E.G.S.PILLAYENGINEERINGCOLLEGE

(Autonomous)

Approved byAICTE,NewDelhi|Affiliated to AnnaUniversity, Chennai Accredited byNAAC with „A‟Grade|AccreditedbyNBA(CSE, EEE, MECH)

NAGAPATTINAM–611002

B.E.Electronicsand CommunicationEngineering

FullTimeCurriculumand Syllabus

FinalYear– SeventhSemester

Course Code	CourseName	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1702EC701	Microwave Engineering	2	0	0	2	40	60	100
1702EC702	Optical Communication	3	0	0	3	40	60	100
1702EC703	Wireless Communication	3	0	0	3	40	60	100
1702EC704	Image Processing	3	0	0	3	40	60	100
	Professional(Open)Elective – V	3	0	0	3	40	60	100
	Professional Elective –VI	3	0	0	3	40	60	100
LaboratoryCourse								
1702EC751	Microwave and Optical Communication Laboratory	0	0	2	1	50	50	100
1702EC753	Mini Project	0	0	0	1	100	-	100
1704EC753	In-plant Training/ Internship Presentation	0	0	0	1	100	-	100
1704GE751	Life Skills: Competitive Exams Preparation	2	0	0	2	100	-	100
	Total	**20**	**0**	**6**	**24**	**640**	**460**	**1100**

Professional Elective - V								
1703MG701	Principles of Management	3	0	0	3	40	60	100
1703MG702	Disaster Management	3	0	0	3	40	60	100
1703MG703	Total Quality Management	3	0	0	3	40	60	100
1703MG704	Industrial Economics	3	0	0	3	40	60	100
1703MG705	Foundation Skills in Integrated Product Development	3	0	0	3	40	60	100
Professional Elective – VI								
1703EC021	Advanced Digital Signal Processing	3	0	0	3	40	60	100
1703EC022	Embedded System	3	0	0	3	40	60	100
1703EC023	Pattern Recognition and Machine Learning	3	0	0	3	40	60	100
1703EC024	Speech Processing	3	0	0	3	40	60	100
1703EC025	VLSI Signal Processing	3	0	0	3	40	60	100
1703EC026	RF System Design	3	0	0	3	40	60	100

L–Lecture|T–Tutorial|P–Practical|C–Credit|CA –ContinuousAssessment| ES–EndSemester

1702EC701	MICROWAVE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

1.To gain knowledge about RF Electronics.
2. To study about the various microwave component, signal generators and amplifiers.
3. To gain knowledge about integrated circuits and microwave meaurements.

Unit I	INTRODUCTION TO RF ELECTRONICS	9 Hours

The Electromagnetic Spectrum, units and Physical Constants, Microwave bands, RF behavior of Passive components: Tuned resonant circuits, Vectors, Inductors and Capacitors. Voltage and Current in capacitor circuits, Tuned RF/IF Transformers.

Unit II	MICROWAVE COMPONENTS	9 Hours

Introduction to Microwaves and their applications, Coaxial Line Components, Wave-guide Components, Directional Couplers, Hybrid Tee Junction, Magic Tee, Attenuators, Ferrite Devices, Isolators, Circulators, Cavity Resonators, Re-entrant Cavities, Wave-meters, Microwave Filters, Detectors, Mixers.

Unit III	MICROWAVE SIGNAL GENERATORS AND AMPLIFIERS	9 Hours

Vacuum Tube Triodes, Resonant Cavity Devices, Reflex Klystron, Two –Cavity Klystron, Multi – Cavity Klystron, Slow – Wave Devices, TWT, Crossed Field Devices, Magnetrons, Semiconductor Devices, Microwave BJTs, FETs, Tunnel Diodes, Gunn Diode, IMPATT, TRAPATT Diodes.

Unit IV	MICROWAVE INTEGRATED CIRCUITS	9 Hours

Materials, Substrate, Conductor, Dielectric and Resistive Materials, MMIC Growth, Fabrication Techniques, MOSFET Fabrication, NMOS Growth and CMOS Development, Thin Film Formation.

Unit V	MICROWAVE MEASUREMENTS	9 Hours

VSWR, Frequency, Guide Wavelength, Coupling and Directivity measurements

	Total:	45 Hours

Further Reading:

1.Recent trend in Microwave application.

Course Outcomes:

After completion of the course, Student will be able to
1.Explain about RF Electronics.
2. Identify the component for microwave application.
3.Discuss signal generator and amplifiers.
4. Illustrate the concept of microwave integrated circuits.
5. Explain about microwave measurements.

References:

1. Reinhold Ludwing, Pavel Bretchko, “RF Circuit design: Theory and applications”, Pearson Education Asia Publication, New Delhi 2001.
2.Foundations For Microwave Engineering, R. R. Collin, McGraw Hill
3.Microwave Communications – Components and Circuits, E. Hund, McGrawHill.
4.Microwave Devices and Circuits, S. Y. Liao, PHI.
5.Microwave Engineering, R. Chatarjee, East – West Press Pvt. Ltd.

1702EC702	OPTICAL COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
2. To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors. Design optimization of SM fibers, RI profile and cut-off wave length.
3. To learn about various Optical Sources and Detectors.
4. To Explore the trends of optical fiber measurement systems.
5. To Enrich the idea of optical fiber networks algorithm such as SONET/SDH and optical CDMA

Unit I **INTRODUCTION TO OPTICAL FIBERS** **9 Hours**

Evolution of fiber optic system- Element of an Optical Fiber Transmission link Ray theory transmission- Total internal reflection-Acceptance angle –Numerical aperture – Skew rays – Electromagnetic mode theory of optical propagation –EM waves – modes in Planar guide – phase and group velocity – cylindrical fibers –SM fibers- Graded Index fiber structure.

Unit II **SIGNAL DEGRADATION OPTICAL FIBERS** **9 Hours**

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion- Pulse Broadening in GI fibers-Mode Coupling -Optical fiber connectors**,** Fiber alignment and Joint Losses – Fiber Splices – Fiber connectors – Expanded Beam Connectors – Fiber Couplers

Unit III **SOURCES AND DETECTORS** **9 Hours**

Optical sources: Light Emitting Diodes - LED structures - surface and edge emitters, mono and hetero structures - internal - quantum efficiency, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies- injection laser diode structures.
Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance, Photo detector noise –Noise sources, Signal to Noise ratio , Detector response time.

Unit IV **FIBER OPTIC RECEIVER AND MEASUREMENTS** **9 Hours**

Fundamental receiver operation, Pre amplifiers, Error sources – Receiver Configuration– Probability of Error – Quantum limit. Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements.

Unit V **OPTICAL NETWORKS AND SYSTEM TRANSMISSION** **9 Hours**

Basic Networks – SONET / SDH – Broadcast – and –select WDM Networks –Wavelength Routed Networks – Non linear effects on Network performance –-Link Power budget -Rise time budget- Noise Effects on System Performance-Operational Principles of WDM Performance of WDM + EDFA system – Solitons – Optical CDMA – Ultra High Capacity Networks**.**

Total: 45 Hours

Further Reading:

1. Design Optimization of SM fibers-RI profile and cut-off wavelength.
2. Fiber amplifiers- Power Launching and coupling, Lencing schemes

Course Outcomes:

After completion of the course, Student will be able to

1. Discuss the various optical fiber modes, configurations.
2. Demonstrate various signal degradation factors associated with optical fiber.
3. Classify various optical sources and optical detectors and their use in the optical communication system.
4. Explain Various Fiber Optic measurements.
5. Calculate the digital transmission and its associated parameters on system performance.

References:

1. Gerd Keiser, "Optical Fiber Communication" Mc Graw -Hill International, 4th Edition., 2010.
2. John M. Senior , “Optical Fiber Communication”, Second Edition, Pearson Education, 2007.
3. Ramaswami, Sivarajan and Sasaki “Optical Networks”, Morgan Kaufmann, 2009
4. J.Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3rd Edition, 2008.
5. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

1702EC703	WIRELESS COMMUNICATIONS (Common to B.E / B.Tech – ECE, IT)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To become skilled at fundamentals of mobile and wireless communication technologies and its applications.
2. To create the student to work on the transceivers for wireless channels.

Unit I	Introduction	4 Hours

Introduction to wireless Communication systems – Evolution of Mobile communication system – 2G, 3G, 4G, UMTS, LTE, WLL, WLAN, WPAN, Bluetooth, Ultra Wide Band

Unit II	Mobile Radio Propagation	10 Hours

Large scale path loss –Path loss models: Free Space and TwoRay models -Link Budget design –Small scale fading-Parameters of mobile multipath channels –Time dispersion parameters-Coherence bandwidth –Doppler spread & Coherence time, Fading due to Multipath time delayspread–flat fading frequency selective fading –Fading due to Doppler spread –fast fading –slow fading.

Unit III	Cellular Communication	10 Hours

Introduction, Frequency reuse, Cell Assignment techniques, Hand off Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and capacity in cellular systems.Multiple Access techniques: FDMA, TDMA, CDMA, SDMA

Unit IV	Modulation Schemes and Spread Spectrum	12 Hours

Modulation techniques: M-QAM, M-PSK, GMSK, Spread Spectrum Systems: PN sequence-m-sequence -Direct Sequence Spread Spectrum-Frequency Hopping Spread Spectrum, Synchronization techniques for Spread Spectrum signals, Diversity and Combining Techniques: Time Diversity, Frequency diversity, Space Diversity

Unit V	Multiple Antenna Techniques	9 Hours

MIMO systems – spatial multiplexing -System model – Pre-coding -Beam forming –Space Time Coding, Alamouti scheme -Channel state information-capacity in fading and non-fading channels- combining techniques-Selection combining, Equal gain combining, Maximum ratio Combining, RAKE receiver. Introduction to OFDM

Total: 45

Further Reading:

WANET, IoT, Zigbee Technology, WiMax, WLAN

Course Outcomes:

After completion of the course, Student will be able to

1. Characterize interference between mobile and base stations.
2. Apply the knowledge in understanding the allocation of the limited wireless spectrum by government regulatory agencies.
3. Predict the received signal through the multipath channel.
4. Analyze and Evaluate receiver and transmitter diversity techniques.
5. Analyze the multiple antenna techniques

References:

1. Rappaport. T.S., **"Wireless Communications: Principles and Practices",** Second Edition,PHI, 2014
2. Andrea Goldsmith, **"Wireless Communication"**, Cambridge University Press, 2005
3. Andreas.F.Molisch, **"Wireless Communications"**, John Wiley, 2010
4. John G. Proakis, **"Digital Communication"**McGraw Hill, 4th Edition, 2008
5. Gordon L.Stuber, **"Principles of Mobile Communication"**, 3rd Edition, Springer International Ltd.,2011
6. William C Lee, **"Wireless and Cellular Communications"** 3rd Edition McGraw Hill, 2006

1702EC704	IMAGE PROCESSING (Common to ECE/CSE/IT)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To make the students to understand the digital image fundamentals.
2. To study the digital image using different transforms.
3. To acquire the basic knowledge in filters, image enhancement, image restoration and compression techniques.

Unit I **DIGITAL IMAGE FUNDAMENTALS** **9 Hours**

Elements of digital image processing systems, Elements of visual perception, Image sampling andquantization, Basic Relationships between pixels. Image Transforms:Discrete Fourier transform, Cosine,Hadamard, Haar, Walsh and Slant transform..

Unit II **IMAGE ANALYSIS** **9 Hours**

Histogram processing, Equalization and specification techniques,Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Image smoothing and sharpening using frequency domain filters.

Unit III **IMAGE SEGMENTATION** **9 Hours**

Point, line and edge detection-Detection of isolated points, Line detection, Edge models, Basic edgedetection, Edge linking and boundary detection. Thresholding-basic global thresholding, Otsu's method,Multiple, Variable and multivariable thresholding. Region-based segmentation-Region growing, Regionsplitting and merging.

Unit IV **IMAGE RESTORATION AND RECOGNITION** **9 Hours**

Image degradation/ restoration model, Noise models, Restoration-Spatial Filtering, Constrained Leastsquare filtering, Inverse filtering, Wiener Filtering, Object recognition-Patterns and patternclasses,Matching-Minimum Distance classifiers, Neural networks-Background, Training by Back Propagation.

Unit V **IMAGE COMPRESSION** **9 Hours**

Fundamentals, Basic compression methods-Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run – length coding, Lossless and Lossy predictive coding, Block transform coding, Waveletcoding.

Total: 45 Hours

Further Reading:

KL transform and their properties, Homomorphic filtering, Morphological image processing – Erosionand Dilation, Opening and closing, Segmentationusing morphological watersheds,Applications of neuralnetworks in image processing, Digital image watermarking.

Course Outcomes:

After completion of the course, Student will be able to

1. Analyze the image using image transforms.
2. Develop a methodology for smoothening and sharpening of the image
3. Segment the image using edge detection, thresholding and region based approach.
4. Develop a method to restore the image and object recognition
5. Compress the image using lossy and lossless compression techniques.

References:

1. C.Rafeal Gonzalez and E.Richard Woods, Digital Image Processing, Third Edition, Pearson Education 2008.
2. Anil K.Jain, Fundamentals of Digital Image Processing, PHI, 2010.
3. S Jayaraman, S Esakkirajan T Veerakumar, Digital Image Processing , Mc Graw- Hill, 2010
4. K.William Pratt, Digital Image Processing, John Wiley, 1997.
5. M.A.Sid Ahmed, Image Processing Theory, Algorithm and Architectures, McGraw - Hill, 1995.

1702EC751	Microwave and Optical Communication Lab	L	T	P	C
		0	0	4	2

Course Objectives:

1. To have a detailed practical study on microwave equipmentsand microstrip components.
2. To study the optical devices and to use in appropriate application.

List of Experiments:

MICROWAVE EXPERIMENTS:

1. Reflex Klystron – Mode characteristics
2. Gunn Diode – Characteristics
3. VSWR, Frequency and Wave Length Measurement
4. Directional Coupler – Directivity and Coupling Coefficient – S – parameter Measurement
5. Circulator – S - parameter measurement
6. Attenuation and Power measurement
7. S - matrix Characterization of E-Plane T, H-Plane T and Magic T.
8. Radiation Pattern of Antennas.
9. Antenna Gain Measurement

OPTICAL EXPERIMENTS:

1. DC characteristics of LED and PIN Photo Diode.
2. Mode Characteristics of Fibers.
3. Measurement of Connector and Bending Losses.
4. Fiber Optic Analog and Digital Link
5. Numerical Aperture Determination for Fibers
6. Attenuation Measurement in Fibers.

Contend Beyond:

- Study of Manchester coding.

Total: 45 Hours

Course Outcomes:

After completion of the course, Student will be able to

1. Able to study and analyze microwave equipments.
2. Able to study and analyze optical devices.

1703MG001	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1. To enable the students to study the evolution of Management
2. To study the functions and principles of management
3. To learn the application of the principles in an organization

Unit I **INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS** **9 Hours**

Definition of Management – Science or Art – Manager Vs Entrepreneur - Types of managers - managerial roles and skills – Evolution of Management – Scientific, Human relations , System and contingency approaches – Types of Business organization - Sole proprietorship, partnership, Company-public and private sector enterprises - Organization culture and Environment – Current trends and issues in Management.

Unit II **PLANNING** **9 Hours**

Nature and purpose of planning – Planning Process – Types of planning – Objectives – Setting objectives – policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

Unit III **ORGANISING** **9 Hours**

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – Delegation of authority – Centralization and Decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, Selection, Training and Development, Performance Management , Career planning and Management.

Unit IV **DIRECTING** **9 Hours**

Foundations of Individual and Group behaviour – Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – Types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication –Communication and IT.

Unit V **CONTROLLING** **9 Hours**

System and process of controlling – Budgetary and non-budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

Total: 45 Hours

Further Reading:

1. Decision roles of managers.
2. Motivational thoughts.

Course Outcomes:

After completion of the course, Student will be able to

1. Explain the elements of Management and Organization.
2. Summarize the types, policies, tools and techniques in Planning in Management
3. Relate the job design and human resource management in Organizing
4. Illustrate the skills of leadership and communication
5. Interpret the controlling techniques in Management

References:

1. Stephen A. Robbins & David A. Decenzo& Mary Coulter, “Fundamentals of Management” 7 th Edition, Pearson Education, 2011.
2. Stephen P. Robbins & Mary Coulter, “Management”, 10th Edition,Prentice Hall (India) Pvt. Ltd., 2009.
3. Robert Kreitner& Mamata Mohapatra, “ Management”, Biztantra, 2008.
4. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6 thEdition,Pearson Education, 2004.
5. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999
6. Harold Koontz & Heinz Weihrich “Essentials of management” Tata McGraw Hill,1998.

1703MG002	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1. To provide an exposure to disasters, their significance and types.
2. To understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
3. To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)

Unit I	INTRODUCTION TO DISASTERS	9 Hours

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc – Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Dos and Don'ts during various types of Disasters.

Unit II	APPROACHES TO DISASTER RISK REDUCTION (DRR)	9 Hours

Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies

Unit III	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9 Hours

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.

Unit IV	DISASTER RISK MANAGEMENT IN INDIA	9 Hours

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy) - Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

Unit V	DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS	9 Hours

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

	Total:	45 Hours

Further Reading:

1. Discussion about the Air Pollution and Nuclear pollution - case studies
2. DRR Master Planning for the Future

Course Outcomes:

After completion of the course, Student will be able to

1. Develop an understanding of the key concepts, definitions a key perspectives of all Hazards Emergency Management
2. Differentiate the types of disasters, causes and their impact on environment and society
3. Assess vulnerability and various methods of risk reduction measures as well as mitigation.
4. Draw the hazard and vulnerability profile of India, Scenarios in the Indian context,
5. Disaster damage assessment and management

References:

1. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012
2. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
3. KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010
4. Dr.Mirnalinipandey- "Disaster Management", wiley India Pvt Ltd.
5. C. K. Rajan, NavalePandharinath"Earth and Atmospheric Disaster Management : Nature an Manmade" B S Publication
6. Shailesh Shukla, Shamna Hussain "Biodiversity, Environment and Disaster Management Unique Publications

1703MG005	TOTALQUALITYMANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn concepts, dimension quality and philosophies ofTQM.
2. To study the TQM principles and itsstrategies.
3. To impart knowledge on TQM tools for continuous improvement.

Unit I	INTRODUCTION	9 Hours

Definition of Quality - Dimensions of Quality - Quality Planning - Quality costs - Analysis Techniques for Quality Costs - Basic concepts of Total Quality Management - Historical Review - Quality Statements - Strategic Planning, Deming Philosophy - Crosby philosophy - Continuous Process Improvement - JuranTrilogy, PDSA Cycle, 5S, Kaizen - Obstacles to TQM Implementation

Unit II	TQM PRINCIPLES	9 Hours

Principles of TQM, Leadership - Concepts - Role of Senior Management - Quality Council, Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits - Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy, Performance Measure

Unit III	STATISTICAL PROCESS CONTROL (SPC)	9 Hours

The seven tools of quality - Statistical Fundamentals - Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables X bar and R chart and attributes P, NP, C, and u charts, Industrial Examples, Process capability, Concept of six sigma - New seven Management tools

Unit IV	TQM TOOLS	9 Hours

Benchmarking - Reasons to Benchmark - Benchmarking Process, Quality Function Deployment(QFD)- House of Quality, QFD Process, and Benefits - Taguchi Quality Loss Function - Total Productive Maintenance (TPM) - Concept, Improvement Needs, and FMEA - Stages of FMEA- Casestudies

Unit V	QUALITY SYSTEMS	9 Hours

Concept, Requirements of ISO 9000 and Other Quality Systems - ISO 9000:2000 Quality System - Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 9000:2005 and 9001:2015, ISO 14000.

Total:	45 Hours

Further Reading:

1. Case Study: TQM Quality and Environmental Concepts in real World Applications
2. Environment Management system

Course Outcomes:

After completion of the course, Student will be able to

1. Understand the concepts, dimension quality and philosophies ofTQM.
2. Understand the principles of TQM and itsstrategies.
3. Apply seven statistical quality and managementtools
4. Understand TQM tools for continuousimprovement.
5. Understand the QMS andEMS

References:

1. Rathakrishnan, Gas Dynamics, 5th edition, PHI Learing Private Limited,2013.
2. N. Gupta and B. Valarmathi, Total Quality Management, Tata McGraw-Hill Publishing Company Pvt. Ltd., New Delhi,2009.
3. S. Kumar, Total Quality Management, Laxmi Publications Ltd. New Delhi,2006
4. P.N. Muherjee, Total Quality Management, Prentice Hall of India, New Delhi,2006.
5. DaleH.Besterfiled, Total Quality Management, Pearson Education Inc., New Delhi,2003.
6. James R. Evans and William M. Lidsay, The Management and Control of Quality, South- Western2002.

1703MG006	INDUSTRIAL ECONOMICS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the concepts of micro, macroeconomic systems and business decisions in industry.
2. To acquire knowledge on laws of demand & supply and methods of forecasting thedemand
3. To emphasis the systematic evaluation of the costs, breakeven point for return on economics and diseconomies

Unit I	INTRODUCTION	9 Hours

Introduction to Industrial economics- Micro and Macro economics - Kinds of Economic Systems - Production PossibilityFrontier - Opportunity Cost - Objective of Organizations - Kinds of Organization.

Unit II	DEMAND AND SUPPLY	9 Hours

Functions of Demand and Supply - Law of diminishing Marginal Utility - Law of Demand and SupplyElasticity of Demand - Demand Forecasting Methods - Indifference curve.

Unit III	PRODUCTION AND COST	9 Hours

Production Function - Returns to Scale - Law of Variable Proportion - Cost and Revenue concepts and Cost Curves - Revenue curves - Economies and Dis-Economies of scale - Break Even point.

Unit IV	MARKET STRUCTURE	9 Hours

Market Structure - Perfect Competition - Monopoly - Monopolistic - Oligopoly - Components of Pricing - Methods f Pricing - Capital Budgeting IRR - ARR - NPV - Return on Investment - Payback Period.

Unit V	INTRODUCTION TO MACRO ECONOMICS AND FINANCIAL ACCOUNTING	9 Hours

National Income - Calculation Methods - Problems - Inflation - Deflation - Business Cycle - Taxes - Direct and Indirect Taxes - Fiscal and monetary policies.

	Total:	45 Hours

Further Reading:

1. Nature and characteristics of Indian Economy
2. Role and functions of Central bank - LPG - GATT - WTO.

Course Outcomes:

After completion of the course, Student will be able to

1. Understand the micro and macroeconomic environment for a favorable businessenvironment
2. Apply laws of demand and supply in engineering economy and forecast thedemand
3. Evaluate the various costs and breakeven point for organizationalprofitability
4. Analyze the pricing, payback on investments and e-commercecompletions.
5. Asses the influence of macro level economics, taxation in businesses and financial accountingprocess

References:

1. A Ramachandra Aryasri and V V Ramana Murthy, Engineering Economics and Financial Accounting, Tata McGraw Hill Publishing Company Limited, New Delhi,2006.
2. R Kesavan, C Elanchezhianand T Sunder Selwyn, Engineering Economics and Financial Accounting, Laxmi Publication Ltd, New Delhi,2005.
3. V L Samuel Paul and G S Gupta,Managerial Economics Concepts and Cases, Tata McGraw Hill Publishing Company Limited, New Delhi,1981.
4. S N Maheswari, Financial and Management Accounting, SultanChand
5. V L Samuel Paul and G S Gupta, Managerial Economics-Concepts andCases.
6. Barthwal R.R., Industrial Economics - An Introductory Text Book, New Age.

1703MG007	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the recent subsequent development of global trends and development methodologies of various types of products and services
2. To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
3. To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification

Unit I	FUNDAMENTALS OF PRODUCT DEVELOPMENT	9 Hours

Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

Unit II	REQUIREMENTS AND SYSTEMDESIGN	9 Hours

Requirement Engineering - Types of Requirements - Quality Function Deployment & Phases - Modeling - Requirement Management - Introduction to System Modeling – System Optimization-System Specification.

Unit III	DESIGN AND TESTING	9 Hours

Introduction to Concept generation Techniques - Concept Screening & Evaluation - Detailed Design - Component Design and Verification - High Level /Low Level product Design - S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing.

Unit IV	SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT	9 Hours

Sustenance -Maintenance and Repair – Enhancements - Product EOL - Obsolescence Management – Configuration Management - EOL Disposal

Unit V	BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY	9 Hours

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development Processes - Product Development Trade-offs - Intellectual Property Rights – Security and Configuration Management.

	Total:	45 Hours

Further Reading:

1. Rapid Prototyping and Rapid Manufacturing
2. PESTLE Analysis

Course Outcomes:

After completion of the course, Student will be able to

1. Define, formulate and analyze a problem
2. Solve specific problems independently or as part of a team
3. Gain knowledge of the Innovation & Product Development process in the Business Context
4. Work independently and also in teams
5. Manage a project from beginning to end

References:

1. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013
2. Hiriyappa B, ―Corporate Strategy – Managing the Business‖, Author House, 2013.
3. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
4. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.
5. 4. Peter F Drucker, ―People and Performance‖, Butterworth – Heinemann [Elsevier], Oxford, 2004.
6. Vinod Kumar Garg and Venkita Krishnan N K

1703EC021	ADVANCED DIGITAL SIGNALPROCESSING	L	T	P	C
		3	0	0	3

Course Objectives: To provide in-depth treatment on methods and techniques in

1. Discrete-time signal transforms, digital filter design, optimal filtering
2. Power spectrum estimation, multi-rate digital signal processing
3. DSP architectures which are of importance in the areas of signal processing, control and communications.

Unit I **Parametric Methods for Power Spectrum Estimation** **9 Hours**

Relationship Between Auto Correlation and Model Parameters: The Yule Walker method for the AR model parameters - the Burg method for the AR model parameters – unconstrained least square method for the AR model parameters - sequential estimation methods for the AR model parameters.

Unit II **Non-Parametric Methods for Power Spectrum Estimation** **9 Hours**

Estimation of spectra from finite duration observation of signals; Non-Parametric Methods: Bartlett - Welch and Blackman - Tukey method.

Unit III **Adaptive Signal Processing** **9 Hours**

FIR Adaptive Filters: Steepest descent adaptive filter - LMS algorithm - convergence of LMSalgorithms; Applications: Noise cancellation - channel equalization; Adaptive recursivefilters - recursive least squares.

Unit IV **Multirate Signal Processing** **9 Hours**

Decimation by a factor D – Interpolation by a factor I – Filter design and implementation forsampling rate conversion; Direct form FIR filter structures – Polyphase filter structure.

Unit V **Discrete Transforms** **9 Hours**

Discrete Transforms: Discrete Fourier transform - discrete cosine transform; WaveletTransform: Introduction - Haar scaling functions and function spaces- nested spaces –Haarwavelet function - orthogonality of $\varphi(t)$ and $\psi(t)$ - normalization of Haar bases at differentscales - Daubechies wavelets -support of wavelet system.

Total: **45Hours**

Further Reading: http://www.ti.com/processors/dsp/overview.html

Course Outcomes:

After completion of the course, Student will be able to

1. To design adaptive filters for a given application
2. To design multirate DSP systems.

References:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI. 2003.
2. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling", Wiley, 2002.
3. Roberto Crist, "Modern Digital Signal Processing", Thomson Brooks/ Cole, 2004.
4. Raghuveer. M. Rao and AjitS.Bopardikar, "Wavelet Transforms: Introduction to Theoryand Applications", Pearson Education, Asia, 2000.
5. K. P Soman, K. I Ramachanadran and N.G Reshmi, "Insights into Wavelets: From
6. Theory to Practice", 3rd Edition, Prentice Hall of India, 2010.

1703EC022	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

1. In this course it is aimed to Understand the fundamentals of embedded systemsdifferences of microprocessor and controller.
2. Understand the microcontroller architecture and pin diagrams.
3. Understand and able to write the assemble languageprogram.
4. Understand and able to write the I/O andtimers/counter programming
5. To use the embedded controllers In real time applications

Unit I	Embedded system introduction	9 Hours

Introduction to embedded system, embedded system architecture, classifications of embedded systems, challenges and design issues in embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC,fundamentals of Vonneuman/Harvard architectures, types of microcontrollers, selection of microcontrollers.

Unit II	Microcontroller (89C51 & 89S51 & 89S52)	9 Hours

Microcontroller-Pin diagram of each series -Complete Pin description-Difference between 8031, 8051, 8052-Addressing modes -Instruction sets used in ATMEL-Types of instructions -Timers/Counters with I/O ports -Applications using timers/counters-Simple programs.

Unit III	AVR Architecture	9 Hours

Brief History of AVR Microcontrollers, Architecture of AVR Atmega32x Microcontroller, Pin diagram, AVR Family Overview, Atmega32 Family Members, AVR Assembly Language Programming.

Unit IV	I/O Device Interfacing	9 Hours

Assembly Language and Embedded C Programming- Interfacing Simple I/O Devices Like LED, Seven Segment, LCD, Switches -89c51 and AVR controller

Unit V	Embedded controllers Application	9 Hours

Sensor Interfacing and Signal Conditioning, Relay Interfacing, Optoisolator and Stepper Motor Interfacing, PWM Programming and DC Motor Control and various control applications.

Total: 45Hours

Further Reading: Serial communications, i2c communications

Course Outcomes:

After completion of the course, Student will be able to

1. Explain 8051,52 and AVR Microcontroller Architecture.
2. Develop an Assembly Language Program..
3. Build an interface for I/O Devices using Embedded C and ALP
4. Make use of internal and external peripherals.
5. Develop an interface for Sensors and Actuators.

References:

1. Programming PIC microcontrollers with PIC basic by chuck helebuyck
2. PIC microcontrollers-programming in basic by Milan verle.
3. Mohammad Ali Mazidi, Sarmad Naimi, SepehrNaimi; The AVR Microcontroller and Embedded Systems using Assembly and C; 1stEdition,Pearson Education India.
4. Dhananjay Gadre; Programming and Customizing the AVR Microcontroller; 1 st Edition, McGraw Hill.
5. The 8051 Microcontroller and Embedded Systems Using Assembly and C Second Edition Muhammad Ali Mazidi Janice GillispieMazidiRolin D. McKinlay

EMBEDDED SYSTEMS LABORATORY		
List of Experiments:		
1. StudyofARMevaluationsystem		
2. InterfacingADCandDAC		
3. InterfacingLEDandPWM		
4. Interfacingrealtimeclock and serial port		
5. InterfacingkeyboardandLCD		
6. InterfacingEPROMand interrupt		
7. Mailbox		
8. InterruptperformancecharacteristicsofARMandFPGA		
9. FlashingofLED's		
10. Interfacingsteppermotor andtemperaturesensor		
11. Implementingzigbeeprotocolwith ARM		
	Total:	**45 Hours**
Additional Experiments:		
1. LCD display using Arduino processor		
2. Interfacing of keyboard and serial port using Arduino processor		
Course Outcomes:		
After completion of the course, Student will be able to		
1. Writeprogramsin ARMforaspecificApplication		
2. InterfaceA/Dand D/AconvertorswithARMsystem		
3. Writeprogrammesforinterfacingkeyboard,display,motorandsensor		
4. Formulateamini project inembeddedsystem		
References:		
1. Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011		
2. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008		
3. David A. Bell, "Electronic Devices and Circuits", Fifth Edition, Oxford University Press, 2008		
4. Millman J. and Taub H., "Pulse Digital and Switching Waveforms", TMH, 2000		
5. Millman and Halkias. C., Integrated Electronics, TMH, 2007		

1703EC023	PATTERN RECOGNITION AND MACHINE LEARNING (Common to B.E / B.Tech – CSE, IT & ECE)	L	T	P	C
		3	0	0	3

Course Objectives:

1. Provide knowledge of models, methods and tools used to solve regression, classification, feature selection and density estimation problems
2. Provide knowledge of learning and adaptation in supervised modes of learning
3. Provide knowledge of recognition, decision making and statistical learning problems.
4. Provide knowledge of current research topics and issues in Pattern Recognition and Machine Learning
5. Provide knowledge about linear functions

Unit I	SPEECH FUNDAMENTALS	9 Hours

Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods

Unit II	VLSI SIGNAL PROCESSING	9 Hours

An overview of DSP concepts- Representations of DSP algorithms.- Loop bound and iteration bound-Transformation Techniques: Retiming, Folding and Unfolding

Unit III	RF SYSTEM DESIGN	9 Hours

Characteristics- amplifier power relations- stability considerations- constant gain circles- constant VSWR circles- low noise circles broadband- high power and multistage amplifiers.

Unit IV	MULTIMEDIA COMMUNICATION	9 Hours

Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.

Unit V	CLOUD COMPUTING	12 Hours

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models:- Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

Total:	45 + 15 Hours

Further Reading:

Dimensional Reduction and Model Selection, On Feature Selection in Gaussian Mixture Clustering

Course Outcomes:

After completion of the course, Student will be able to

1:Identify areas where Pattern Recognition and Machine Learning can offer a solution

2: Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems

3: Describe genetic algorithms, validation methods and sampling techniques

4 :l Describe some discriminative, generative and kernel based techniques

5 :Describe and model sequential data

References:

1.Lawrence RabinerandBiing-Hwang Juang, “Fundamentals of Speech Recognition”, Pearson Education, 2003

2. Keshab k. Parhi,” VLSI Digital Signal Processing Systems: Design and Implementation”, Wiley, inter science

3.Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, First Edition, 2001.

1703EC024	SPEECH PROCESSING	L	T	P	C
		3	0	0	3

Course Objectives:

1. To make the students to understand the digital Speech fundamentals.
2. To study the digital models and processing of speech signal
3. To acquire the basic knowledge in filters, voice enhancement, voice restoration and compression techniques.

Unit I **SPEECHPRODUCTION MODEL** **9 Hours**

1D soundwaves-functional blockoftheVocal tractmodel–Linear predictiveco-efficients(LPC)-Auto-correlation method-Levinson-durbinalgorithm-Auto-co- variancemethod-Latticestructure-Computationof Latticeco-efficientfromLPC-Phonetic Representation of speech-Perception of Loudness - Critical bands – Pitch perception – Auditory masking.

Unit II **FEATURE EXTRACTION OFTHE SPEECH SIGNAL** **9 Hours**

Endpointdetection-Dynamic time warping-Pitch frequency estimation: Autocorrelation approach- Homomorphic approach-Formant frequency estimationusingvocaltract modelandHomomorphicapproach-Linearpredictive co-efficient -Poles of the vocal tract-Reflectionco-efficient-LogArearatio

Unit III **FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING** **9 Hours**

Cepstrum-Linespectralfrequencies-Functionalblocksoftheear-Melfrequencycepstral co-efficients-Spectrogram-Timeresolution versus frequency resolution-Discrete waveletransformation.

Unit IV **PATTERN RECOGNITION FORSPEECHDETECTION** **9 Hours**

Back-propagationNeuralNetwork-SupportVector Machine-HiddenMarkovModel (HMM)-GaussianMixtureModel(GMM)-Unsupervised Learningsystem:K-MeansandFuzzy K-meansclustering-Kohonenself-organizingmap- Dimensionality reduction techniques: Principle component analysis (PCA), Linear discriminantanalysis (LDA),Kernel-LDA(KLDA), Independentcomponent analysis(ICA).

Unit V **SPEECH ANALYSIS AND SYNTHESIS** **9 Hours**

Non-uniformquantization for Gaussiandistributeddata-Adaptive quantization-Differential pulsecodemodulation-CodeExitedLinearprediction(CELP)-Quality assessmentofthe compressedspeechsignal TexttoSpeech (TTS)analysis–Evolutionofspeech synthesis systems-Unit selection methods - TTSApplications

Total: 45 Hours

Further Reading:

Phonetic Mechanisms in Speech Perception
Disorders of Peripheral and Central Auditory Processing
Neurobiology of Statistical Information Processing in the Auditory Domain

Course Outcomes:

After completion of the course, Student will be able to

1. Illustratehowthespeechproductionis modeled
2. Summarizethevarioustechniquesinvolvedincollectingthefeaturesfromthe speechsignal in bothtime andfrequency domain
3. summarize thefunctional blocksof the ear.
4. compare thevarious pattern recognition techniques involved in speech and speakerdetection
5. summarize thevarious speechcompression techniques

References:

1. L.R.Rabinerand R.W.Schafer," Introduction to Digital speech processing",now publishersUSA,2007
2. E.S.Gopi,"Digital speechprocessingusingmatlab",Springer,2014
3. L.R.Rabinerand R.W.Schafer,"Digitalprocessing of speech signals", PrenticeHall,1978
4. T.F.Quatieri,"Discrete-timeSpeechSignal Processing",Prentice-Hall,PTR,2001
5. L.Hanzaetal,"Voice CompressionandCommunications",Wiley/ IEEE,2001.

1703EC025	VLSI Signal Processing	L	T	P	C
		3	0	0	3

Course Objectives:

1. To enable students to design VLSI systems with high speed and low power.
2. To encourage students to develop a working knowledge of the central ideas of implementation of DSP algorithm with optimized hardware.

Unit I	INTRODUCTION TO DSP SYSTEMS	9 Hours

An overview of DSP concepts, Representations of DSP algorithms. Systolic Architecture Design: FIR Systolic Array, Matrix-Matrix Multiplication, 2D Systolic Array Design. Digital Lattice Filter Structures: Schur Algorithm, Derivation of One-Multiplier Lattice Filter, Normalised Lattice Filter, Pipelining of Lattice Filter.

Unit II	PIPELINING AND RETIMING	9 Hours

Scaling and Round off Noise - State variable description of digital filters, Scaling and Round off Noise computation, Round off Noise in Pipelined IIR Filters, Round off Noise Computation using state variable description, Slow-down, Retiming and Pipelining.

Unit III	BIT-LEVEL ARITHMETIC ARCHITECTURES	9 Hours

Bit level arithmetic Architectures- parallel multipliers, interleaved floor-plan and bit-plane- based digital filters, Bit serial multipliers, Bit serial filter design and implementation, Canonic signed digit arithmetic, Distributed arithmetic.

Unit IV	REDUNANT ARTITHMETIC	9 Hours

Redundant arithmetic -Redundant number representations carry free radix-2 addition and subtraction, Hybrid radix-4 addition, Radix-2 hybrid redundant multiplication architectures, data format conversion, Redundant to Non redundant converter.

Unit V	NUMERICAL STRENGTH REDUCTION	9 Hours

Numerical Strength Reduction - Subexpression Elimination, Multiple Constant Multiplication, Subexpression Sharing in Digital Filters, Additive and Multiplicative Number Splitting.

	Total:	45 Hours

Further Reading:

1. Special decoders
2. Sparse array processing

Course Outcomes:

After completion of the course, Student will be able to

1. Understand basics of DSP systems
2. Know about algorithmic strength reduction
3. Convolute IIR filters
4. Identify bit level arithmetic algorithms
5. Compare protocols

References:

1. Keshab K. Parhi, " VLSI Digital Signal Processing Systems, Design and implementation ", Wiley, Interscience, 2007
2. U. Meyer – Baese, " Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004

1703EC026	RF SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the basics of system design
2. To understand the concepts of radio architectures
3. To introduce to the students the transmitter and receiver system design techniques and analysis
4. To learn the applications of RF systems in wireless communication.

Unit I	**TRANSCEIVER ARCHITECTURES**	**9 Hours**

Heterodyne and Homodyne architectures, Discrete and CMOS realization passive components for RF, Impedance Matching, Distortion, IIP3 and Blocking Effects, Noise Figure, Noise matching conditions. Friis Formula for cascaded blocks.

Unit II	**CMOS LNAS AND MIXERS**	**9 Hours**

Noise Figure of and impedance matching issues CS, CG and differential LNAs, Passive mixers and conversion loss, Active mixers, Gilbert cells, linearity and Noise Figure of mixers

Unit III	**OSCILLATORS**	**9 Hours**

Negative transconductance, nonlinearity and Differential LC tuned oscillators, Ring oscillators and Colpitts oscillator, Quadrature oscillators–Phase noise

Unit IV	**PLLS AND SYNTHESIZERS**	**9 Hours**

Phase Detectors, charge pumps and their transfer functions, Synthesizers based on first, second and third order PLLs and stability issues, Introduction to integer and fractional N synthesizers

Unit V	**POWER AMPLIFIERS**	**9 Hours**

Class A, B, C, D, E, F and AB power amplifiers, Linearization and impedance matching issues of power amplifiers.

Total: 45 Hours

Further Reading:

Measurement of noise, jitter, SFDR, intermodulation products for RF system

Course Outcomes:

After completion of the course, Student will be able to

1. Understand radio transceiver architectures.
2. Design and Analyze CMOS LNAs , Mixers
3. Design and AnalyzeOscillators, PLLs,
4. Design and AnalyzeSynthesizers and Power Amplifiers.

References:

1. B. Razavi, ―RF Microelectronics‖, Pearson Education, 2nd edition,2012.
2. Thomas Lee, ―The Design of CMOS Radio Frequency Integrated Circuits, Cambridge University Press, Second Edition, 2004
3. Zhipei Chi, *High Performance, High Speed VLSI Architectures for Wireless Communication Applications* University of Minnesota, 2000.