E.G.S. PILLAY ENGINEERINGCOLLEGE

(Autonomous)

Approved byAICTE,New Delhi|Affiliated to AnnaUniversity, Chennai Accredited byNAAC with „A"Grade|Accredited byNBA (CSE, EEE, MECH)

NAGAPATTINAM–611002

B.E.Electronics and Communication Engineering

Full Time Curriculum and Syllabus

Final Year– Seventh Semester

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
1702EC752	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

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:

Employability

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:

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

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

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 Diode 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, 2008.	
5. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.	

Entrepreneurship

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

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

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

Entrepreneurship

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

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
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1702EC704	IMAGE PROCESSING	L	T	P	C
		3	0	0	3
	(Common to ECE/CSE/IT)				

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, basic enhancement 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 – Erosion and Dilation, Opening and closing, Segmentation using morphological watersheds, Applications of neural networks in image processing, Digital image watermarking.

Course Outcomes:

Entrepreneurship

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.

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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.

Content 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 th Edition,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: - Skill Development

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.Mrinalinipandey- "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

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
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Nagapattinam (Dt) Tamil Nadu.

1703MG005	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn concepts, dimension quality and philosophies of TQM.
2. To study the TQM principles and its strategies.
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 of TQM.
	2. Understand the principles of TQM and its strategies.
	3. Apply seven statistical quality and management tools
	4. Understand TQM tools for continuous improvement.
	5. Understand the QMS and EMS
References:	
1.	Rathakrishnan, Gas Dynamics, 5th edition, PHI Learing Private Limited,2013.
2.	N. Gupta and S. 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. Mukherjee, 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 diseconomics				
Unit I	INTRODUCTION				**9 Hours**
Introduction to Industrial economics- Micro and Macro economics - Kinds of Economic Systems - Production Possibility Frontier - 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 Supply Elasticity 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				

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 Businessl, 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 J. Drucker – –People and Performancel, Butterworth – Heinemann [Elsevier], Oxford, 2004.
6. Vinod Kumar Garg and Venkita Krishnan N K

Professional Electives – VI

1703EC021	ADVANCED DIGITAL SIGNAL PROCESSING	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:	**45 Hours**
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.

Employability / Entrepreneurship

References:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, PHI, 2005.
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 Ajit S. Bopardikar, 'Wavelet Transforms: Introduction to Theoryand Applications", Pearson Education, Asia, 2000.
5. K. P Soman, K. I Ramachandran and N G Reshmi, "Insights into Wavelets: From
6. Theory to Practice", 3rd Edition, Prentice Hall of India, 2010.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

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 systems differences of microprocessor and controller.
2. Understand the microcontroller architecture and pin diagrams.
3. Understand and able to write the assemble language program.
4. Understand and able to write the I/O and timers/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 microcontroilers.

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, Opto isolator 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. Understand the micro and macroeconomic environment for a favorable business environment
	2. Apply laws of demand and supply in engineering economy and forecast the demand
	3. Evaluate the various costs and breakeven point for organizational profitability
	4. Analyze the pricing, payback on investments and e-commerce completions.
	5. Asses the influence of macro level economics, taxation in businesses and financial accounting process
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 Elanchezhian and 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. Banuwal 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		

	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 GillispieMazidi Rolin D. McKinlay

	EMBEDDED SYSTEMS LABORATORY		
List of Experiments:			
1.	StudyofARMevaluationsystem		
2.	InterfacingADC andDAC		
3.	Interfacing LCDand PWM		
4.	Interfacing real timeclock and serial port		
5.	Interfacingkeyboard,stepper motor and CLCD		
6.	InterfacingEPROMand interrupt		
7.	Mailbox		
8.	Interrupt performancecharacteristicsofARMandFPGA		
9.	FlashingofLED's		
10.	Interfacingstepper motor andtemperaturesensor		
11.	Implementation ofCANprotocol with 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.	Writeprograms in ARMforaspecificApplication		
2.	Interface A/Dand D/Aconvertorswith ARMsystem		
3.	Writeprogrammesforinterfacingkeyboard,display,motorandsensor		
4.	Formulatemini project inembeddedsystem		
References:			
1.	Sedra and Smith, "Micro Electronic Circuits", Sixth Edition, Oxford University Press, 2011		
2.	Robert L. Boylestad and Louis Nashelesky, "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		

Entrepreneurship

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1703EC923	PATTERN RECOGNITION AND MACHINE LEARNING	L	T	P	C
		3	0	0	3
	(Common to B.E / B.Tech – CSE, IT & ECE)				
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, Pipelining 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:

Employability

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 .Describe some discriminative, generative and kernel based techniques

5 .Describe and model sequential data

References:

1.Lawrence Rabiner and B. 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 P. Bretchko, "RF Circuit Design -- Theory and Applications, Pearson Education Asia, First Edition, 2001

Dr. S. RAMABALAN, M.E., PH.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
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Nagapattinam (Dt) Tamil Nadu.

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	SPEECH PRODUCTION MODEL	**9 Hours**

1D sound waves-functional block of the vocal tract model –Linear predictive co- efficients (LPC) -Auto-correlation method-Levinson-durbin algorithm-Auto-co- variance method-Lattice structure-Computation of

Lattice co-efficient from LPC-Phonetic Representation of speech-Perception of Loudness - Critical bands – Pitch perception – Auditory masking.		
Unit II	**FEATURE EXTRACTION OF THE SPEECH SIGNAL**	**9 Hours**
Endpoint detection-Dynamic time warping- Pitch frequency estimation: Autocorrelation approach- Homomorphic approach-Formant frequency estimation using vocal tract model and Homomorphic approach-Linear predictive co-efficient -Poles of the vocal tract-Reflection co-efficient-Log Arearatio		
Unit III	**FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING**	**9 Hours**
Cepstrum- Line spectral frequencies- Functional blocks of the ear- Mel frequency cepstral co-efficients-Spectrogram-Time resolution versus frequency resolution-Discrete wavelettransformation.		
Unit IV	**PATTERN RECOGNITION FOR SPEECH DETECTION**	**9 Hours**
Back-propagation Neural Network-Support Vector Machine- Hidden Markov Model (HMM)-Gaussian Mixture Model(GMM) -Unsupervised Learning systems- K-Means and Fuzzy K-means clustering - Kohonen self-organizing map- Dimensionality reduction techniques: Principle component analysis (PCA), Linear discriminant analysis (LDA), Kernel-LDA (KLDA), Independent component analysis(ICA).		
Unit V	**SPEECH ANALYSIS AND SYNTHESIS**	**9 Hours**
Non-uniform quantization for Gaussian distributed data- Adaptive quantization-Differential pulse code modulation-Code Exited Linear prediction (CELP)- Quality assessment of the compressed speech signal Text to Speech (TTS) analysis –Evolution of speech synthesis systems-Unit selection methods - TTS Applications		
	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. Illustrate how the speech production is modeled
2. Summarize the various techniques involved in collecting the features from the speech signal in both time and frequency domain
3. Summarize the functional blocks of the ear.
4. Compare the various pattern recognition techniques involved in speech and speaker detection
5. Summarize the various speech compression techniques

References:

1. *L.R.Rabiner and R.W.Schafer," Introduction to Digital speech processing",now publishers USA,2007*
2. *E.S.Gopi,"Digital speech processing using matlab",Springer,2014*
3. *L.R.Rabiner and R.W.Schafer,"Digital processing of speech signals", PrenticeHall,1978*
4. *T.F.Quatieri,"Discrete-time Speech Signal Processing", Prentice-Hall, PTR,2001*
5. *L.Hanzaelal,"Voice Compression and Communications", 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	REDUNDANT ARITHMETIC	**9 Hours**
Redundant arithmetic- Redundant bit 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 Number Multiplier, Number Splitting.		
	Total:	**45 Hours**

Further Reading:

1. Special decoders
2. Systolic array processing

Entrepreneurship/ Employability

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. Convolve 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, 1999.
2. U. Meyer – Baese " Digital Signal Processing with Field Programmable Gate Arrays", Springer, Second Edition, 2004.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

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, Detection, 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 Analyze Oscillators, PLLs,
4. Design and Analyze synthesizers 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.

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NAGAPATTINAM–611002

B.E. Electronics and Communication Engineering

Full Time Curriculum and Syllabus

Fourth Year– Eighth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
	Professional Elective -VII	3	-	-	3	40	60	100
	Professional Elective -VIII	3	-	-	3	40	60	100
	Professional Elective – IX	3	-	-	3	40	60	100
Laboratory Course								
1704EC851	Project Work	-	-	18	9	50	50	100
	Total	**9**	-	**18**	**18**	**170**	**230**	**400**
Professional Elective - VII								
1703EC027	Multimedia Communication	3	0	0	3	40	60	100
1703EC028	Wireless Sensor Networks	3	0	0	3	40	60	100
1703EC029	Radar and Navigation Aids	3	0	0	3	40	60	100
1703EC030	Microwave Integrated Circuits	3	0	0	3	40	60	100
1703EC031	Satellite Communication	3	0	0	3	40	60	100
Professional Elective – VIII								
1703EC032	System on Chip Design	3	0	0	3	40	60	100
1703EC033	Network on Chip Design	3	0	0	3	40	60	100
1703EC034	Low Power VLSI Design	3	0	0	3	40	60	100
1703EC035	Analog IC Design	3	0	0	3	40	60	100
1703EC036	Mixed Signal CMOS Design	3	0	0	3	40	60	100

Professional Elective - IX								
1703EC037	Electromagnetic Interference and Compatibility	3	0	0	3	40	60	100
1703EC038	Digital System Design and Testing	3	0	0	3	40	60	100
1703EC039	Optical Networks	3	0	0	3	40	60	100
1703EC040	RF MEMS	3	0	0	3	40	60	100
1703EC041	Digital Switching and Transmission	3	0	0	3	40	60	100
1703EC042	ARM Processors	3	0	0	3	40	60	100
1703EC043	Mobile Computing	3	0	0	3	40	60	100

Professional Elective – VII

1703EC027	MULTIMEDIA COMMUNICATIONS	L	T	P	C
		3	0	0	3
	(Common to B.E / B.Tech –ECE, CSE, IT)				

Course Objectives:

1. To have a detailed knowledge of compression and decompression techniques
2. To introduce the concepts of multimedia communication
3. To introduce standards of MPEG

Unit I	**Introduction to Multimedia Communications**	**5 Hours**

Components of multimedia system. Desirable features, Applications of multimedia systems, Introduction to different types. Multimedia storage device.

Unit II	**Digital audio representation**	**9 Hours**

Digital audio representation and processing-time domain and transform domain representations. Coding standards, transmission and processing of digital audio. Musical instrument synthesizers.

Unit III	**Image coding algorithms**	**12 Hours**

Still image coding-JPEG. Discrete cosine Transform. Sequential and Progressive DCT based encoding algorithms, lossless coding, hierarchical coding. Basic concepts of discrete wavelet transform coding and embedded image coding algorithms. Introduction to JPEG2000.

Unit IV	**MPEG**	**9 Hours**

Feature of MPEG 1, structure of encoding and decoding process, MPEG 2 enhancements, and different blocks of MPEG video encoder.

Unit V	**Video coding**	**10 Hours**

Content based video coding, overview of MPEG 4 video, motion estimation and compensation. Different coding techniques and verification models. Block diagram of MPEG 4 video encoder and decoder. An overview of H261 and H263 video coding techniques.

Total:	**45**

Further Reading:

1. Advanced compression techniques
2. Coding Techniques

Course Outcomes:

After completion of the course, Student will be able to

1. Describe various multimedia components
2. Describe compression and decompression techniques
3. Apply the compression concepts in multimedia communication
4. Describe the video encoding
5. To know the digital audio representation

References:

1. Fred Halsall, "Multimedia Communications", Pearson education, 2001

2. J.S. Chitode, **"Information coding techniques"**, Technical publications, 1st edition 2007.
3. Raif steinmetz, Klara Nahrstedt, **"Multimedia: Computing, Communications and Applications"**, Pearson education, 2002
4. John Billamil, Louis Molina, **"Multimedia : An Introduction"**, PHI, 2002

1703EC028	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3
	(Common to B.E / B.Tech – CSE, IT & ECE)				

Course Objectives:

1. To study about Wireless networks, protocol stack and standards.
2. To study about fundamentals of 3G Services, its protocols and applications.
3. To study about evolution of 4G Networks, its architecture and applications.

Unit I WIRELESS NETWORK ARCHITECTURE **9 Hours**

Introduction-Wireless network logical architecture – Network physical architecture- Wireless LAN standards: System architecture, protocol architecture, physical layer, MAC layer, 802.11 Enhancements – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth- VoWLAN and VoIP security – WPA- IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

Unit II ADHOC AND SENSOR NETWORKS **9 Hours**

Introduction – Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6- Mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing- Characteristics of MANETs, Table-driven and Source-Initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks-Classification, MAC and Routing protocols

Unit III PROTOCOLS AND TCP/IP SUIT **9 Hours**

The Need for a Protocol Architecture - The TCP/IP Protocol Architecture - The OSI Model - Internetworking TCP enhancements for wireless protocols - Traditional TCP: Windows based Congestion control, fast retransmit/fast recovery, Influences of mobility on TCP mechanism - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks

Unit IV DESIGN OF WIRELESS WIDE AREA NETWORK **9 Hours**

Basics of indoor RF planning- Three phases of wireless network design- Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: link budgets for GSM, CDMA, 3G-MSC, 3G- SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)systems - LTE network architecture and protocol

Unit V CURRENT AND FUTURE OF WIRELESS NETWORKING TECHNOLOGY **9 Hours**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – Leading edge WNT: Wireless mesh network routing- Network independent roaming- Gigabit wireless LANs- OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio

Total: 45 Hours

Further Reading:

Signal Encoding Techniques, Cordless Systems and Wireless Local Loop
Equalization, Coding, and Diversity, Heterogeneous Wireless Networks

Course Outcomes:

Entrepreneurship

After completion of the course, Student will be able to

1. Conversant with the latest 3G/4G and WiMAX networks and its architecture.
2. Design and implement Routing Techniques
3. Analyze wireless network environment for any application using latest wireless protocols and standards.
4. Compare and Analyze the Different types Networks
5. Implement different type of applications for smart phones and mobile devices with latest network strategies.

References:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", First Edition, Pearson Education 2013

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1703EC029	RADAR AND NAVIGATION AIDS	L	T	P	C
		3	0	0	3

Course Objectives:

1. Able to understand radar equations and types of radar
2. Able to understand aids and navigation systems
3. Obtain the knowledge of Doppler effects and equations nd detect the moving objects

Unit I	RADAR EQUATIONS	9 Hours

RADAR Block Diagram & operation- RADAR Frequencies- RADAR Equation- Detection of signals in Noise- RADAR cross section of targets- RADAR cross section fluctuations- transmitter power- pulse repetition frequency- system losses and propagation effects

Unit II	MTI AND PULSE DOPPLER RADAR	9 Hours

Introduction to Doppler & MTI RADAR- Delay Line canceller- Moving Target Detector- Pulse Doppler RADAR- Non-Coherent MTE- CW RADAR- FMCW RADAR- Tracking RADAR- Monopulse Tracking – Conical Scan and Sequential Lobing.

Unit III	RADAR SIGNAL DETECTION AND PROPAGATION ON WAVES	9 Hours

Detection criteria- automatic detection- constant false alarm rate receiver- information available from a RADAR- ambiguity diagram- pulse compression- introduction to clutter- surface clutter RADAR equation- anomalous propagation and diffraction.

Unit IV	TRACKING , MAGING AND SCANNING RADAR	9 Hours

Tracking with radar ,monopulse tracking ,conical scan and sequential lobing, low angle tracking ,air surveillance radar, Introduction to synthetic aperture radar ,tracking in range and Doppler ,acquisition Principle of phased array for electronic scanning ,and its operation .Radio ranges: LF/MF four course radio ranges ,VHF omni directional range ,vor receiving equipment, Hyperbolic system of navigation :LCRAN,DECCA

Unit V	SATELLITE NAVIGATIONAL SYSTEM	9 Hours

Instrument landing system, Ground controlled approach system, Microwave landing system, Distance measuring equipment ,TACAN Doppler navigation _Doppler effect, Track stabilization .SATELLITE navigation :GPS principle of operation ,position location determination, principle of GPS receiver and applications

	Total:	45 Hours

Further Reading:

GPS principle of operation, Position location determination, principle of GPS receiver and applications

Course Outcomes:

Employability

After completion of the course, Student will be able to

1. Students equipped to find the range and tracking moving object
2. Learn the equations of radar and Doppler effect
3. Study the satellite navigation system
4. Learn the range equation
5. Understand Principles of navigation and landing aids

References:

1. "Introduction to radar system", Merrill I.skolnik ,3rd edition Tata McGraw hill 2003.
2. "Elements electronic navigation system" ,N.S.Nagaraja ,2nd edition Tata McGraw hill 2000.
3. " Principle of Radar" J.C Toomay ,PHI 2nd edition 2004.
4. " Radar Principles ",Peyton Z. Peebles ,John Wiley ,2004.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1703EC030	MICROWAVE INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To enhance the students knowledge in the area of planar microwave engineering and to make them understand the intricacies in the design of microwave circuits.
2. To impart knowledge about the state of art in MIC technology.

Unit I	**INTRODUCTION TO MICROWAVE CIRCUITS**	**9 Hours**
Definitions – Frequency Bands - Lumped versus Distributed Circuits - Behavior of finite length transmission lines – General Characteristics of PC Boards – Transmission Lines on PC Boards – Passives made from Transmission Lines – Resonators - Combiners, Splitters and Couplers		
Unit II	**MATCHING NETWORKS AND FILTER DESIGN**	**9 Hours**
Circuit Representation of two port RF/Microwave Networks: Low Frequency Parameters, High Frequency Parameters, Transmission Matrix, ZY Smith Chart, Design of Matching Circuits using Lumped Elements, Matching Network Design using Distributed Elements, Filter design.		
Unit III	**AMPLIFIERS AND OSCILLATORS**	**9 Hours**
Amplifiers: Stability considerations in active networks – Gain Consideration in Amplifiers – Noise Consideration in active networks – Broadband Amplifier design – Low Noise Amplifier Design, Oscillators: Oscillator versus Amplifier Design - Oscillation conditions – Design and stability considerations of Microwave Transistor Oscillators		
Unit IV	**MIXERS AND CONTROL CIRCUITS**	**9 Hours**
Mixer Types – Conversion Loss – SSB and DSB Mixers – Design of Mixers: Single Ended Mixers – Single Balanced Mixers - Sub Harmonic Diode Mixers , Microwave Diodes , Phase Shifters – PIN Diode Attenuators		
Unit V	**MICROWAVE IC DESIGN AND MEASUREMENT TECHNIQUES**	**12 Hours**
Microwave Integrated Circuits – MIC Materials, Hybrid versus Monolithic MICs – Multichip Module Technology , Fabrication Techniques, Miniaturization techniques, Introduction to SOC, SOP, Test fixture measurements, probe station measurements, thermal and cryogenic measurements, experimental field probing techniques.		
	Total:	**45 + 15 Hours**

Further Reading:

1. Monolithic Microwave Integrated circuit (mmic) technology for space communication applications
2. Integrated Microwave packaging Antenna design

Course Outcomes:

After completion of the course, Student will be able to

1. Equipped from fundamentals to recent techniques in MIC technology.
2. Independently design and assess the performance of various planar configurations.
3. Know measurement techniques
4. Able to design microwave amplifiers and oscillators
5. Able to design lumped and distributed elements.

Entrepreneurship

References:

1. Thomas H.Lee, "Planar Microwave Engineering", Cambridge University Press, 2004.
2. Matthew M. Radmanesh, "Radio Frequency and Microwave Electronics", Pearson Education, II Edition, 2001
3. "Microwave Transistor Amplifiers – Analysis and Design", II Edition, Prentice Hall, New Jersy
4. Ravender Goyal, "Monolithic MIC: Technology & Design", Artech House, 1989.
5. Gupta K.C. and Amarjit Singh, "Microwave Integrated Circuits", John Wiley, New York, 1975.
6. Hoffman R.K., "Handbook of Microwave Integrated Circuits", Artech House, Boston, 198
7. Ulrich L. Rohde and David P. Newkirk, "Microwave Circuit Design for Wireless Applications", John W

Dr. S. RAMABALAN, M.E., Ph.D.
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1703EC031	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

Course Objectives:

1. To impart knowledge about the Satellite communication.
2. To enhance the students' knowledge in astronomy and space

Unit I	**SATELLITE ORBITS**	**9 Hours**

Introduction - Spectrum allocations for satellite systems -Kepler's Laws - orbital parameters - orbital perturbations - station keeping – Type of orbits - Geo stationary orbits – look angle determination- limits of visibility – eclipse -sub satellite point – sun transit outage - launching procedures - launch vehicles and propulsion.	
Unit II	**SPACE AND EARTH SEGMENT** **9 Hours**
Spacecraft technology- structure- power supply- attitude and orbit control - thermal control and propulsion - communication subsystems - telemetry, tracking and command - TranspondersAntenna subsystem, Equipment reliability. Earth station technology -Receive only home TV systems - MATV – CATV – Transmit Receive Earth Stations.	
Unit III	**SATELLITE ACCESS** **9 Hours**
Modulation and Multiplexing: Voice, Data, Video, Analog - digital transmission system-Digital video broadcast - multiple access: FDMA, TDMA, CDMA - assignment methods -spread spectrum communication -compression – encryption. Mobile satellite Services: GSM, GPS, communication between satellites	
Unit IV	**SATELLITE LINK DESIGN** **9 Hours**
Introduction- Equivalent isotropic radiated power -Transmission Losses – Link power budget equation - System Noise, Carrier to Noise ratio – uplink – downlink – effects of rain – combined uplink and downlink C/N ratio –inter modulation noise - Interference between satellite circuits.	
Unit V	**SATELLITE APPLICATIONS** **12 Hours**
Satellite mobile services – VSAT, Inmarsat- GPS - Globalstar-iridium- Direct Broadcast satellites (DBS) - Direct to home Broadcast (DTH) -Digital audio broadcast (DAB) – World space services, Business TV (BTV) – GRAMSAT - Specialized services: E-mail, Video conferencing, Internet- INTELSAT Series- INSAT – INMARSAT. Remote sensing	
	Total: 45 Hours
Further Reading:	
Latest trend in satellite communication, Recent launching satellites and its application, Communication between satellites, Comparison of satellite	
Course Outcomes:	
After completion of the course, Student will be able to	
1. Discuss orbital mechanics and launch methodologies.	
2. Describe various space subsystems.	
3. Explain different subsystems of earth segment	
4. Design and analyze link power budget for satellites	
5. Describe in various Satellite Applications	
References:	
1. Wilbur L. Pritchard, Henri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007	
2. N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.	
3. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Bostan London, 1997.	
4. Tri T. Ha, "Digital Satellite Communication" II nd edition, 1990.	
5. Emanuel Fthenakis, "Manual of Satellite Communications", Mc Graw Hill Book Co., 1984.	
6. Robert G. Winch, "Telecommunication Trans Mission Systems", Mc Graw-Hill Book Co., 1983	
7. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.	
8. G.B.Bleazard, "Introducing Satellite communications", NCC Publication, 1985.	
9. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan 2003.	

Professional Electives – VIII

1703EC032	SYSTEM ON CHIP DESIGN	L	T	P	C
		3	0	0	3
Course Objectives:					

	1. To introduce architecture and design concepts underlying system on chips	
	2. To gain knowledge of designing SoCs	
	3. To impart knowledge about the hardware-software design of a modest complexity chip the way from specifications, modeling, synthesis and physical design	
Unit I	**: SYSTEM ARCHITECTURE: OVERVIEW**	**9 Hours**
Components of the system –Processor architectures –Memory and addressing –system level interconnection –SoC design requirements and specifications –design integration –design complexity – cycle time, die area and cost, ideal and practical scaling, area-time-power tradeoff in processor design, Configurability		
Unit II	**PROCESSOR SELECTION FOR SOC**	**9 Hours**
Overview –Soft processors, processor core selection, Basic concepts–instruction set, branches, interrupts and exceptions. Basic elements in instruction handling –Minimizing pipeline delays –reducing the cost of branches –Robust processors –Vector processors, VLIW processors, Superscalar processors.		
Unit III	**MEMORY DESIGN**	**9 Hours**
SoC external memory, SoC internal memory, Scratch pads and cache memory –cache organization and write policies –strategies for line replacement at miss time –split I-and D-caches –multilevel caches –SoC memory systems –board based memory systems –simple processor/memory interaction		
Unit IV	**INTERCONNECT ARCHITECTURES AND SOC CUSTOMIZATION**	**9 Hours**
Bus architectures –SoC standard buses –AMBA, CoreConnect –Processor customization approaches Reconfigurable technologies –mapping designs onto reconfigurable devices -FPGA based design – Architecture of FPGA, FPGA interconnect technology, FPGA memory, Floor plan and routing.		
Unit V	**FPGA BASED EMBEDDED PROCESSOR**	**9 Hours**
Hardware –software task partitioning – FPGA fabric Immersed Processors –Soft Processors and Hard Processors –Tool flow for Hardware/Software Co-design–Interfacing Processor with memory and peripherals – Types of Custom interfaces –Wishbone interface, Avalon Switch Matrix, OPB Bus Interface, Creating a Customized Microcontroller -FPGA-based Signal interfacing and Conditioning		
	Total:	**45 Hours**

Further Readings

1.Modern system design trends
2.MPSoCs design

Employability / Entrepreneurship

Course Outcomes:

After completion of the course, Student will be able to

1.Explain all important components of a System-on-Chip and an embedded system, i.e. digital hardware and embedded software
2.Outline the major design flows for digital hardware and embedded software
3.Discuss the major architectures and trade-offs concerning performance, cost and power consumption of single chip and embedded systems
4.Gain the knowledge of designing SoCs.
5.Understand designing complexity in specification ,Modelling, synthesis and physical design.

References:

1. Michael J. Flynn and Wayne Luk, Computer System Design: System-on-Chip", John Wiley and sons, 2011
2. Rahul Dubey, "Introduction to Embedded System Design Using Field Programmable Gate Arrays", Springer Verlag London Ltd., 2009.
3. Sudeep Pasricha and Nikil Dutt,On-Chip Communication Architectures-System on Chip Interconnect, Elsevier, 2008
4. Wayne Wolf "Modern VLSI Design – System – on – Chip Design", Prentice Hall, 3rd Edition, 2008.
5. Wayne Wolf Modern VLSI Design – IP based Design, Prentice Hall, 4th Edition, 2008.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1703EC033	NETWORK ON CHIP	L	T	P	C
		3	0	0	3

Course Objectives:

1. Understand the various classes of Interconnection networks
2. Learn about different routing techniques for on-chip network
3. Knows the importance of flow control in on-chip network

Unit I	ICN ARCHITECTURE — **9 Hours**

Introduction - Classification of ICNs - Topologies - Direct networks - Indirect networks-Performance analysis

Unit II	SWITCHING TECHNOLOGIES — **9 Hours**

Basic switching techniques - Virtual channels - Hybrid switching techniques Optimizing switching techniques - Comparison of switching techniques - Deadlock, livelock and Starvation

Unit III	ROUTING TECHNOLOGIES — **9 Hours**

Taxonomy of routing algorithms - Deterministic routing algorithms - Partially adaptive algorithms - Fully adaptive algorithms - Routing in MINs - Routing in switch-based networks with irregular topologies - Resource allocation policies Flow control

Unit IV	NETWORK ON CHIP — **9 Hours**

NoC Architectures - Router architecture - Area, energy and reliability constraints - NoC design Iternatives - Quality-of-Service (QoS) issues in NoC architectures

Unit V	EMERGING TRENDS — **9 Hours**

Fault-tolerance issues - Emerging on-chip interconnection technologies- 3D NoC- Simulation

Total:	**45 Hours**

Further Readings

1. Multiprocessor System on chip (MpSOC)
2. NoC in Real time systems (RTS)

Course Outcomes:

After completion of the course, Student will be able to

1. Identify the major components required to design an on-chip network
2. Compare different switching techniques
3. Evaluate the performance of given on chip process
4. Demonstrate the dead lock free and live lock free routing protocols
5. Simulate and assess the performance of given on chip network

References:

1. Jose Duato, Sudhakar Yalamanchili, Lionel Ni, "Interconnection Networks: An Engineering Approach", Morgan Kaufmann, 2002
2. William James Dally, Brian Towles, "Principles and Practices of Interconnection Networks", Morgan Kaufmann, 2004
3. Giovanni De Micheli, Luca Benini, "Networks on Chips: Technology and Tools", Morgan Kaufmann, 2006
4. Natalie D. Enright Jerger, Li-Shiuan Peh, "On-Chip Networks (Synthesis Lectures on Computer Architecture)", Morgan and Claypool, 2001
5. Fayez Gebali, Haytham Elmiligi, Mohamed Watheq El-Kharashi, "Networks-on-Chips: Theory and Practice", CRC Press, 2008

1703EC034	LOW POWER VLSI DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

1. Identify sources of power in an IC.
2. Identify the power reduction techniques based on technology independent and technology dependent

	Power dissipation mechanism in various MOS logic style.
	Identify suitable techniques to reduce the power dissipation.
	Design memory circuits with low power dissipation.

Unit I	POWER DISSIPATION IN CMOS	**9 Hours**
Hierarchy of limits of power – Sources of power consumption – Physics of power dissipation in CMOS FET devices – Basic principle of low power design.		
Unit II	POWER OPTIMIZATION	**9 Hours**
Logic level power optimization – Circuit level low power design – circuit techniques for reducing power consumption in adders and multipliers.		
Unit III	DESIGN OF LOW POWER CMOS CIRCUITS	**9 Hours**
Computer arithmetic techniques for low power system – reducing power consumption in memories – low power clock, Inter connect and layout design – Advanced techniques – Special techniques.		
Unit IV	POWER ESTIMATION	**9 Hours**
Power Estimation techniques – logic power estimation – Simulation power analysis –Probabilistic power analysis.		
Unit V	SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER	**9 Hours**
Synthesis for low power – Behavioral level transform – software design for low power.		
	Total:	**45 Hours**

Further Reading:

Dual VDD architecture, High VDD for critical paths and low VDD for non-critical paths.

Course Outcomes:

After completion of the course, Student will be able to

1. Know the basics and advanced techniques in low power design
2. Know the recent trend in power dissipation.
3. Explain the low power CMOS circuits
4. Analyze Power Estimation in low power
5. Synthesis the Low Power Circuits.

References:

1. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.
2. Kaushik Roy and S.C.Prasad, "Low power CMOS VLSI circuit design", Wiley, 2000.
3. DimitrieSoudris, ChristianPignet, Costas Goutis, "Designing CMOS Circuits for Low Power", Kluwer, 2002.
4. J.B.Kuo and J.H.Lou, "Low voltage CMOS VLSI Circuits", Wiley 1999.
5. A.P.Chandrasekaran and R.W.Brodersen, "Low power digital CMOS design", Kluwer,1995.
6. AbdelatifBelaouar, Mohamed I.Elmasry, "Low power digital VLSI design", Kluwer, 1995.
7. James B.Kuo, Shih-Chia Lin, "Low voltage SOI CMOS VLSI devices and Circuits", John Wiley and sons, inc.2001.

1703EC035	ANALOG IC DESIGN	L	T	P	C
		3	0	0	3

Course Objectives:

To impart knowledge about the Analog VLSI Design.

To enhance the students' knowledge in classical VLSI Design

Unit I	MOS DEVICES AND CIRCUITS	**9 Hours**
Evolution of ICs - VLSI design flow - Device modeling -Moore_s law- MOS transistors- depletion and enhancement mode operations - NMOS and CMOS inverter circuits - Stick diagram and Layout diagram- Two input NAND and NOR circuits using CMOS		
Unit II	FABRICATION OF ICS	**9 Hours**

NMOS and CMOS fabrication – N-well, P-well and twin tub processes		
Unit III	IMPLEMENTATION STRATEGIES	9 Hours
PLDs – PAL, PLA, CPLD, Full custom and Semi custom ASIC design- Standard cell design, FPGA building block architectures, FPGA interconnect – Routing – FPGA, Xilinx 4000 series - Altera Cyclone III		
Unit IV	CURRENT TRENDS	9 Hours
BiCMOS and GaAs devices- Introduction to Low power VLSI circuit techniques - Introduction to analog and mixed signal design.		
Unit V	VERILOG HARDWARE DESCRIPTION LANGUAGE	9 Hours
Introduction to Verilog HDL –Behavior modeling –Tasks and functions -Verilog structure, syntax and semantics. Gate level modeling – Dataflow modeling Design examples - Adders, Multiplexers, Flip Flops, Registers, counters		
	Total:	45 Hours
Further Reading:		
Analog Design Essentials		
Stability and Frequency Compensation		
Course Outcomes:		
After completion of this course, Student will be able to		
1. Explain the operation and characteristics of MOS transistor		
2. Discuss the steps involved in fabrication of IC		
3. Outline the role of stick diagram and Layout diagram		
4. Discuss the basic concepts of FPGA and ASIC		
5. Use the Verilog HDL for digital design		
References:		
1. Pucknell D.A and Eshraghian K, "Basic VLSI Design", PHI publication, Second Edition, 2011.		
2. Charles H. Roth, "Digital Systems Design Using VHDL", CL Engineering/Cengage Learning India, 2012.		
3. Samir Palnitkar, "Verilog HDL Guide to Digital design and synthesis", Second Edition Pearson Education, 2006.		
4. M.J. Smith "Application specific integrated circuits", Addison Wesley, 2008.		
5. West N and Eshraghian K, "Principles of CMOS VLSI Design", Addison Wesley Publication, Second Edition, 1993.		

1703EC036	MIXED SIGNAL CMOS DESIGN	L	T	P	C
		3	0	0	3
Course Objectives:	1. To know mixed signal circuits like DAC, ADC, PLL etc. 2. To gain knowledge on filter design in mixed signal mode. 3. To acquire knowledge on design different architectures in mixed signal mode.				
Unit I	CMOS AMPLIFIERS BASICS				9 Hours
Introduction to MOS Capacitances- passive components and their parasitic- small and large signal modelling and analysis- Different Single stage and Differential Amplifiers- Current Mirrors.					
Unit II	MULTI-STAGE AMPLIFIERS				9 Hours
Telescopic and Folded cascode amplifiers- Slew-rate, Pole splitting-Two-stage amplifiers – analysis-Frequency response- Stability compensation- Common mode feedback analysis-feedback amplifier topologies.					
Unit III	CIRCUIT DESIGN				9 Hours
Custom Circuit design-Cell based and Array based design implementations- Static and Dynamic Characteristics of CMOS inverter-Power dissipation-Logical effort- Module 2 Designing combinational and sequential circuits.					

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NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

First Year – First Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1901MA104	Engineering Mathematics –I (Linear Algebra, Calculus and Partial differentiation)	3	1	0	4	40	60	100
1901CH102	Chemistry for Electronic Engineers	3	0	0	3	40	60	100
1901GEX03	Programming for Problem Solving	3	0	0	3	40	60	100
1901ENX01	English for Engineers	2	0	0	2	100	-	100
Laboratory Course								
1901GEX52	Computer Programming Lab	0	0	2	1	50	50	100
1901GEX51	Engineering Intelligence I	0	0	2	1	50	50	100
1901CHX51	Engineering Chemistry Lab	0	0	2	1	50	50	100
1901HS151	Communication Skills	0	0	2	1	100	0	100
Total		**11**	**1**	**8**	**16**	**470**	**330**	**800**

L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester

1901MA104	MATHEMATICS –I (LINEAR ALGEBRA, CALCULUS AND PARTIAL DIFFERENTIATION)	L	T	P	C
		3	1	0	4

(Common for ECE, MECH & BME Programme)

MODULE I MATRICES **9 Hours**

Inverse and rank of a matrix - rank-nullity theorem - System of linear equations – Symmetric-skew-symmetric and orthogonal matrices – Determinants - Eigen values and Eigen vectors-Diagonalization of matrices-Cayley-Hamilton Theorem - Orthogonal transformation.

MODULE II DIFFERENTIAL CALCULUS **9 Hours**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature- Evaluates and involutes.

MODULE III INTEGRAL CALCULUS **9 Hours**

Double integration – Cartesian and polar coordinates – Change the order of Integration – Applications: Area of a curved surface using double integral – Triple integration in Cartesian co-ordinates – Volume as triple integral.

MODULE IV SEQUENCES AND SERIES **9 Hours**

Convergence of sequence and series-Tests for convergence - Power series - Taylor's series, Series for exponential - trigonometric and logarithm functions.

MODULE V PARTIAL DIFFERENTIATION **9 Hours**

Partial derivatives, total derivative; Maxima, minima and saddle points; Method of Lagrange multipliers.

TOTAL: 45 HOURS

REFERENCES:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2018.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

1901CH102 **CHEMISTRY FOR ELECTRONIC ENGINEERS** **L T P C**
(Common for ECE & EEE Programme) **3 0 0 3**

Employability | Entrepreneurship

MODULE I **9 Hours**

Electrochemistry- Cell Terminology-Electrochemical cells- Electrolytic cells- Cell reactions- Daniel cell- Difference between electrolytic cells and electrochemical cells. Reversible cells and irreversible cells -types- EMF and its applications - Nernst equation (derivation and problems). Single electrode potential - Hydrogen electrode - Calomel electrode - Glass electrode - pH measurement using glass electrode.

MODULE II **9 Hours**

Semiconductors- Conductors, insulators, semiconductors, – Band theory semiconductors – Junction devices – Super conductivity – Ionic conductivity – defects in stoichiometric and Non stoichiometric crystals. Optical properties of solids – Lasers and phosphors – Photovoltaic effect- Solar energy storage and conversion materials.

MODULE III **9 Hours**

Materials for communications - crystalline semiconductors; metalized film conductors; dielectric films; solders; ceramics and polymers. Electronic materials, Semiconductor crystals - Silicon, III–V compounds, Photoresist films, Packaging materials, Photonic materials, Crystalline materials - Epitaxial layers, Optical switching, Optical transmission-NLO and OLED Materials.

MODULE IV **9 Hours**

Biosensors- biosensors -types of biosensors- magnetic biosensors, thermal biosensors- piezoelectric biosensors- optical biosensors - applications of biosensor. introduction: classification of polymers – natural and synthetic; thermoplastic and thermosetting. conducting polymers, electron conducting polymers- polyaniline (pan), polypyrroles (ppy), polythiophenes (pt) and polyphenylene vinylenes (ppv) - light emitting diodes , photo-induced doping.

MODULE V **9 Hours**

Nanotechnology - Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: nano cluster, nano rod, nanotube (CNT) and nanowire. Synthesis: precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and applications.

TOTAL: 45 HOURS

REFERENCES:

1. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New delhi 2010
3. Gowariker V.R., Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age .
4. Ozin G. A. and Arsenault A. C., "Nanochemistry: A Chemical Approach to Nanomaterials", RSC Publishing, 2005
5. Biosensors: An Introductory Textbook by C. S. Pundir and Jagriti Narang,2017
6. J.O.M.Bockris & A.K.N.Reddy, "Modern Electrochemistry –Vol. I & II" , Plenum Press, New York, 2000
7. Peter Atkins and Julio de Paula, "Physical Chemistry", VII Edition, Oxford University Press, New York, 2002.
8. A.J. Bard and L.R. Faulkner, "Electrochemical Methods – Fundamentals and applications" 3 rd edition John Wiley & Sons Inc, 2001.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

	PROGRAMMING FOR PROBLEM SOLVING	L	T	P	C
1901GEX03	(Common for all B.E./B.Tech Programme)	3	0	3	4

Entrepreneurship

MODULE I INTODUCTION TO PROGRAMMING **9 Hours**

Components of Computers and its Classifications- Problem Solving Techniques – Algorithm- Flowchart–Pseudo code – Program-Compilation -Execution

MODULE II BASICS OF C PROGRAMMING **9 Hours**

Structure of C program - C programming: Data Types – Storage classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/output statements – Decision making statements - Switch statement - Looping statements – Pre-processor directives.

MODULE III ARRAYS AND STRINGS **9 Hours**

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – Example Program: Matrix Operations - String operations

MODULE IV FUNCTIONS AND POINTERS **9 Hours**

Introduction to functions: Function prototype, function definition, function call, Built-in functions – Recursion – Example Program – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference

MODULE V STRUCTURES & FILE PROCESSING **9 Hours**

Structure - Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Dynamic memory allocation -Files – Types - File processing: Sequential access, Random access - Command line arguments

TOTAL: 45 HOURS

REFERENCES:

1. Paul Deitel and Harvey Deitel, —C How to Program‖, Seventh edition, Pearson Publication
2. Juneja, B. L and Anita Seth, —Programming in C‖, CENGAGE Learning India pvt. Ltd., 2011
3. Pradip Dey, Manas Ghosh, —Fundamentals of Computing and Programming in C‖, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, —Computer Fundamentals and Programming in C‖, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C",McGraw-Hill Education, 1996.

Dr. S. RAMABALAN, M.E., Ph.D.
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1901ENX01 **ENGLISH FOR ENGINEERS** **L T P C**

(Common for all B.E./B.Tech. Programme) **3 0 0 3**

Skill Development

MODULE I FOCUS ON LANGUAGE (Vocabulary and Grammar) **9 Hours**

Vocabulary -The Concept of Word Formation - prefixes- suffixes- Synonyms – Antonyms - Grammar -Articles- Preposition- Adjective-Adverb-connectives -Tenses (present, past & future) - Sentence pattern- types of sentences -Active voice –passive voice and Impersonal passive voice - Wh- Questions.

MODULE II LISTENING SKILLS **9 Hours**

Listening- listening intently-arousing and sustaining interest-listening to short or longer texts- formal and informal conversations- telephonic etiquettes- narratives from different sources. -listening and Note taking- correlative verbal and nonverbal communication-listening to TOEFL & IELTS programs-listening to Project presentation- listening to technical seminar and conferences.

MODULE III SPEAKING SKILLS **9 Hours**

Speaking - stress and intonation –persuasive speaking -Describing person, place and thing - sharing personal information — greetings –taking leave -Individual and Group Presentation-impromptu Presentation-public speaking-Group Discussion- project planning-facing viva voce and delivering project.

MODULE IV READING SKILLS **9 Hours**

Reading– comprehending general and technical articles -cloze reading - inductive reading- short narrative and descriptions from newspapers – Skimming and scanning-reading and interpretation-critical reading interpreting and transferring graphical information- sequencing of sentences-analytical reading on various Projects.

MODULE V WRITING SKILLS **9 Hours**

Writing- Precise writing –Summarizing- interpreting visual texts (pie chart, bar chart, picture - advertisements etc., - Proposal writing (launching new units or department in a institution or industry & to get loan from bank) -report writing (accident, progress, project, survey, Industrial visit)- job application- e-mail drafting- letter writing (permission, accepting and decaling)-instructions – recommendations –checklist

TOTAL: 45 HOURS

REFERENCES:

1. Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: Principles and Practice", Oxford University Press, New Delhi, 2011.
2. Rizvi and Ashraf M., "Effective Technical Communication", Tata McGraw-Hill, New Delhi, 2005.
3. G. Radhakrishna Pillai, "English for Success", Central Institute of English and Foreign Languages", Emerald Publishers ,Hyderabad, 2003
4. Jones, D, "The Pronunciation of English", CUP, . Cambridge,2002.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1901GNX51	ENGINEERING INTELLIGENCE I (Common for all B.E./B.Tech. Programme)	L	T	P	C
		0	0	2	1

MODULE I BEHAVIORAL CHANGES – TRANSITION OF SCHOOL TO COLLEGE **6 Hours**

Vocabulary -The Concept of Word Formation - prefixes- suffixes- Synonyms – Antonyms - Grammar - Articles-Preposition- Adjective-Adverb-connectives -Tenses (present, past & future) - Sentence pattern-types of sentences -Active voice –passive voice and Impersonal passive voice - Wh- Questions.

MODULE II EXPOSURE TO INDIVIDUAL COMPETANCE **6 Hours**

Listening- listening intently-arousing and sustaining interest-listening to short or longer texts- formal and informal conversations- telephonic etiquettes- narratives from different sources. -listening and Note taking- correlative verbal and nonverbal communication-listening to TOEFL & IELTS programs-listening to Project presentation- listening to technical seminar and conferences.

MODULE III CAREER PLANNING **6 Hours**

Speaking - stress and intonation –persuasive speaking -Describing person, place and thing - sharing personal information — greetings –taking leave -Individual and Group Presentation-impromptu Presentation-public speaking-Group Discussion- project planning-facing viva voce and delivering project.

MODULE IV INTRODUCTION TO COMMUNICATION SKILLS **6 Hours**

Reading– comprehending general and technical articles -cloze reading - inductive reading- short narrative and descriptions from newspapers – Skimming and scanning-reading and interpretation-critical reading interpreting and transferring graphical information- sequencing of sentences-analytical reading on various Projects.

MODULE V COMMUNICATION EXERCISE-1 **6 Hours**

Writing- Precise writing –Summarizing- interpreting visual texts (pie chart, bar chart, picture - advertisements etc., - Proposal writing (launching new units or department in a institution or industry & to get loan from bank) -report writing (accident, progress, project, survey, Industrial visit)- job application-e-mail drafting- letter writing (permission, accepting and decaling)-instructions – **recommendations –checklist**

TOTAL: 30 HOURS

REFERENCES:

1. Dr.P.Prasad(2012) "The Functional Aspects of COMMUNICATION SKILLS";fifth Edition;S.K Kataria &Sons Publication
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.
3. Aruna Koneru (2008) "Professional Communication"; Second edition; Tata McGraw-Hill Publishing Ltd.

1901HS151

COMMUNICATION SKILLSLAB (Common for all B.E./B.Tech. Programme)	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

List of Experiments:

1. **Activities on Fundamentals of Inter-personal Communication**

Starting a conversation - responding appropriately and relevantly - using the right body language - Role Play in different situations & Discourse Skills- using visuals.

2. **Activities on Reading Comprehension**

General Vs Local comprehension, reading for facts, guessing meanings from context, Scanning, skimming, and inferring meaning, critical reading & effective googling.

3. **Activities on Writing Skills**

Structure and presentation of different types of writing - letter writing/ Resume writing/e-correspondence/ Proposal writing/Technical report writing/ Portfolio writing - planning for writing - improving one's writing.

4. **Activities on Presentation Skills**

Oral presentations (individual and group) through JAM sessions / seminars / PPTs and written presentations through posters/ projects/ reports/ e-mails/ assignments etc.- creative and critical thinking.

5. **Activities on Soft Skills**

Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation-Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conferencing and Mock Interviews-Timemanagement-stress management –paralinguistic features- Multiple intelligences – emotionalintelligence – spiritual quotient (ethics) – intercultural communication – creative and critical.

Total: 45 Hours

References:

1. Raman, Meenakshi and Sangeetha Sharma, "Technical Communication: Principles and Practice", Oxford University Press, New Delhi, 2011.
2. Sudha Rani, D , "Advanced Communication Skills Laboratory Manual" , Pearson Education 2011.
3. Paul V. Anderson ,"Technical Communication",. Cengage Learning pvt. Ltd. New Delhi, 2007.
4. "English Vocabulary in Use series", Cambridge University Press 2008.
5. "Management Shapers Series" ,Universities Press (India) Pvt Ltd., Himayatnagar, Hyderabad 2008.
6. Rizvi and Ashraf M., "Effective Technical Communication", Tata McGrawHill, New Delhi, 2005.
7. Jones, D, "The Pronunciation of English", CUP, . Cambridge,2002.

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NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

First Year – Second Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1901MA204	Engineering Mathematics –II (Calculus, Ordinary Differential Equations and Complex Variable)	3	2	0	4	40	60	100
1901PH202	Semiconductor Physics and Optoelectronics	3	0	0	3	40	60	100
1901GEX01	Basic Electrical and Electronics Engineering	3	0	0	3	40	60	100
1901GEX02	Engineering Graphics	2	2	0	3	50	50	100
1901GE201	Engineering Exploration	2	0	0	2	40	60	100
Laboratory Course								
1901GE254	Computer Hardware and IT Essentials Lab	0	0	2	1	50	50	100
1901GE252	Engineering Intelligence - II	0	0	2	1	100	0	100
1901GEX51	CAD Lab	0	0	2	1	50	50	100
1901GEX53	Basic Electrical and Electronics Engineering Lab	0	0	2	1	50	50	100
1901PHX51	Engineering Physics Lab	0	0	2	1	50	50	100

L – Lecture | T – Tutorial | P – Practical | CA – Continuous Assessment | ES – End Semester

1901CHX51

ENGINEERING CHEMISTRY LAB
(Common for all B.E./B.Tech. Programme)

L	T	P	C
0	0	2	1

List of Experiments:

1. Determination of total, temporary & permanent hardness of water by EDTA method
2. Determination of strength of given hydrochloric acid using pH meter
3. Estimation of iron content of the given solution using potentiometer
4. Estimation of sodium present in water using flame photometer
5. Corrosion experiment – weight loss method
6. Determination of molecular weight of a polymer by viscometer method
7. Conductometric titration of strong acid Vs strong Base
8. Estimation of dissolved oxygen in a water sample/sewage by Winkler's method.
9. Comparison of alkalinities of the given water samples
10. Determination of concentration of unknown colored solution using spectrophotometer
11. Determination of percentage of copper in alloy
12. Determination of ferrous iron in cement by spectrophotometry method
13. Adsorption of acetic acid on charcoal
14. Determination the flash point and fire point of a given oil using pen skyMartine closed cup apparatus
15. Determination the calorific value of solid fuels
16. Determination the structural of the compound using chemo software.

Total: 45 Hours

References:

1. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., "Vogel"s Textbook of practical organic chemistry", LBS Singapore (1994).
2. Jeffery G.H., Bassett J., Mendham J.and Denny vogel"s R.C, "Text book of quantitative analysis chemical analysis", ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
3. Daniel R. Palleros, "Experimental organic chemistry" John Wiley & Sons, Inc., New Yor (2001).
4. Kolthoff I.M., Sandell E.B. et al. "Quantitative chemical analysis", Mcmillan, Madras 1980.

1901MA204	ENGINEERING MATHEMATICS – II (Calculus, Ordinary Differential Equations and Complex Variable)	L	T	P	C
		3	2	0	4

MODULE I LAPLACE TRANSFORM Skill Development Entrepreneurship **12 Hours**

Laplace Transform – Conditions for existence – Transform of Elementary Functions – Basic Properties – Transform of Unit step function and Impulse function – Transform of Periodic function – Inverse Laplace Transform – Convolution Theorem (excluding Proof) – Initial and Final value Theorems – Solution of Linear ODE of Second order with constant coefficient using Laplace Transform techniques.

MODULE II VECTOR CALCULUS **12 Hours**

Gradient, Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration: Green"s theorem in a plane, Gauss divergence theorem and Stokes" theorem (excluding proofs) – Applications of the above theorems to find surface area of a closed region and volume of cube and parallel piped.

MODULE III ORDINARY DIFFERENTIAL EQUATIONS **12Hours**

Second order linear differential equations with variable coefficients, method of variation of parameters.

MODULE IV COMPLEX VARIABLE – DIFFERENTIATION **12Hours**

Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; Conformal mappings, Mobius transformations.

MODULE V COMPLEX VARIABLE– INTEGRATION **12 Hours**

Contour integrals, Cauchy Integral formula (without proof), Taylor"s series, zeros of analytic functions, singularities, Laurent"s series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

TOTAL: 60 HOURS

REFERENCES:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
5. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., McGraw Hill, 2004.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
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1901PH202 SEMICONDUCTOR PHYSICS AND OPTOELECTRONICS

L	T	P	C
3	0	0	3

MODULE I ELECTRONIC MATERIALS **9 Hours**

Free electron theory, Density of states and energy band diagrams, Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors and insulators, Occupation probability, Fermi level.

MODULE II SEMICONDUCTORS **9 Hours**

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier- concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal- semiconductor junction (Ohmic and Schottky).

MODULE III SEMICONDUCTOR LASERS **9 Hours**

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain. Semiconductor laser (GaAs): materials, device characteristics, figures of merit and Vertical-Cavity Surface-Emitting Lasers (VECSEL), Tunable semiconductor lasers.

MODULE IV SEMICONDUCTOR PHOTODETECTORS **9 Hours**

Types of semiconductor photodetectors -p-n junction, PIN, and Avalanche and their structure, working principle, and characteristics, Noise limits on performance; Solar cells.

MODULE V NANO- OPTOELECTRONIC DEVICES **9 Hours**

Digital systems: Boolean algebra - Reduction of Boolean expressions - De-Morgan"s theorem - Logic gates - Implementation of Boolean expressions.

TOTAL: 45 HOURS

REFERENCES:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
7. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1901GEX01 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

MODULE I INTRODUCTION TO DC AND AC CIRCUITS **7 Hours**

Introduction to DC and AC circuits: Ohms law - Kirchhoff's laws - Mesh analysis - Nodal analysis - Generation of AC waveforms - Analysis of R-L, R-C, R-L-C circuits - Introduction to three phase systems - Types of connections.

MODULEII ELECTRICAL MACHINES **6 Hours**

Electrical Machines: DC Generator, DC Motor, Transformer, Induction Motor: Working principle, construction and applications.

MODULEIII MEASURING INSTRUMENTS Entrepreneurship **6 Hours**

Measuring instruments: Classification of instruments; Voltmeter, Ammeter, Wattmeter, Energy meter, Multimeter, CRO: Principles and operation.

MODULEIV SEMICONDUCTOR DEVICES Entrepreneurship **7 Hours**

Semiconductor devices: V-I characteristics of PN junction diode and Zener diode; Rectifiers - Half wave and full wave rectifiers; BJT - configurations; Amplifiers & Oscillators: classification, operation and applications; SCR: Construction and V-I characteristics; Basic power converters (Block diagram approach only).

MODULEV DIGITAL SYSTEMS **6 Hours**

Digital systems: Boolean algebra - Reduction of Boolean expressions - De-Morgan's theorem - Logic gates - Implementation of Boolean expressions.

MODULEVI COMMUNICATION SYSTEMS **6 Hours**

Communication Systems: Model of communication system - Analog and digital, Wired and wireless channel - Block diagram of various communication systems - Microwave, satellite, optical fiber and cellular mobile system.

MODULEVII ELECTRICAL SAFETY AND WIRING **7 Hours**

Electrical safety and wiring: Safety measures in electrical system - Safety devices - types of wiring - Wiring accessories- staircase, fluorescent lamps and corridor wiring - Basic principles of earthing - Types of earthing - layout of generation, transmission and distribution of power (Single line diagram).

TOTAL: 45 HOURS

REFERENCES:

1. Smarajit Ghosh, "Fundamentals of Electrical and Electronics Engineering", 2nd Edition, PHI Learning, 2010.
2. R. Muthusubramaniam, S. Salaivahanan and K.A. Mureleedharan, "Basic Electrical Electronics and Computer Engineering",Tata McGraw Hill, 2004.
3. D.P. Kothari and I.J. Nagrath, "Theory and Problems of Basic Electrical Engineering", PHI learning, New Delhi, 2004
4. J.B. Gupta, "Fundamentals of Electrical Engineering and Electronics", S.K. Kataria and Sons, Reprint 2012 Edition.
5. R.L. Boylestad and L. Nashelsky, "Electronic Devices and Circuit Theory", Pearson, 11th Edition, 2013.
6. George Kennedy and Bernard Davis, "Kennedy's Electronic communication Systems", McGraw Hill Education, 5th Edition, 2011.
7. Donald P. Leach, Albert Paul Malvino and Goutam Saha, "Digital Principles and Applications", McGraw-Hill Education, 8th Edition, 2014.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore -611 002.
Nagapattinam (Dt) Tamil Nadu.

1901GEX02	ENGINEERING GRAPHICS	L	T	P	C
		2	2	0	3

MODULE I CONCEPTS AND CONVENTIONS (Not for Examination) **5 Hours**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

MODULEII PLANE CURVES AND FREE HAND SKETCHING **9 Hours**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three-Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of Objects.

MODULEIII PROJECTION OF POINTS, LINES AND PLANE SURFACES **9 Hours**

Orthographic projection- principles-Principal Planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

MODULEIV PROJECTION OF SOLIDS **9 Hours**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

MODULE V PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES **9 Hours**

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

MODULE VI ISOMETRIC AND PERSPECTIVE PROJECTIONS **9 Hours**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 45+5 HOURS

REFERENCES:

1. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore,2016.
2. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
3. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2015.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2017.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2015.
6. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2016.

1901GE201	ENGINEERING EXPLORATION	L	T	P	C
		2	0	0	2

What is Engineering: Engineering Requirement, Knowledge within Engineering disciplines, Engineering advancements

Engineering Design: Problem definition, idea generation through brainstorming and researching, solution creation through evaluating and communicating, text/analysis, final solution and design improvement.

Defining problems and Brainstorming: Researching design, sketching problem solving.

Communicating solution: Dimensioning orthographic drawing, perspective drawing.

Modeling and Testing final output: Product evaluation, reverse engineering, final project report.

Civil Engineering: Structural forces structural analysis, bridge design components, structural design.

Mechanical Engineering: Types of motion, mechanical power system, mechanical power formula, mechanical design.

Electrical Engineering: Reading analog multimeter, measuring current, voltage and resistance, electricity from chemicals, solar cells, magnets, Ohms law and watts law, circuit identification and circuit calculation, resistor color code, continuity.

Computer Engineering: Logic gates, algorithms, computer architecture, binary code.

TOTAL: 30 HOURS

REFERENCES:

1. Ryan A.Brown, Joshua W.Brown and Michael Berkihiser: "Engineering Fundamentals: Design, Principles, and Careers", Goodheart-Willcox Publisher, Second Edition, 2014.
2. Saeed Moaveni ,"Engineering Fundamentals: An Introduction to Engineering", Cengage learning, Fourth Edition, 2011.

1901GE254	COMPUTER HARDWARE AND IT ESSENTIALS LAB	L	T	P	C
		0	0	2	1

List of Experiments:

1. Study of hardware components (such as storage devices, I/O devices, CPU, Motherboard, other peripherals).
2. Installation of operating systems (Windows and Linux).
3. Other software installation.
4. Study of network components.
5. Network establishment(configuring IP address, Domain name system)
6. Study of Internet.
7. Introduction to Web.
8. Usage of internet services- Email, File Sharing, Social Media etc.
9. Study of firewalls and Antivirus.
10. Troubleshooting various problems.

Skill Development

TOTAL: 30 HOURS

REFERENCES:

1. Craig Zacker& John Rourke, "The complete reference:PC hardware", Tata McGrawHill, New Delhi, 2001.
2. Mike Meyers, "Introduction to PC Hardware and Troubleshooting", Tata McGrawHill, New Delhi, 2003.
3. B.Govindarajulu, "IBM PC and Clones hardware trouble shooting and maintenance",
4. Tata McGraw-Hill, New Delhi, 2002
5. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014.
6. James F. Kurose, —Computer networking: A Top-Down Approachl, Sixth Edition, Pearson, 2012.
7. R. Kelly Rainer , Casey G. Cegielski , Brad Prince, Introduction to Information Systems, Fifth Edition, Wiley Publication, 2014
8. Craig Zacker& John Rourke, "The complete reference:PC hardware", Tata McGrawHill, New Delhi, 2001.

Dr. S. RAMABALAN, M.E., Ph.D.
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1901GE252	ENGINEERING INTELLIGENCE II	L	T	P	C
		0	0	2	1

Skill Development

MODULE I VOCABULARY BULIDING **6 Hours**

Parts of Grammar- SVA- Art of Writing- word building activities

MODULEII COMMUNICATION WORKSHOP **6 Hours**

Story Telling- Newspaper Reading-Extempore.

MODULEIII INTERPERSONAL SKILLS **6 Hours**

Personality Development - Creativity and innovation –Critical Thinking and Problem Solving – Work Ethics-Technical Skill Vs Interpersonal Skills

MODULEIV LEADERSHIP& EMPLOYABILITY SKILLS **6 Hours**

Levels of Leadership-Making of leader-Types of leadership-Transactions Vs Transformational Leadership – Exercises - Industry Expectations & Career Opportunities- Recruitment patterns.

MODULE V RESUME BUILDING **6 Hours**

Importance of Resume- Resume Preparation - introducing onself

TOTAL: 30 HOURS

REFERENCES:

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxfor Publishers.
2. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007.
3. Arun Sharma and Meenakshi Upadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
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Nagapattinam (Dt) Tamil Nadu.

1901GEX51	CAD (COMPUTER AIDED DRAFTING) LAB	L	T	P	C
		0	0	2	1

List of Experiments:

Basics commands of a CAD software- two-dimensional drawing, editing, layering and dimensioning - coordinate Systems-Drawing practice - orthographic views of simple solids using CAD software.

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using B-spline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
7. Drawing isometric projection of simple objects.
8. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

TOTAL: 30 HOURS

References:

1. N.D. Bhatt, Machine Drawing, Charotar Publishing House Pvt. Ltd., 2014.
2. P.S. Gill, A Textbook of Machine Drawing, Katson books, 2013.
3. R.K. Dhawan, A Textbook of Machine Drawing, S. Chand,2012.
4. K.C. John, Textbook of Machine Drawing, PHI Learning Pvt. Ltd.,2009.

1901GEX53	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

List of Experiments:

1. Experiments related to verification of Ohm"s law and Kirchhoff"s laws
2. Experiments involving logic gates
3. Fan and light control using regulators
4. Design of 6V regulated power supply
5. Energy conservation demonstration experiment using energy meter
6. Waveform generation and calculation of RMS and average values
7. IC 555 and IC 741 based experiments
8. Experiments in earthing
9. Staircase wiring and residential building wiring
10. Speed control of DC shunt motor

Total: 30 Hours

References:

1. Edward Hughes, " Electrical Technology,", Pearson Education
2. D.P. Kothari and Nagrath" Basic Electronics",MH Education 2013.
3. Paul Scherz and Simon Monk "Practical Electronics for inventors" Mc Graw Hill Publications 2013.

1901PHX51	ENGINEERING PHYSICS LAB	L	T	P	C
		0	0	2	1

List of Experiments:

1. Determination of wavelength of various colours of mercury spectrum using Laser grating
2. Determination of velocity of liquids using ultrasonic interferometer
3. Determine the dispersive power of a prism using spectrometer
4. Determine the unknown resistance of the given wire using Carey-Foster"s Bridge
5. Determine the band gap of the given semiconductor
6. Determine the acceptance angle and particle size using Laser
7. Torsional pendulum – Rigidity modulus of a steel wire
8. Thickness of a thin wire – Air Wedge
9. Measurement of Young"s modulus – Uniform and Non-uniform bending
10. Thermal conductivity –Lee"s Disc method

Total: 45 Hours

References:

1. „Practical Physics", R.K. Shukla, Anchal Srivastava, New age international (2011)
2. „B.Sc. Practical Physics", C.L Arora, S. Chand &Co. (2012)

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B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Full Time Curriculum and Syllabus

Third Year – Fifth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks			Category
						CA	ES	Total	
Theory Course									
1902EC501	Analog Communication	3	0	0	3	40	60	100	PCC
1902EC502	Digital Signal Processing	2	2	0	3	40	60	100	PCC
1902EC503	Transmission Lines and Wave guides	2	2	0	3	40	60	100	PCC
1902EC504	Control Systems	2	2	0	3	40	60	100	PCC
1902EC505	Computer Networks	2	0	0	2	40	60	100	PCC
	Professional Elective – I	3	0	0	3	40	60	100	PEC
Laboratory Course									
1902EC551	Digital Signal Processing Laboratory	0	0	2	1	50	50	100	PCC
1902EC552	Computer Networks Laboratory	0	0	2	1	50	50	100	PCC
1904GE551	Life Skills: Aptitude I	2	0	0	1	100	-	100	EEC
Audit Course									
1901MCX03	Essence of Indian Traditional Knowledge	2	0	0	0	100	-	100	MC
Total		18	6	4	20	**540**	**460**	**1000**	

1902EC501 **ANALOG COMMUNICATION**

L	T	P	C
3	0	0	3

MODULE I AMPLITUDE MODULATION **9 Hours**

Introduction to communication systems – Modulation – Need for modulation – Classifications of modulation techniques – Amplitude Modulation – Generation and Detection of AM – Transmitters and Receivers of AM –Super heterodyne receiver – Double Side Band Suppressed Carrier (DSBSC) systems - generation and detection – Single Side Band (SSB) systems – SSB-SC generation and detection, Vestigial Side Band (VSB) – Comparison of various AM systems.

MODULE II ANGLE MODULATION **9 Hours**

Frequency modulation: Narrowband and wideband FM – Generation of FM signal: Direct FM, indirect FM – Demodulation of FM signals using detectors – FM transmitters – FM receivers – Phase Modulation – Phase Locked Loop – Comparison of AM,FM and PM.

MODULE III NOISE IN COMMUNICATION SYSTEM **9 Hours**

Noise sources and types – External Noise – Internal Noise – Noise calculation – Noise figure – Noise temperature – Noise equivalent bandwidth – Narrowband noise – PSD of in-phase and quadrature noise – Noise in AM receivers – Noise in FM receivers – Pre-emphasis and de-emphasis in FM system – Capture effect and threshold effect – Comparison of noise performance of AM and FM systems.

MODULE IV PULSE MODULATION AND SAMPLING **9 Hours**

PAM – PWM – PPM – Comparison of Pulse modulation – Time Division Multiplexing – Frequency Division Multiplexing – Pulse Time Modulation systems: Generation and detection – Sampling Process: Sampling of Band limited signals – Ideal and practical sampling – Anti aliasing and reconstruction filters.

MODULE V INTRODUCTION TO INFORMATION THEORY **9 Hours**

Measure of information – Entropy and properties – Source coding theorem – Channel coding theorem – Discrete memory less channels – Binary Symmetric Channel – Mutual information – Channel capacity – Shannon Hartley law – Shannon Fano algorithm – Huffman Coding – LZ coding.

Total: 45 Hours

Employability / Entrepreneurship

Further Reading:

1. Working principle of MODEM, AM /FM broadcasting.
2. Design of AM and FM radio, Television Receivers.

References:

1. Simon Haykin, "Communication Systems" John Wiley &Sons , 4th Edition-2016.
2. J.G. Proakis, "Digital Communications" McGraw Hill, 5th edition -2007
3. B.P. Lathi, "Communication Systems" BS Publication-2004.
4. V.Chandrasekar, "Analog communication", Oxford University press-2010
5. P.Rama Krishna rao, Analog Communication, Tata McGraw-Hill-2011
6. Nptel link: https://nptel.ac.in/courses/117/105/117105143/

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902EC502 **DIGITAL SIGNAL PROCESSING**

L	T	P	C
3	2	0	4

MODULE I DISCRETE FOURIER TRANSFORM **9 Hours**

Introduction to DFT and IDFT – Properties of DFT –Filtering methods based on DFT – FFT Algorithms – Decimation in time Algorithms,Decimation in frequency Algorithms.

MODULE II IIR FILTER DESIGN Skill Development **9 Hours**

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design byImpulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF)filter design using frequency translation.

MODULE III FIR FILTER DESIGN Entrepreneurship **9 Hours**

Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques(Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques.

MODULE iV FINITE WORDLENGTH EFFECTS **9 Hours**

Finiteword length effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum.Fixed point and floating point number representations – Quantization- Truncation and Roundingerrors - Quantization noise – quantization error – Overflowerror – Roundoff noise power - limit cycle oscillations due to product round off and overflow errors.

MODULE V DIGITAL SIGNAL PROCESSORS **9 Hours**

Introduction – TMS320c5X Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DSP Processors –TMS320C64XX, TMS320 C54X.

Total: 45+15 Hours

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

1. Spectrum estimation.
2. Linear estimation and prediction

References:

1. J.G. Proakis and D.G. Manolakis, „Digital Signal Processing Principles, Algorithms and Applications", Pearson Education, New Delhi, PHI. 2003.

2. S.K. Mitra, „Digital Signal Processing – A Computer Based Approach", McGraw Hill Edu, 2013.

3. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

4. Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning,2014.

5. P. Ramesh Babu, „Digital Signal Processing",Scitech Publications Pvt Ltd, Fourth Edition - 2011

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902EC503 **TRANSMISSION LINES AND WAVEGUIDES**

L	T	P	C
3	0	0	3

Entrepreneurship

MODULE I TRANSMISSION LINE THEORY **10 Hours**

Generalsolutionoftransmissionline–Thetwostandardformsforvoltageandcurrentof alineterminatedbyanimpedance–Physicalsignificanceoftheequation andtheinfinite line–Reflectioncoefficient–Wavelength andvelocityofpropagation–Waveform distortion–Distortion lesstransmissionline–Thetelephonecable–Inductanceloading of telephone cables – Input impedance of lossless lines – Reflection on a line not terminatedbyZ_o–Transferimpedance–Reflection factorandreflectionloss.

MODULE II THE LINE AT RADIO FREQUENCIES Entrepreneurship **8 Hours**

Standingwavesandstandingwaveratio onaline–Oneeighthwaveline–Quarterwave lineandimpedancematching–Thehalf-waveline–Smith chart – Application of the smith chart – Conversion from impedance to reflection co-efficient and vice-versa – Impedance to admittance conversion and vice-versa – Input impedanceof a lossless lineterminatedby an impedance – Single stub matching and double stub matching.

MODULE III FILTERS AND GUIDED WAVES **9 Hours**

Constant K Filters - Low pass, High pass band, pass band elimination filters - m -derived sections Waves between parallel planes of perfect conductors – Transverse electric and transverse magnetic waves – Characteristics of TE and TM waves – Transverse electromagnetic waves–Velocitiesofpropagation–Componentuniform planewavesbetweenparallel planes – Attenuation of TE and TM waves in parallel plane guides –Wave impedances.

MODULE IV RECTANGULAR WAVEGUIDES **9 Hours**

Transversemagneticwavesinrectangularwave guides – Transverseelectricwavesin rectangular waveguides – Characteristics of TE and TM waves – Cutoff wavelength and phase velocity – Impossibility of TEM waves in waveguides – Dominant mode in rectangularwaveguide– AttenuationofTEandTMmodesin rectangularwaveguide–Wave impedance – Characteristic impedance – Excitation of modes.

MODULE V CIRCULAR WAVE GUIDESAND RESONATORS **9 Hours**

Besselfunctions–Solutionoffieldequationsin cylindricalco-ordinates–TMandTE waves in circular guides –Wave impedancesand characteristic impedance – Dominant modeincircularwaveguide–Excitationof modes–Microwavecavities–Rectangular cavityresonators–Circularcavityresonator–Semicircularcavityresonator–Qfactorof a cavity resonator for TE_{101}mode.

Total: 45Hours

Further Reading: Transmission line equations at radio frequencies - Characteristic impedance of symmetrical networks- Thecirclediagram forthe dissipation less line –composite filters.

References:

1. Ryder J. D., "Networks, Lines and Fields", PHI, 2003.
2. Jordan E.C. and BalmainK. G., "Electro Magnetic Waves and Radiating System", PHI, 2003.
3. Ramo, Whineeryand Van Duzer, "Fields and Waves in Communication Electronics",John Wiley, 2003.
4. David M. Pozar, "Microwave Engineering", 2nd Edition, John Wiley, 1997.
5. DavidK.Cheng."FieldandWavesinElectromagnetism".PearsonEducation,1989.

Dr. S.RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902EC504 **CONTROL SYSTEMS**

L	T	P	C
3	0	0	3

MODULE I **CONTROL SYSTEMS REPRESENTATION** **10 Hours**

Introduction to Control systems- Open loop and Closed loop control systems-Transfer function-Modelling of control systems – Mechanical translational and Rotational systems - Electrical systems -Block diagram reduction techniques – Signal flow graph reduction using Masons gain formula.

MODULE II **TIME RESPONSE ANALYSIS** **8 Hours**

Standard test signals- type and order of a system - Time response of First order control systems for step input-Time response of Second order control systems for step input-Time domain specifications--Steady state error- Controllers-PI, PD, PID controllers.

MODULE III **FREQUENCY RESPONSE ANALYSIS** **9 Hours**

Frequency domain specifications-Frequency response analysis using Polar plot-Bode Plot and Nyquist Plot

MODULE IV **STABILITY ANALYSIS OF CONTROL SYSTEMS** **9 Hours**

Introduction to stability-Stability and the roots of characteristic equation-Routh Hurwitz stability criterion-conditionally stable systems-Construction of Root locus.

MODULE V **COMPENSATORS AND STATE SPACE ANALYSIS** **9 Hours**

Compensators:

Compensators-Lead, Lag and Lag-Lead Compensation – Design of compensator using Bode plot.

State Space Representation:

Introduction to state space analysis-State model of linear systems-Solution of state equation - State transition matrix-Concept of Controllability and Observability.

Total: **45Hours**

Further Reading: www.nptel.ac.in/courses/108101037

References:

1. Nagrath I.J. and Gopal M., —Control Systems Engineering‖, 5th Edition, New Age International Publishers, New Delhi, 2011.
2. Norman S. Nise, —Control Systems Engineering‖, 6th Edition, Wiley Publishers, 2011
3. Nagrath I.J. and Gopal.M,‖Control Systems Engineering ‖, 5th Edition, New Age International Publishers, New Delhi, 2008
4. Kuo,B.C. —Automatic Control Systems‖, 8th Edition. John Wiley and Sons, New York, 2003

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Nethi. Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1904GE551 **LIFE SKILLS: APTITUDE - I**

L	T	P	C
0	0	2	1

Employability / Skill Development

MODULE I **INTRODUCTION TO NUMBER SYSTEM, BASIC SHORTCUTS MULTIPLICATION, DIVISION** **6 Hours**

Classification of numbers - Properties of Numbers - Divisibility rules - Finding the Modules digit - Finding remainders in divisions by higher powers - LCM and HCF Models - Fractions and Digits – Square, Square roots – Shortcuts of addition, multiplication, Division.

MODULE II **PROPORTION, AVERAGES** **6 Hours**

Definition of Ratio - Properties of Ratios - Comparison of Ratios - Problems on Ratios - Compound Ratio - Problems on Proportion - Mean proportional and Continued Proportion Definition of Average - Rules of Average - Problems on Average - Problems on Weighted Average - Finding average using assumed mean method.

MODULE III **PERCENTAGE, PROFIT AND LOSS** **6 Hours**

Introduction Percentage - Converting a percentage into decimals - Converting a Decimal into a percentage - Percentage of fractions - Problems on percentages - Problems on Profit and Loss percentage- Relation between Price and Selling price - Discount and Marked Price - Two different articles sold at same Cost Price - Two different articles sold at same Selling Price - Gain% / Loss% on Selling Price.

MODULE IV **CODING, DECODING, DIRECTION SENSE** **6 Hours**

Coding using same letters - Coding using different set of letters - Coding into a number - Problems on R-model - Solving the paths - Finding the net distance travelled - Finding the direction - Problems on shadows - Problems on direction sense using symbols and notations.

MODULE V **LETTER SERIES NUMBER AND LETTER ODD MAN OUT** **6 Hours**

Difference series - Squares series - Cubes series - Alternate series - Combination series - Miscellaneous series - Definition of letters - Definition of Analogy - Problems on number analogy - Problems on letter analogy - Problems on verbal analogy - Problems on number Odd man out - Problems on letter Odd man out - Problems on verbal Odd man out

Total: **30 Hours**

Further Reading:

- www.ti.com/processors/dsp/overview.html
- estimation.
- imation and prediction

References:

1. Arun Sharma, "Quick learning for Quantitative Aptitude for the CAT", 7th edition, McGraw Hills publications.
2. Arun Sharma, "Quick learning for Logical Reasoning for CAT", 4th edition, McGraw Hills publications.
3. R S Aggarwal, "A modern approach to Logical reasoning", revised edition, S.Chand publication, 2017.
4. R S Aggarwal, "A modern approach to Aptitude for Competitive Examinations", revised edition, S.Chand publications.
5. Rajesh Verma, "Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwali, Indu Sijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2nd edition, 2014.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902EC552 **...PUTER NETWORKS LAB**

L	T	P	C
0	0	4	2

List of Experiments:

1. Study of Network ...logies
2. Implementation o... ...it Protocol
3. Implementation a... ...l Protocol
4. Implementation a... ...Repeat Protocol
5. Configure a Netw... ...ing ...ector Routing Protocol
6. Configure a Netw... ...Vector Routing Protocol
7. Implementation a... ... Protocol
8. Implementation o... ... Decryption
9. Configure a Netw... ...y ...acket Tracer Software
10. To Create Scenar... ...In... Th... ...rmance of Network With CSMA/CD Protocols through Simulation

Total: 45 Hours

Additional Experi...

1. ...Sc... ...And Study The Performance of Token Bus And Token Ring
   ...Thr... ...imulation
2. St... ...et P... ...ing

References:

1. Computer N... ...proach, 4th Ed. (2007), by Larry Peterson and Bruce Davie. Covers back... ...erial with which students should have familiarity.
2. Computer Ne... ...\ To... ...n Approach Featuring the Internet, 5th Ed. (2010), by James F. Kurose an... ...Ross... ...rs similar material to Peterson and Davie.

LABORATORY COURSES

1902EC551 SIGNAL PROCESSING LAB

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS:

1. Generation of Signals
2. Properties of Discrete time Sy -Linearity, Stability, Causality &Time Variance.
3. Sampling of an udio signal ferent sampling rate and reconstruct the sampled signal
4. Computation o FT of a s ng basic equation and FFT & power spectrum estimation using DFT
5. Design and Sim ation of II
6. Design and Sim ion of FI
7. Multirate signa ocessing- mpling , Up sampling , Decimation and Interpolation.
8. Arithmetic ope ns in
9. Generation of forms Ps
10. Computation o nvolutio rrelation between signals using DSPs.
11. Implementatio IIR Filte DSPs
12. Implementatio FIR Fil DSPs

ADDITIONAL EXP ENTS

Total: 45 Hours

1. imag tion algorithm development
2. e filt tial and frequency domain
3. phologi tions in analyzing image structures

References:

1. John G. Proakis& ris G. s, "Digital Signal Processing – Principles, Algorithms & Applications", Fou dition, Education / Prentice Hall, 2007.
2. Emmanuel C..Ifea s. "Digital Signal Processing", Second Edition, Pearson Education / Prenti l, 2
3. Sanjit K. Mitra, "I Sig ng – A Computer Based Approach", Tata Mc Graw Hill, 2007.
4. A.V.Oppenheim, Schaf Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson,
5. Andreas Antonio al S ssing", Tata Mc Graw Hill, 2006.

Professional Elective – I

1903EC004 **DISPLAY SYSTEMS**

L	T	P	C
3	0	0	3

MODULE I INTRODUCTION TO DISPLAY SYSTEMS **9 Hours**

Introduction to displays. Requirements of displays. Display technologies, CRT, Flat panel and advanced display technologies. Technical issues in displays.

MODULE II HEAD MOUNTED DISPLAY **9 Hours**

Head mounted displays. Displays less than and greater than 0.5 m diagonal. Low power and light emitting displays.

MODULE III WORKING OPERATION OF DISPLAY **9 Hours**

Operation of TFTs and MOS. LCD brightness. Types of LCD displays.

MODULE IV Types of Displays **9 Hours**

Emissive displays. ACTFEL, Plasma and Field emission displays, operating principle and performance.

MODULE V APPLICATIONS OF DISPLAY **9 Hours**

Types of Displays: 3D, HDTV, LED screen.

Total: 45 Hours

Further Reading:

1. 5G Communication
2. IoT and C

References:

1. L.W. Mackonald, A.C. Lowe, Display Systems, Design and Applications, Wiley, 2003.
2. E.H. Stupp & M. Brennesholtz, Projection Displays, Wiley,1999
3. Peter A. Keller, Electronic Display Measurement: Concepts, Techniques, and Instrumentation, Wiley-Inter science, 1997.
4. Recent literature in Display Systems.

Audit Course

1901MCX03 ...IAN TRADITIONAL KNOWLEDGE (Common to All Branches)

L	T	P	C
2	0	0	0

MODULE I INTRO... ...URE — **6 Hours**
Culture, civilization, cultu... characteristics of culture, importance of culture in human literature, Indian Culture, Ancient In... ...dern India.

MODULE II INDIAN... ...URE AND LITERATURE — **6 Hours**
Indian Languages and L... ...f Sanskrit. significance of scriptures to current society, Indian philosophies, other Sansk... ...of south India Indian Languages and Literature-II: Northern Indian languages & literature.

MODULE III RELIG... ...IY — **6 Hours**
Religion and Philosophy i... ...and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected m...

MODULE IV FINE A... ...TECHNOLOGY& ENGINEERING) — **6 Hours**
Indian Painting, Indian ... ...isions of Indian classic music, modern Indian music, Dance and Drama, Indian Architectu... ...nd modern), Science and Technology in India, development of science in ancient, mediev...

MODULE V EDUCA... ...DIA — **6 Hours**
Education in ancient, medi... ...ims of education. subjects, languages, Science and Scientists of Ancient India, Science an... ...India, Scientists of Modern India.

TOTAL 30 Hours

REFERENCES:

1. Kapil Kapoor, "Text a... ...a Tradition",ISBN: 81246033375,2005
2. "Science in Samskrit", ...r, ISBN 13: 978-8187276333,2007
3. NCERT, "Position pap... ...nd Theatre", ISBN 81-7450 494-X,200
4. S. Narain, "Examinati... ...Book Depot,1993
5. Satya Prakash, "Found... ...t India", Vijay Kumar Publisher,1989
6. M. Hiriyanna, "Essenti... ...", Motilal Banarsidass Publishers, ISBN 13: 978- 8120810990, 2014

1902EC505 COMPUTER NETWORKS

L	T	P	C
3	0	0	3

MODULE I INTRODUCTION AND CONCEPTS OF NETWORKS **9 Hours**

Networks – Categories of Networks –Network hardware– Network software– Network Architecture – TCP/IP reference models – Network LAN technologies - Transmission media.

MODULE II DATA LINK LAYER AND PHYSICAL LAYER **9 Hours**

Data link layer: Functionality of data link layer- Data link control and protocols – Error Detection and Error Correction - MAC – Ethernet- wireless LAN- Broadband wireless – Bluetooth – Data link layer switching – **Physical layer:** Basis for data communication- Wireless transmission- Transmission media- Multiplexing- Channel capacity- switching

MODULE III NETWORK LAYER **9 Hours**

Network layer – Functionality of network layer- Network addressing- Network routing- Routing algorithms- Internetworking- Quality of service- Network layer protocols- Switching concepts – Circuit switching – Packet switching- Network layer design issues.

MODULE IV TRANSPORT LAYER **9 Hours**

Functionality of transport layer- Transport layer service – Elements of transport protocols- Transmission control protocol– Congestion control and avoidance – User datagram protocol- Delay tolerant networking- Transport for Real Time Applications (RTP).

MODULE V APPLICATIONS AND SECURITY **12 Hours**

Applications protocols– Client server model- Network services- DES- RSA- Web security- Recent trends, development and issues

Total: 45 + 15 Hours

Further Reading:

1. Computer Networks- A- Tanenbaum- 5th edition
2. Computer Networking- A top down approach- Kurose/ Ross- 6th edition

References:

1. Achyut S Godbole.Atul Kahate "Data Communications and Networks", Second edition 2011
2. Andrew S.Tannenbaum David J Wetherall, "Computer Networks" Fifth Edition , Pearson Education 2011
3. Douglas E. Comer, —Internetworking with TCP/IP (Volume I) Principles, Protocols and Architecture‖, Sixth Edition, Pearson Education, 2013.
4. Forouzan, " Data Communications and Networking", Fifth Edition , TMH 2012.
5. James F. Kurose, Keith W. Ross "Computer Networking: A Top-down Approach, Pearson Education, Limited, sixth edition, 2012.
6. Larry L. Peterson & Bruce S. Davie "Computer Networks – A systems Approach", Fifth Edition, Morgan Kaufmann, 2011
7. William Stallings, —Data and Computer Communications‖, Tenth Edition, Pearson Education, 2013

E.G.S.PILLAYENGINEERINGCOLLEGE

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NAGAPATTINAM–611002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

Full Time Curriculum and Syllabus

Third Year – Sixth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1902EC601	Antenna and Waveguide Propagation	2	2	0	3	40	60	100
1902EC602	VLSI Design	3	0	0	3	40	60	100
1902EC603	Digital Communication	3	0	0	3	40	60	100
1901MGX01	HSS Elective I	3	0	0	3	40	60	100
1903EC030 1903EC025	Open Elective I	3	0	0	3	40	60	100
1903EC008	Professional Elective – II	3	0	0	3	40	60	100
Laboratory Course								
1902EC651	VLSI Design Laboratory	0	0	2	1	50	50	100
1902EC652	Analog & Digital Communication Laboratory	0	0	2	1	50	50	100
1904EC653	Industrial Visit Presentation	0	0	0	1	50	50	100
1904GE651	Life Skills: Aptitude II & GD	2	0	0	1	100	-	100
	Total	**19**	**2**	**4**	**22**	**540**	**460**	**1000**

L–Lecture| T–Tutorial| P–Practical| C–Credit| CA –Continuous Assessment| ES–End Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
HSS Elective - I								
1901MGX01	Total Quality Management	3	0	0	3	40	60	100
1901MGX02	Project Management and Finance	3	0	0	3	40	60	100
1901MGX03	Operations Research	3	0	0	3	40	60	100
1901MGX04	Principles of Management	3	0	0	3	40	60	100
Open Elective – I (Even Semester)								
1903EC028	Medical Electronics	3	0	0	3	40	60	100
1903EC029	High Speed Networks	3	0	0	3	40	60	100
1903EC030	Generations of Communication Technology.	3	0	0	3	40	60	100
1903EC031	Optical Networks	3	0	0	3	40	60	100
1903EC025	Satellite Communication	3	0	0	3	40	60	100
Professional Elective - II								
1903EC006	Radar and Navigation Aids	3	0	0	3	40	60	100
1903EC007	Automotive Electronics	3	0	0	3	40	60	100
1903EC008	Internet of Things	3	0	0	3	40	60	100
1903EC009	Biomedical Engineering	3	0	0	3	40	60	100
1903EC010	Information Coding Techniques	3	0	0	3	40	60	100

1902EC601	ANTENNAS AND WAVE PROPOGATION	L	T	P	C
		3	0	0	3

MODULE I FUNDAMENTALS OF RADIATION **9 Hours**

Definition of antenna parameters – Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching – Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole, Yagi array.

MODULE II ANTENNA ARRAYS Entrepreneurship **9 Hours**

N element linear array, Pattern multiplication, Broad side and End fire array – Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial Arrays, Tchebychev polynomial.

MODULE III APERTURE AND SLOT ANTENNAS Entrepreneurship **9 Hours**

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna , Reflector antenna , Aperture blockage , Feeding structures , Slot antennas, Micro strip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis.

MODULE IV SPECIAL ANTENNAS **9 Hours**

Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas-Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR.

MODULE V PROPAGATION OF RADIO WAVES Entrepreneurship **9 Hours**

Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth, concept Sky wave propagation – Virtual height, critical frequency, Maximum usable frequency – Skip distance, Fading , Multi hop propagation.

Total: 45 Hours

Further Reading:

1. Signal processing in Microwaves.

References:

1 John D Kraus, Ronald J Marhefka, Ahmad S Khan, Antennas for All Applications, The McGraw Hill Companies, 3rd Edition, 2010.
2 K. D. Prasad, "Antenna & Wave Propagation", SatyaPrakashan, New Delhi, Fourth Edition 2006.
3 John D Kraus, "Antenna& Wave Propagation", McGraw Hill, Communications and Networking, Morgan Kaufmann Publishers, an Imprint of Elsevier, 4th Edition, 2008.
4 C.A. Balanis, "Antenna Theory - Analysis and Design", John Wiley, Fourth Edition. 2016.
5 Vijay K Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, An Imprint of Elsevier, First Edition, 2008.

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902EC602

VLSI DESIGN

L	T	P	C
3	0	0	3

MODULE I FABRICATION OF CMOS IC AND PHYSICAL DESIGN **9 Hours**

An overview of Silicon Semiconductor technology- NMOS fabrication - CMOS fabrication: n-well, P-well- Twin Tub and SOI Process- Layout design rules- Lambda Design Rules Stick Diagrams-VLSI Layout Design - Layout of Basic Structures - CMOS Logic Gates- Implementation of given logic function using CMOS logic

MODULE II MOS CIRCUIT DESIGN PROCESS **9 Hours**

Pass Transistor and Transmission Gate Static CMOS design, Pseudo NMOS –dynamic CMOS logic Clocked CMOS logic, Pre charged domino logic- Keeper Circuits - Dual Rail- Cascade Voltage Switch Logic-Circuit Pit Falls

MODULE III CMOS MEMORIES AND CLOCKING **9 Hours**

Sequencing Static Circuits Conventional CMOS Latches and Flip-Flops, Class Semi dynamic Flip-Flop (SDFF) –TSPC Latches and FF – Memory architecture- Flash Memory ,CMOS Static RAM- Dynamic RAM and CAM -,CMOS Clocking Styles

MODULE IV VLSI SUBSYSTEM DESIGN Employability **9 Hours**

CMOS Mux - Equality Detector - Shift and Rotation Operation – Priority encoder- Ripple Carry Adder-Carry Look Ahead Adder -Carry Skip Adder - Carry select and Carry save-Adder - Braun/ Baugh Wooley -Modified Booth Encoded Multiplier.

MODULE V IMPLEMENTATION STRATEGIES **9 Hours**

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnect routing procedures.

Total: 45 Hours

Further Readings:

1. Comparison of Logic Styles - Differential and Sense Amplifier Circuits Prescaler - Bit Slice – ALU CMOS Clock Generation and Distributions - BICMOS- FINFET Technology

References:

1. John P. Uyemura, "Introduction to VLSI circuits and systems", John Wiley & Sons, 2015
2. Neil.H.E Weste David Harris CMOS VLSI Design: A Circuits and Systems Perspective, 4th edition, Pearson Addison Wesley, 2015.
3. Kamran Eshraghian, Douglas A. Pucknell, Essentials of VLSI Circuits and Systems Prentice Hall of India, 2015.
4. E. Fabricious, Introduction to VLSI Design, 1st edition, McGraw Hill, 2014
5. Keng,Lablebick, "CMOS Digital Integrated Circuits", Tata McGraw Hill, 2014

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College.
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902EC603 **DIGITAL COMMUNICATION**

L	T	P	C
3	0	0	3

MODULE I **DIGITAL PULSE MODULATION** **9 Hours**

Review of Sampling, Aliasing and Reconstruction – Quantization: Uniform and Non-uniform quantization – Quantization noise – Commanding of speech signal – Waveform coding: Pulse Code Modulation – Differential pulse code modulation – Adaptive differential pulse code modulation - Delta modulation – Adaptive Delta modulation – Linear Predictive Coding.

MODULE II **BASEBAND TRANSMISSION** **9 Hours**

Digital line encoding techniques: Need for line shaping of signals, Properties of Line codes, Unipolar / Polar RZ & NRZ, Bipolar NRZ, Manchester – Matched filter – Inter Symbol Interference and Nyquist criteria for ISI cancellation – Pulse shaping with raised cosine filter – Correlative level coding – M-ary PAM transmission – Optimum linear receivers – Equalization techniques – Eye pattern.

MODULE III **ERROR CONTROL CODING TECHNIQUES** **9 Hours**

Discrete memory less channel – Linear block codes – Hamming codes – Cyclic codes – BCH codes, RS codes, Go lay codes, CRC codes – Convolution codes – State diagram – Code Trellis – Viterbi algorithm for decoding –Problems.

MODULE IV **PASSBAND DATA TRANSMISSION TECHNIQUES** **9 Hours**

Generation, Detection, Representation of signal, Signal constellation diagram, Error probability and Power spectrum of ASK, FSK, BPSK, DPSK, QPSK, MSK, GMSK and QAM coherent schemes – Comparison and BER Analysis.

MODULE V **SYNCHRONIZATION AND SPREAD SPECTRUM TECHNIQUES** **9 Hours**

Importance of Synchronization – Carrier, frame and symbol/Chip synchronization techniques, Spread Spectrum- PN Sequence code and properties – Direct Sequence and Frequency Hopping Spread Spectrum Systems –Processing gain and Jamming Margin.

Total: **45 Hours**

Further Reading:

1. Mobile radio propagation
2. TDMA – FDMA – CDMA – OF DMA.

References:

1. Simon Haykin, "Digital Communications", John Wiley, 2015.
2. J.G. Proakis, "Digital Communications", McGraw Hill, 5th edition,2007
3. Bernard Sklar, "Digital Communication",2nd Edition, Pearson Education, 2006.
4. H Taub& D L Schilling, "Principles of Communication Systems", 3rd Edition, Tata McGraw Hill, 2008.
5. Nptellink : https://onlinecourses.nptel.ac.in/noc20_ee17/course
6. https://www.tutorialspoint.com/digital_communication/index.htm

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902EC651	VLSI DESIGN LABORATORY	L	T	P	C
		0	0	4	2

List of Experiments:

1. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
2. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
3. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
4. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
5. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA
6. Design and Simulate a CMOS Inverting Amplifier.
7. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers
8. Design and simulate a CMOS Basic Gates and Flip-Flops
9. FPGA Implementation of ALU
10. FPGA Implementation of 4 bit adder

Additional Experiments:

Entrepreneurship

1. Designing a CMOS Latch
2. Using VHDL design a frequency divider

References:

1. E. Fabricious, Introduction to VLSI Design, 1st edition, McGraw Hill, 2014
2. Neil.H.EWeste David Harris CMOS VLSI Design: A Circuits and Systems Perspective, 4th edition, Pearson Addison Wesley, 2015
3. Kamran Eshraghian, Douglas A. Pucknell, Essentials of VLSI Circuits and Systems Prentice Hall of India, 2015.
4. John P.Uyemura, "Introduction to VLSI circuits and systems", John Wiley & Sons, 2015

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1902EC652	ANALOG AND DIGITAL COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2

List of Experiments:

Design, Simulate and implement the following,

1. Amplitude Modulation.
2. Frequency Modulation.
3. Pre-emphasis and de-emphasis in FM.
4. PAM, PWM and PPM.
5. Time Division Multiplexing and Frequency Division Multiplexing.
6. Analog Signal Sampling and Reconstruction.
7. Pulse Code Modulation.
8. Delta Modulation
9. Line Coding formats
10. Error Control Coding
11. ASK, FSK, BPSK, QPSK

Additional Experiments:

1. Super heterodyne Receiver
2. Simulation of Equalization Techniques

References:

1. J.G. Proakis, "Digital Communications", McGraw Hill, 5th edition, 2007
2. Simon Haykin, Communication Systems, John Wiley, 2001.
3. Jack Quinn, „Digital Data Communication", Prentice Hall; 1st edition,-199)
4. P.Michael Fitz, Fundamentals of Communication System, Tata McGraw-Hill -2008.
5. P.Rama Krishna rao, Analog Communication, Tata McGraw-Hill -2011

HSS ELECTIVE – I

1901MGX01 **TOTAL QUALITY MANAGEMENT**

L	T	P	C
3	0	0	3

MODULE 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 - Juran Trilogy, PDSA Cycle, 5S, Kaizen - Obstacles to TQM Implementation

MODULE 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

MODULE 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

MODULE 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

MODULE 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

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.

OPEN ELECTIVE – II

		L	T	P	C
1903EC030	**GENERATIONS OF COMMUNICATION TECHNOLOGY**	**3**	**0**	**0**	**3**

MODULE I 1G EVOLUTIONS **9 Hours**

History of wireless cellular technology, radio communication, concept of cellular radio system, antenna used in 1G, security measures in 1G, advantages and disadvantages in first generation.

MODULE II 2G EVOLUTIONS **9 Hours**

Review of cellular standards, migration and advancement of GSM architecture and CDMA architecture, WLAN – IEEE 802.11and HIPERLAN, Bluetooth.

MODULE III 3G EVOLUTIONS **9 Hours**

IMT-2000 - W-CDMA, CDMA 2000 – radio & network components, network structure, packet-data transport process flow, Channel Allocation, core network, interference-mitigation techniques, UMTS-services, air interface, network architecture of 3GPP, UTRAN – architecture, High Speed Packet Data-HSDPA,HSUPA.

MODULE IV 4G EVOLUTION **9 Hours**

Introduction to LTE-A – Requirements and Challenges, network architectures – EPC, E- UTRAN architecture - mobility management, resource management, services, channel -logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

MODULE V 5G EVOLUTIONS **9 Hours**

Introduction, Need for 5G, Evolution of 5G, Comparison of different generations, QoS, 5G network architecture, Future enhancement.

Total: 45 Hours

Further Reading:

1. Free space optical communication
2. Satellite mobile networks

References:

1. Kaveh Pahlavan, "Principles of wireless networks", Prentice-Hall of India, 2008
2. A.F.Molisch, Wireless Communications, Wiley, 2005.
3. T.S.Rappaport, Wireless Communications: Principles and Practice, Second Edition, PearsonEducation/ Prentice Hall of India, Third Indian Reprint 2003.
4. Vijay K.Garg, "Wireless Network Evolution- 2G & 3G" Pearson, 2013.
5. K. Daniel Wong, "Fundamentals of Wireless Communication Engineering Technologies" Wiley,2012.
6. P.MuthuChidambaraNathan, Wireless Communications, PHI, 2008
7. A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.

1903EC025	SATELLITE COMMUNICATION	L	T	P	C
	(Open elective)	3	0	0	3

(Common to B.E / B.Tech – CSE, IT & ECE)

MODULE I SATELLITE ORBITS **9 Hours**

Introduction - Spectrum allocations for satellite systems -Kepler„s Laws - orbital parameters - orbital perturbations– Type of orbits - Geo stationary orbits – look angle determination- limits of visibility – eclipse - sub satellite point – sun transit outage

MODULE II SPACE AND EARTH SEGMENT **9 Hours**

Spacecraft technology- structure- power supply- attitude and station keeping ,orbit control - thermal control - communication subsystems - telemetry, tracking and command – Transponders Antenna subsystem, Earth station technology -Receive only home TV systems - MATV – CATV

MODULE III SATELLITE ACCESS **9 Hours**

Modulation and Multiplexing-Voice, Data, Video, Analog – digital transmission system-Digital video broadcast - multiple accesses: (FDMA, TDMA, CDMA, SDMA-assignment methods) -spread spectrum communication

MODULE IV SATELLITE NAVIGATIONAL SYSTEM **9 Hours**

GPS principle of operation, position location determination, principle of GPS receiver and applications- launching procedures - launch vehicles and propulsion.

MODULE V SATELLITE APPLICATIONS **9 Hours**

Satellite mobile services – VSAT- Radarsat- Direct Broadcast satellites (DBS) - Direct to home Broadcast (DTH) -Digital audio broadcast (DAB) – World space services, Business TV (BTV) – GRAMSAT - Specialized services: E mail, Video conferencing, Internet- INTELSAT Series- INSAT – INMARSAT. Re

Total: 45 Hours

Further Reading:

1. GIS

References:

1.Dennis Roddy, „Satellite Communication", McGraw Hill International, 4th Edition, 2006.

2.Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication SystemsEngineering", Prentice Hall/Pearson, 2007.

3.N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.

4.Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House BostanLondon, 1997.

5.Tri T. Ha, "Digital Satellite Communication", II nd edition, 1990.

6."Elements electronic navigation system",N.S.Nagaraja ,2nd edition Tata McGraw Hill 2000.

PROFESSIONAL ELECTIVE – II

1903EC008	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

(Common to B.E / B.Tech – CSE, IT & ECE)

MODULE I Introduction to IoT **9 Hours**

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs ,Machine to Machine, Difference between IoT and M2M, Software Defined Network(SDN)

MODULE II Network and Communication Aspects **9 Hours**

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

MODULE III Challenges of IoT **9 Hours**

Design challenges, Development challenges, Security challenges, Other challenges

MODULE IV Applications of IoT **9 Hours**

Home automation, Industry applications, Surveillance applications, Other IoT applications

MODULE V Developing IoTs **9 Hours**

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Total: 45 Hours

Further Reading:

1. Cloud Computing
2. Dockers and Containers

References:

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"
2. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

1904EC653	INDUSTRIAL VISIT PRESENTATION	L	T	P	C
		0	0	2	1

GUIDELINE FOR EVALUATION

In order to provide the experiential learning to the students, shall take efforts to arrange at least two industrial visit / field visits in a year. A presentation based on Industrial visits shall be made in this semester and suitable credit may be awarded.

1904GE651 **LIFE SKILLS: APTITUDE - II**

L	T	P	C
0	0	2	1

MODULE I PARTNERSHIP, MIXTURES AND ALLEGATIONS, PROBLEM ON AGES, SIMPLE INTEREST, COMPOUND INTEREST **9 Hours**

Introduction Partnership - Relation between capitals, Period of investments and Shares- Problems on mixtures - Allegation rule - Problems on Allegation – Problems on ages - Definitions Simple Interest - Problems on interest and amount - Problems when rate of interest and time period are numerically equal - Definition and formula for amount in compound interest - Difference between simple interest and compound interest for 2 years on the same principle and time period.

MODULE II BLOOD RELATIONS, , CLOCKS, CALENDARS **9 Hours**

Defining the various relations among the members of a family - Solving Blood Relation puzzles - Solving the problems on Blood Relations using symbols and notations - Finding the angle when the time is given - Finding the time when the angle is known - Relation between Angle, Minutes and Hours - Exceptional cases in clocks - Definition of a Leap Year - Finding the number of Odd days - Framing the year code for centuries - Finding the day of any random calendar date .

MODULE III TIME AND DISTANCE, TIME AND WORK **9 Hours**

Relation between speed, distance and time - Converting kmph into m/s and vice versa - Problems on average speed - Problems on relative speed - Problems on trains - Problems on boats and streams - Problems on circular tracks - Problems on races - Problems on Unitary method - Relation between Men, Days, Hours and Work - Problems on Man-Day-Hours method - Problems on alternate days - Problems on Pipes and Cisterns.

MODULE IV DATA INTERPRETATION AND DATA SUFFICIENCY **9 Hours**

Problems on tabular form - Problems on Line Graphs - Problems on Bar Graphs - Problems on Pie Charts - Different models in Data Sufficiency - Problems on data redundancy.

MODULE V ANALYTICAL AND CRITICAL REASONING **9 Hours**

Problems on Linear arrangement - Problems on Circular arrangement - Problems on Double line-up - Problems on Selections - Problems on Comparisons - Finding the Implications for compound statements - Finding the Negations for compound statements- Problems on assumption - Problems on conclusions - Problems on inferences - Problems on strengthening and weakening of arguments .

Total: 45 Hours

References:

1. Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT", 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT", 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning", revised edition, S.Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations", revised edition, S.Chand publication, 2017.
5. Rajesh Verma, "Fast Track Objective Arithmetic", 3rd edition, Arihant publication, 2018.
6. B.S. Sijwalii and InduSijwali, "A New Approach to REASONING Verbal & Non-Verbal", 2nd edition, Arihnat publication, 2014.