite link.
05	To measure the signal parameters in an analog FM/FDM TV satellite link.
06	To study the functionality of a satellite MODEM.
07	To measure the C/N ratio.
08	To measure the S/N ratio.
09	To measure the digital base band signal parameters in a Satellite communication link
10	To measure the range of baud rates that the system can Support.
11	To send tele-command and receive the telemetry Data and study the operation of a codec.

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12	To study the effect of fading and measure the fading margin of a received signal.
13	To study the effect of path loss and calculate the distance between transmitter & Receiving Antenna.
14	To observe the Propagation Delay of signal in a satellite communication link.

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Mega Project Phase -II

PRJ06	PROJ	Mega Project Phase -II	0-0-8	4 Credits

Teaching scheme:	**Examination Scheme:**
Practical: 8hrs/week	CA1 :25 Marks CA2 :25 Marks End Semester Exam: 50 Marks

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

CO1	Demonstrate the sound technical knowledge of the selected technical topic.
CO2	Demonstrate the technical presentation skill.
CO3	Compose the progress report.

Course Contents

Since Mega Project Phase-II is in continuation to Mega Project Phase-I, the students are expected to complete the total project by the end of semester VII. After completion of project work, they are expected to submit the project report including the work done in Phase-I and Phase-II.

The report shall be comprehensive and presented typed on A4 size sheets and **hard bound**. The number of copies to be submitted is number of students plus two. The assessment would be carried out by the panel of examiners (Guide and Project Evaluation Members) for both, term work and oral examinations.

The project work should be published in any one of the national/international quality conference or reputed journal.

Report shall summarize the literature survey; spell out the scope of work, methodology and results.

Viva-voce Examination shall be based on work carried out by the student

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Seminar

PRJ07	PROJ	seminar	0-0-2	1Credits

Teaching scheme:	**Examination Scheme:**
Practical: 2hrs/week	End Semester Exam: 50 Marks

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

CO1	Demonstrate the sound technical knowledge of the selected technical topic.
CO2	Demonstrate technical presentation skill.
CO3	Compose the progress report.

Course Contents

Student shall choose a topic of his/her interest in consultation with faculty in the Electronics and Telecommunication Engineering Department. The topic for seminar may be related to Recent Developments in Electronics and Telecommunication Engineering area and/or interdisciplinary area. Student shall attempt to collect necessary information and present a summary indicating comprehension of the topic and acquired depth of knowledge. A brief report on topic of seminar shall be submitted. Evaluation shall be based on report and power point presentation.

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Values and Ethics

MC	HSMC	Values and Ethics	2-0-0	Audit

Teaching scheme:	**Examination Scheme:**
Lecture: 2hrs/week	CA1 :25 Marks CA2 :25 Marks

Pre-Requisites:

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

CO1	Understand the Ethics & Human interface.
CO2	Understand Attitude, Morals, Aptitude, Integrity towards Society.
CO3	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
CO4	Understand the significance of value inputs in a classroom and start applying them in their life and profession.
CO5	Understand Publication ethics.
CO6	Understand Business ethics in professional careers.

Course Contents

Unit No.01: **Ethics and Human Interface:** Ethics and Human Interface, Essence, determinants and consequences of ethics in human actions; Dimensions of ethics; ethics in private and public relationships Human Values – lessons from the lives and teachings of great leaders, reformers and administrators, Role of family, society in inculcating values, role of educational institutions in inculcating values.	[4]
Unit No.02: **Attitude, Morals, Aptitude, Integrity towards Society** Attitude: content, structure, function, Attitude and its influence and relation with thought and behavior, Aptitude and foundational values towards society, integrity, impartiality and non-partisanship, empathy, tolerance and compassion intelligence-concepts.	[4]
Unit No.03: **Understanding Harmony in the Human Being - Harmony in Myself** Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body', Understanding the Body as an instrument of	[4]

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'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Programs to ensure Sanyam and Swasthya.	
Unit No. 04: **Value Education** Need, Guidelines, content and process for Value Education, Self-exploration - Natural Acceptance and Experiential Validation, Continuous Happiness and Prosperity, Relationship and Physical Facilities, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	[4]
Unit No.05: Publication Ethics Publication Ethics: Introduction, Scope & importance, best practices/standards initiatives & Guidelines: COPE, WAME, etc., Conflict of Interest, Publication Misconduct: definition, concept, problems that lead to unethical behavior & Vice versa, complaints & appeals.	[4]
Unit No.06: Business Ethics Ethics - Meaning, Importance, & Types of Ethics, Nature and Relevance to Business ethics, Values and Attitudes of Professional Engineers, Seven Principles of Public Life, Ethics in Business: Features, Principles, Need & Importance, Improving ethical behavior in Business.	[4]

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
3. Neeraj Kumar, "Lexicon for Ethics, Integrity & Aptitude", Chronicle Publication, 2016.
4. Santosh Ajmera, Nand Kishor Reddi, "Ethics - Integrity and Aptitude", Tata Mc Graw Hill Publication, 2014.
5. M. Karthikeyan"Ethics, Integrity and Aptitude", Tata Mc Graw Hill Publication, 2015.

Reference Books:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA.
2. A N Tripathy, 2003, Human Values, New Age International Publishers.
3. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press.
4. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
5. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

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