E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai
Accredited by NAAC with 'A'Grade |Accredited by NBA (CIVIL, CSE, ECE, EEE, IT, MECH)
NAGAPATTINAM – 611 002

B.E ELECTRONICS AND COMMUNICATION ENGINEERING

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
	HSS Elective I	3	0	0	3	40	60	100
	Open Elective I	3	0	0	3	40	60	100
	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	100	-	100
1904GE651	Life Skills: Aptitude II & GD	2	0	0	1	100	-	100
Total		**19**	**2**	**4**	**22**	**540**	**460**	**1000**

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
1903EC032	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	Medical Electronics System	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

Course Objectives:

1. To introduce the fundamental principles of antenna theory and various types of antennas.
2. To gain knowledge about Antenna arrays.
3. To learn the fundamentals of Propagation of Radio waves.

Unit 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.

Unit II	**ANTENNA ARRAYS**	**9 Hours**

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

Unit III	**APERTURE AND SLOT ANTENNAS**	**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.

Unit 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.

Unit V	**PROPAGATION OF RADIO WAVES**	**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:

Signal processing in Microwaves.

Course Outcomes:

After completion of the course, Student will be able to

1. Explain the parameters and fundamentals of antennas in antenna theory.
2. Demonstrate the concept of antenna arrays in antenna theory.
3. Propose numerical tool for antenna of aperture and slot antennas.
4. Measure the parameters of special antennas in antenna theory.
5. Describe the modes of propagation of radio waves in antenna theory .

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.

1902EC602		VLSI DESIGN	L	T	P	C
			3	0	0	3

Course Objectives:		
	1.To understand the CMOS Fabrication Process and CMOS Circuits	
	2.To study CMOS Circuits using various Logic Styles	
	3.To provide basic knowledge about Clocking, Memory and VLSI Subsystem Design	
UNIT 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		
UNIT II	**MOS CIRCUIT DESIGN PROCESS**	**9 Hours**
Pass Transistor and Transmission Gate Static CMOS design, Pseudo NMOS –dynamic CMOS logic Clocked CMOS logic, Precharged domino logic- Keeper Circuits - Dual Rail- Cascode Voltage Switch Logic-Circuit Pit Falls		
UNIT III	**CMOS MEMORIES AND CLOCKING**	**9 Hours**
Sequencing Static CircuitsConventional CMOS Latches and Flip-Flops, Klass Semidynamic Flip-Flop (SDFF) –TSPC Latches and FF – Memory architecture- Flash Memory ,CMOS Static RAM- Dynamic RAM and CAM -,CMOS Clocking Styles		
UNIT IV	**VLSI SUBSYSTEM DESIGN**	**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.		
UNIT 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 Reading:	Comparison of Logic Styles - Differential and Sense Amplifier Circuits Prescaler - Bit Slice – ALU CMOS Clock Generation and Distributions - BICMOS- FINFET Technology	
Course Outcomes:		
	After completion of the course, Student will be able to	
	1.Demonstrate CMOS Fabrication process and Layout Design.	
	2.Analyze MOS Circuit Design Process.	
	3.Describe CMOS memories and clocking strategies	
	4.Reveal the operation of CMOS Memory and Clocking Strategies	
	5.Implement FPGA building block in VLSI system.	
References:		

1.John P.Uyemura, "Introduction to VLSI circuits and systems", John Wiley & Sons, 2015

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.E. Fabricious, Introduction to VLSI Design, 1st edition, McGraw Hill, 2014

5.Keng,Lablebick,"CMOS Digital Integrated Circuits", Tata McGraw Hill, 2014

1902EC603	DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Analog communication systems
2. Probability and random process

COURSE OBJECTIVES:

1. To know the principles of quantization and waveform coding
2. To apply the concepts of Error control coding.
3. To understand the various Band pass signaling schemes and spread spectrum techniques.

UNIT I DIGITAL PULSE MODULATION **9 Hours**

Review of Sampling, Aliasing and Reconstruction – Quantization: Uniform and Non-uniform quantization – Quantization noise – Companding 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.

UNIT 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.

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

Discrete memoryless channel – Linear block codes – Hamming codes – Cyclic codes – BCH codes, RS codes, Golay codes, CRC codes – Convolutional codes – State diagram – Code Trellis – Viterbi algorithm for decoding –Problems.

UNIT 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.

UNIT 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 / CONTENT BEYOND SYLLABUS / SEMINAR :

1.Mobile radio propagation
2. TDMA – FDMA – CDMA – OFDMA.

COURSE OUTCOMES:

At the end of this course, students will be able to,

CO1	Design and implement the quantization and waveform coding
CO2	Design a system that transmits baseband signals with minimum distortion and analyze the level of ISI using eye pattern
CO3	Capable of configuring error control coding schemes
CO4	Analyze the performance of different digital modulation /demodulation techniques
CO5	Knowledge on the principle of spread spectrum and synchronization.

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

Laboratory Course

1902EC651	VLSI DESIGN LAB	L	T	P	C
		0	0	4	2
	(B.E . ECE)				

Course Objectives:

1. To gain expertise in design, development and simulation of digital circuits with Verilog HDL.
2. To apply concepts and methods of digital system design techniques through hands-on experiments.
3. To develop skills, techniques and learn state-of-the-art engineering tools (such as HDL, Xilinx tools)

List of Experiments:

1. Design Basic Gates using HDL. Simulate it using Xilinx/VIVADO Software.
2. Design an Adder , Subtractor using HDL. Simulate it using Xilinx/VIVADO Software.
3. Design Multiplexer and Demultiplexer using HDL. Simulate it using Xilinx/VIVADO Software.
4. Design Encoder and Decoder using HDL. Simulate it using Xilinx/VIVADO Software.
5. Design a Multiplier, Comparator, ALU and Simulateit using Xilinx/VIVADO Software.
6. Design a Shift Register using HDL. Simulate it using Xilinx/ VIVADO Software.
7. Design a Flip-flops and Counters using HDL. Simulate it using Xilinx/ VIVADO Software.
8. Implement experiment (1) and (2) by FPGA/ARTIX 7 kit
9. Implement experiment (3) and (4) by FPGA/ARTIX 7 kit
10. Implement experiment (5) and (6) by FPGA/ARTIX 7 kit

Total: 45 Hours

Additional Experiments:

1. Design and simulate code converter
2. Design and simulate CMOS Inverter
3. Design Finite State Machine (Moore/Mealy)

List of Hardware/Software Required

1. Xilinx ISE/ VIVADO/ equivalent EDA Tools
2. Xilinx/Altera/equivalent FPGA Boards
3. Artix 7 / Spartan 3E / Spartan 6E Trainer kit
4. Personal Computer 35 Nos.

Course Outcomes:

After completion of the course, Student will be able to

1. Write HDL code for basic as well as advanced digital integrated circuit
2. Import the logic modules into FPGA Boards and Synthesize Place and Route the digital IPs
3. Design, Simulate and Extract the layouts of Digital and Analog IC Blocks using EDA tools
4. Design, Simulate and Extract the layouts of Digital and Analog IC Blocks using EDA tools
5. Write HDL code for basic as well as advanced digital integrated circuit

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

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

Course Objectives:

1. Understand the basics of analog and digital communication.
2. Study the different types of modulators.
3. To know the steps involved in the analysis of digital communication systems

List of Experiments:

sign, 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

Total: 45 Hours

Additional Experiments:

1. Superheterodyne Receiver
2. Simulation of Equalization Techniques

List of Hardware/Software Required

1. MATLAB with Communication System Tool Box or Equivalent Software such as GNU octave in desktop systems
2. Signal Generators (1MHz) – 10 Nos

Course Outcomes:

After completion of the course, Student will be able to

1. Design and measure of AM, FM
2. Analyze the various pulse modulation techniques, Analog signal sampling & reconstruction
3. The ability of visualization and practical implementation of baseband modulation techniques
4. The skill to analyze and implement analogue to digital converters like PCM, DM.
5. The ability to design pass band digital demodulation techniques

References:

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

1904GE651		Life Skills: Aptitude - II	L	T	P	C
			0	0	2	1
		B.E – ECE				

Course Objectives:

1. To brush up problem solving skill and to improve intellectual skill of the students
2. To be able to critically evaluate various real life situations by resorting to Analysis Of key issues and factors
3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students
5. To augment logical and critical thinking of Student

Unit I	Partnership, Mixtures and Allegations, Problem on Ages, Simple Interest, Compound Interest	6 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.

Unit II	Blood relations, ,Clocks, Calendars	6 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 .

Unit III	Time and Distance, Time and Work	6 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.

Unit IV	Data Interpretation and Data Sufficiency	6 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

Unit V	Analytical and Critical Reasoning	6 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:	30 Hours

Course Outcomes:

After completion of the course, Student will be able to

1. Solve problems on Partnership, Mixture & Allegation and ages least time using shortcuts and apply real life situations.
2. Workout family relationships concepts, ability to visualize clocks & calendar and understand the logic behind a Sequence.
3. Calculate concepts of speed, time and distance, understand timely completion using time and work.
4. Learners should be able to understand various charts and interpreted data least time.
5. Workout puzzles, ability to arrange things in an orderly fashion.

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.

HSS Elective 1

1901MGX01		TOTAL QUALITY MANAGEMENT	L	T	P	C
			3	0	0	3

Course Objectives: To facilitate the understanding of Quality Management principles and process.

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 - Juran Trilogy, 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- Case studies

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. Engineering economics and cost analysis
2. Construction and planning management

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.
Reference(s)	

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.Bester filed, Total Quality Management, Pearson Education Inc., New Delhi, 2003.
6. https://onlinecourses.nptel.ac.in/noc17_mg18/preview

1901MGX02	Project Management and Finance	L	T	P	C
		3	0	0	3

UNIT I PROJECTMANAGEMENT,PROJECTSELECTIONANDPROJECT 9 Hours

Objectives ofprojectmanagement:Types ofProjects:ProjectManagementLife Cycle:Project Selection:Feasibilitystudy:EstimationofProject Cost,CostofCapital,NetworkanalysisTechniques: PERT,CPM,Government regulationsandstatutoryforvariousprojects:

UNIT II PROJECTIMPLIMENTATION,MONITORINGAND CONTROL 9 Hours

Project representation: Role of project managers ,relevance with objective of organization, preliminary manipulations ,Basic Scheduling concepts :Resource levelling ,Resource allocation, Settingabaseline,Project managementinformationsystem:Importanceofcontractsinprojects: TeamworkinProject Management:Formationof Effective terms.

UNIT III PROJECTEVALUATION,AUDITINGAND OTHER RELATEDTOPICS IN PROJECTMANAGEMENT 9 Hours

Project Evaluation: Project auditing: Phase of project audit Project closure reports, computers, e-markets inProjectManagement:

UNIT IV WORKINGCAPITALMANAGEMENTANDCAPITALBUDGETING 9 Hours

Currentassets management:Estimationofworkingcapital requirements:Capital budgeting:Capital budgeting methods:Presentvalue method: Accounting rateof returnmethods.

UNIT V FINANCEANDACCOUNTING 9 Hours

Sourceoffinance: TermLoans:CapitalStructure:Financial InstitutionAccountingPrinciples: Preparationand Interpretationofbalancesheets, profitandlossstatements,FixedAssets,Current assets,Depreciationmethods :Breakevenanalysis:

Total: 45 Hours

Reference(s)

1. Project Management Institute"AGuideto theProject Management Body of Knowledge" PMBOK® Guide (SixthEdition),Sept2017
2. JamesC.VanHorne, "FundamentalsofFinancial Management",Person Education2004.
3. **Küster**J.,**Huber**,E.,**Lippmann**,R.,**Schmid**,A.,**Schneider**,E.,**Witschi**,U.,**Wüst**,R." ProjectManagement Handbook",2015
4. Khanna,R.B.,"ProjectManagement", PHI 2011.
5. PrasannaChandra, "Financial Management", TataMcGraw-Hill,2008.
6. By Carl S. Warren, James M. Reeve, Jonathan Duchac."Financial &Managerial Accounting",2016
7. PaneerSelvam,R.,andSenthilkumar,P., "ProjectManagement",PHI, 2011.

1901MGX03	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

UNIT I INTRODUCTION TOLINEARPROGRAMMING(LPP) 9 Hours

Introduction toApplications of Operations Research in functionalareas ofManagement. Linear Programming-Formulation, Solutionby Graphical and Simplex methods (Primal -Penalty, Two Phase), Dualsimplex method. PrinciplesofDuality.

UNIT II TRANSPORTATION AND ASSIGNMENTMODELS 9 Hours

Transportation Models–InitialBasic feasible solutionby N-WCornerRule,Leastcostand Vogel‟s approximationmethods.SolutionbyMODI-AssignmentModels- SolutionbyHungarianmethod-TravellingSalesman problem.

UNIT III NETWORKSANDINVENTORYMODELS 9 Hours

Scheduling by PERTand CPM-InventoryModels–EOQandEBQModels (With andwithout shortages), QuantityDiscountModels.

UNIT IV GAME THEORYAND REPLACEMENTMODELS 9 Hours

GameTheory-TwopersonZerosumgames-Saddlepoint,DominanceRule, Methodsofmatrices, graphicalandLP solutions.ReplacementModels-Individuals replacementModels(With andwithout time value ofmoney)– Group ReplacementModels.

UNIT V QUEUINGTHEORYMODELS 9 Hours

QueuingTheory-singleandMulti-channelmodels–infinitenumberofcustomersand infinite calling source.(M/M/1):(∞/FCFS),(M/M/S):(∞/FCFS),(M/M/1):(N/FCFS),(M/M/S):(N/FCFS)- Simple Problems.

Total: 45 Hours

Reference(s)

1. HamdyATaha, Introduction to Operations Research, Pearson, 9th Edition, 2014.
2. PaneerselvamR., Operations Research, PrenticeHallofIndia, Fourth Print, 2008.
3. G. Srinivasan, OperationsResearch– Principles andApplications, PHI,2007.
4. KalavathyS, Operations Research, Second Edition,VikasPublishingHouse, 2004.
5. N. DVohra, QuantitativeTechniquesinManagement, TataMcGraw Hill, 2010.
6. nptel.ac.in/courses/112106134/1

1901MGX04	PRINCIPLES OF MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To develop cognizance about importance of management principles.
- Extract the functions and responsibilities of managers.
- To Study and understand the various HR related activities.
- Learn the application of the theories in an organization.
- Analyze the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

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

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

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

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

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.

REFERENCES:

1. Robbins, S. (2017). Management, (13th ed.), Pearson Education, New Delhi.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, Fundamentals of Management, Pearson Education,7th Edition, 2011.
3. Robert Kreitner and Mamata Mohapatra, Management, Biztantra, 2008.
4. L. M. Prasad, Principles and Practice of Management. 7th Edition, Sultan Chand & Sons, 2007.
5. P. C. Tripathi and P. N. Reddy, Principles of Management, Fourth Edition, Tata McGraw Hill, 2008

OPEN ELECTIVE – I (EVEN SEMESTER)

1903EC028		MEDICAL ELECTRONICS	L	T	P	C
			3	0	0	3

Course Objectives:	
	1.To gain knowledge about the various physiological parameters and the methods of recording and also the method of transmitting these parameters.
	2. To study about the various assist devices used in the hospitals and Biotelemetry.
	3. To gain knowledge about various recently developed diagnostic and therapeutic techniques.

Unit I	PHYSIOLOGIC SYSTEM AND BIO-POTENTIAL RECORDING	9 Hours

The origin of Bio-potentials, Bio potential electrodes, Endocrine System, Nervous system, Vision system,Respiratory System, ECG, EEG, EMG,PCG, lead systems and recording methods, typical waveforms and signal characteristics.

Unit II	BIOLOGICAL AMPLIFIERS AND NON- ELECTRICAL PARAMETER MEASUREMENT	9 Hours

Biological amplifier, Blood flow meter, Cardiac output, Respiratory measurement, Blood pressure, Temperature, Pulse, Blood Cell Counters.

Unit III	ASSIST DEVICES AND DIATHERMY	9 Hours

Cardiac pacemakers, DC Defibrillator, Dialysis, Shortwave, Ultrasonic and Microwave type and their applications, Surgical Diathermy

Unit IV	BIOTELEMETRY AND ITS APPLICATIONS	9 Hours

Introduction to Biotelemetry, Component of Biotelemetry, Application of Biotelemetry, Radio pill, Electrical safety.

Unit V	RECENT TREND IN IMAGING SYSTEM AND MEDICAL INSTRUMENTS	9 Hours

X-Ray machines and Digital radiography, Biological effect of NMR imaging and Ultrasound, Medical Thermography, Endoscope unit, Laser in medicine, Cryogenic application, Computer tomography

	Total:	45 Hours

Further Reading:	
	1.Human Anatomy 2.Biological Electrodes 3.Recent trend in medical application.

Course Outcomes:	
	After completion of the course, Student will be able to
1.	Explain Bio-Signals and Waveform in internal and external organs of human body.
2.	Explain the Biochemical and Non-electrical parameters in human anatomy.
3.	Find suitable assist devices for the treatment of heart &Kidney diseases.
4.	Describe diathermy techniques for functioning of kidney.
5.	Demonstrate medical diagnostic equipments for treating the Human diseases.

References:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. John G.Webster, “Medical Instrumentation Application and Design”, 3rd Edition, Wiley India Edition, 2007.
3. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw - Hill, New Delhi, 2003.
4.JosephJ.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, New York, 2004.
5.Joseph D.Bronzino,”The Biomedical Engineering Hand Book”, Second Edition, CRC Press,2000.

1903EC029		HIGH SPEED NETWORKS	L	T	P	C
			3	0	0	3

Course Objectives:

1. To tell important concepts of networking.
2. To study traffic management and tunneling protocols for security.
3. To learn about protocols for better service.

Unit I	INTRODUCTION	9 Hours

Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11

Unit II	CONGESTION AND TRAFFIC MANAGEMENT	9 Hours

Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion –Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.

Unit III	ADVANCED NETWORKS CONCEPTS	9 Hours

VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS-operation, Routing, Tunneling and use of FEC, Traffic Engineering, MPLS based VPN, overlay networks-P2P connections.

Unit IV	TRAFFIC MODELLING	9 Hours

Little's theorem, Need for modeling, Poisson modeling and its failure, Non-poisson models, Network performance evaluation.

Unit V	PROTOCOLS FOR QOS SUPPORT	9 Hours

RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

Total:	45 Hours

Further Reading:

IP Switching ,Ipv6,Ipv6 over ATM

Course Outcomes:

After completion of the course, Student will be able to

1. know basics of Networks
2. Understand congestion concepts
3. Examine advanced networking techniques
4. illustrate Traffic modelling concepts
5. review Quality of service prrotocols

References:

1. J.F. Kurose&K.W. Ross,"ComputerNetworking- A topdownapproachfeaturing theinternet", Pearson 2nd edition, 2003.
2. Walrand.J. Varatya,High performance communicationnetwork, MorganKauffman– Harcourt AsiaPvt.Ltd.2nd Edition,2000.3.
3. LEOM-GarCIA,WIDJAJA,"Communicationnetworks", TMH seventh reprint2002.
4. Aunuragkumar,D.MAnjunath, Joykuri, "CommunicationNetworking", MorganKaufmann Publishers,1ed2004.5.
5. HersentGurle& petit, "IP Telephony,packetPoredMultimediacommunicationSystems", Pearsoneducation2003.6.
6. FredHalsall andLinganaGoudaKulkarni,"Computer NetworkingandtheInternet"fifthedition,Pearsoneducation7
7. Nader F.Mir,ComputerandCommunicationNetworks, firstedition.8.
8. Larryl.Peterson&BruceS.David,"ComputerNetworks: A System Approach"-1996

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

Course Objectives:

1. To impart the fundamentals concepts of wireless communication systems.
2. To introduce various technologies and protocols involved in wireless cellular communication.
3. To differentiate the concepts of various generations in wireless cellular communication technology.

Unit 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.

Unit II	2G EVOLUTIONS	9 Hours

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

Unit 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.

Unit 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.

Unit 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

Course Outcomes:

After completion of the course, Student will be able to

1. Explain the evolution and concept of 1G communication technology
2. Summarize the concept of 2G concept and architecture of cellular networks.
3. Describe the 3G communication technology, concept and architecture.
4. Elucidate the 4G networks and architecture
5. Compare the different generations in communication.

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, Pearson Education/ 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.Muthu Chidambara Nathan, Wireless Communications, PHI, 2008
7. A.Goldsmith, Wireless Communications, Cambridge University Press, 2005.

1903EC031		OPTICAL NETWORKS	L	T	P	C
			3	0	0	3

Course Objectives:

1. To get a basic understanding of optical networks components
2. To get a profound understanding of optical switching methods and networking techniques, circuit, packet, hybrid, burst and flow.
3. To get a basic understanding of optical network design.

Unit I	OPTICAL SYSTEM COMPONENTS	9 Hours

Light propagation in optical fibers – Loss & bandwidth, System limitations, Non-Linear effects; Solitons; Optical Network Components – Couplers, Isolators & Circulators, Multiplexers & Filters, OpticalAmplifiers, Switches, Wavelength Converters.

Unit II	OPTICAL NETWORK ARCHITECTURES	9 Hours

Introduction to Optical Networks; SONET / SDH, Metropoliton-Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies for Broadcast Networks, Media-Access Control Protocols, Testbeds for Broadcast & Select WDM; Wavelength Routing Architecture.

Unit III	WAVELENGTH ROUTING NETWORKS	9 Hours

The optical layer, Node Designs, Optical layer cost tradeoff, Routing and wavelength assignment,Virtual topology design, Wavelength Routing Testbeds, Architectural variations.

Unit IV	PACKET SWITCHING AND ACCESS NETWORKS	9 Hours

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronisation, BroadcastOTDM networks, Switch-based networks; Access Networks – Network Architecture overview, Future Access Networks, Optical Access Network Architectures; and OTDM networks.

Unit V	NETWORK DESIGN AND MANAGEMENT	9. Hours

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations; Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

	Total:	45 Hours

Further Reading:

1. Survivability Techniques for Multicast Connections
2. Introduction to Software Defined Networking, Reconfigurable Optical Add/Drop Multiplexer (ROADM).

Course Outcomes:

After completion of the course, Student will be able to

1. Discuss various optical system components.
2. Demonstrate various optical network architectures.
3. Explain wavelength routing networks.
4. Illustrate Packet switching and access networks.
5. Summarize Network design and Management.

References:

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks : A Practical Perspective”, Harcourt Asia Pte Ltd., Second Edition 2004.

2. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks :Concept,Design and Algorithms”, Prentice Hall of India, Ist Edition, 2002.

P.E. Green, Jr., “Fiber Optic Networks”, Prentice Hall, NJ, 1993.

1903EC032	SATELLITE COMMUNICATION	L	T	P	C
	(Open Elective)	**3**	**0**	**0**	**3**
	(Common to B.E / B.Tech – CSE, IT & ECE)				

Course Objectives:

1.To explain about satellites, their operation, types, navigation and launch

2.To discuss about satellites access and antenna systems

Unit 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

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

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

Unit 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

Unit 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.

Unit 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.

Total: 45 Hours

Further Reading:

1. GIS

Course Outcomes:

After completion of the course, Student will be able to

1.Discuss orbital mechanics and launch methodologies.

2.Recognize various space subsystems.

3.Explain different subsystems of earth segment

4.Discuss the Principles of navigation and launching

5.Demonstratevarious Satellite Applications

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

1903EC006	RADAR AND NAVIGATION AIDS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To apply Doppler principle to radars and hence detect moving targets, cluster, also to understand tracking radars.
2. To understand principles of navigation, in addition to approach and landing aids as related to navigation.
3. To refresh principles of antennas and propagation as related to radars.

Unit I	Introduction to Radar Equation	9 Hours

Introduction to radar - Simple form of radar equation - Radar block diagram-Minimum detectable signal - Receiver noise – Probability Density Functions – Signal to Noise Ratio - Integration of pulses - Applications of Radar - Radar Frequencies - Antenna Parameters- System losses – Other Radar Equation Considerations

Unit II	CW and Frequency Modulated Radar	9 Hours

Doppler effect - CW radar - FMCW radar – Altimeter – Multiple frequency CW radar

Unit III	Pulse Doppler Radar and Tracking Radar	9 Hours

Introduction to pulse doppler radar - Tracking radar –Tracking with radar- Sequential lobing- Conical scan- Tracking with surveillance radar.

Unit IV	Radar Waveform Design	9 Hours

Bandwidth and pulse duration requirements - Range and doppler accuracy- The uncertainty relation - Pulse compression and phase coding - Principles of Secondary Surveillance Radar - Synthetic aperture radar, OHR, Air surveillance radar- ECC measure Stealth applications

Unit V	Satellite Navigation System	9 Hours

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment - Instrument Landing System - Ground Controlled Approach System - MLS - Inertial Navigation -Navigation Over the Earth – Components of an Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems - Navstar Global Positioning System (GPS)

Total:	45 Hours

Further Reading:

3. Radar Displays.
4. Automatic Tracking with Surveillance

Course Outcomes:

After completion of the course, Student will be able to

1. Design and apply the radar principles on various applications
2. Analyze the mathematical concepts of radar system
3. Investigate different types of radar systems
4. Be conversant with the concepts and terminologies of advanced radar systems

Analyze the role of radar technology in satellite navigation systems

References:

1. Skolnik.M.I, —Introduction to Radar Systems, 4thEdition, McGraw Hill Book Co., 2001.
2. Raju G.S.N, —Radar Engineering and Fundamentals and Navigational Aids, I.K. International, 2008.
3. Simon Kingsley and Shaun Quegan, —Understanding Radar Systems, SciTech Publishing, 1999.
4. Harold R. Raemer, — Radar System Principles CRC Press, Newyork, 1977.
5. Sharma.K.K, —Fundamentals of Radar, Sonar& Navigation Engineering, S.K. Kataria& Sons, 2012.
6. http://www.radartutorial.eu/index.en.html
7. http://www.rfwireless-world.com/Tutorials/radar-tutorial.html

1903EC007	AUTOMOTIVE ELECTRONICS	L	T	P	C
	(Open elective)	3	0	0	3

Course Objectives:

1. To describe on Automotive Sensors, Actuators and Instrumentations
2. To articulate functions of various systems in automobiles.

Unit I	**VEHICLE SYSTEMS**	**9 Hours**
Power Train System (Air System, Fuel System (Carburettor& Diesel Fuel Injection), Ignition System, Exhaust System and other Auxiliary Systems (Cooling, Lubrications & Electrical Systems)),		
Unit II	**VEHICLE AUXILLARY SYSTEMS**	**9 Hours**
Transmission System (Front, Rear &4 wheels Drive, Manual, Automatic Transmission, Differential). Braking System (Drum, Disc, Hydraulic, Pneumatic), Steering System (Rack and Pinion, Power Steering).		
Unit III	**ELECTRONIC CONTROL**	**9 Hours**
Digital Engine Control, EGR Control, Electronic Ignition Control, Integrated Engine Control System, Anti-locking Braking System, Electronic Suspension System, Electronic Steering Control.		
Unit IV	**SENSORS AND INDICATORS**	**9 Hours**
Computer Based Instrumentation, Display Devices, Flat Panel Display, Fuel Quantity Measurement, Coolant Temperature Measurement, Oil Pressure Measurement, Speed Measurement,		
Unit V	**COMMUNICATION AND NAVIGATION**	**9 Hours**
High-Speed Digital Communication (CAN BUS), Telematics, GPS Navigation, GPS System Structure, Automotive Diagnostics.		
	Total:	**45 Hours**

Further Reading: E-Vehicles, Hybrid trains.

Course Outcomes:

After completion of the course, Student will be able to

1. Describe various vehicle systems in an automobile
2. Illustrate different types of auxiliary system in an automobile
3. Outline the various electronic control systems
4. Demonstrate various sensor and measurement techniques
5. Examine various communication and navigation techniques

References:

1. Joerg Schaeuffele, Thomas Zurawka, ―Automotive Software Engineering Principles, Processes, Methods and Tools‖, SAE International, 2005.
2. BOSCH Automotive Handbook, 6th Edition, 2014.
3. William B. Ribbens, "Understanding Automotive Electronics- An Engineering Prespective",7th Edition, Butterworth-Heinemann Publications, 2012.
4. Young A.P. & Griffiths, "Automotive Electrical Equipment" , ELBS & New Press,1999.
5. Tom Weather Jr. &Cland c. Ilunter, "Automotive computers and control system", Prentice Hall Inc., New Jersey.
6. Crouse W.H., "Automobile Electrical Equipment" , Mc Graw Hill Co. Inc., New York ,1995.
5. Bechhold, " Understanding Automotive Electronic", SAE,1998

1903EC008		INTERNET OF THINGS	L	T	P	C
			3	0	0	3
		(Common to B.E / B.Tech – CSE, IT & ECE)				

Course Objectives:	
	1. To understand the concepts of Internet of Things
	2. To know network and communication protocols of IoT
	3. To explore IoT applications.

Unit 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)		
Unit II	**Network and Communication Aspects**	**9 Hours**
Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination		
Unit III	**Challenges of IoT**	**9 Hours**
Design challenges, Development challenges, Security challenges, Other challenges		
Unit IV	**Applications of IoT**	**9 Hours**
Home automation, Industry applications, Surveillance applications, Other IoT applications		
Unit 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

Course Outcomes:	
	After completion of the course, Student will be able to
	1. Recall concepts of Internet of Things
	2. Review basic protocols in wireless sensor network
	3. Plan IoT applications in different domain and be able to analyze their performance
	4. Implement basic IoT applications on embedded platform
	5. Write codings using Python programming.

References:

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

1903EC009		MEDICAL ELECTRONICS SYSTEM	L	T	P	C
			3	0	0	3

Course Objectives:

1. To gain knowledge about the various physiological parameters and the methods of recording and also the method of transmitting these parameters.
2. To study about the various assist devices used in the hospitals and Biotelemetry.
3. To gain knowledge about various recently developed diagnostic and therapeutic techniques.

Unit I	**PHYSIOLOGIC SYSTEM AND BIO-POTENTIAL RECORDING**	**9 Hours**

The origin of Bio-potentials, Bio potential electrodes, Endocrine System, Nervous system, Vision system, Respiratory System, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.

Unit II	**BIOLOGICAL AMPLIFIERS AND NON-ELECTRICAL PARAMETER MEASUREMENT**	**9 Hours**

Biological amplifier, Blood flow meter, Cardiac output, Respiratory measurement, Blood pressure, Temperature, Pulse, Blood Cell Counters.

Unit III	**ASSIST DEVICES AND DIATHERMY**	**9 Hours**

Cardiac pacemakers, DC Defibrillator, Dialysis, Shortwave, Ultrasonic and Microwave type and their applications, Surgical Diathermy

Unit IV	**BIOTELEMETRY AND ITS APPLICATIONS**	**9 Hours**

Introduction to Biotelemetry, Component of Biotelemetry, Application of Biotelemetry, Radiopill, Electrical safety.

Unit V	**RECENT TREND IN IMAGING SYSTEM AND MEDICAL INSTRUMENTS**	**9 Hours**

X-Ray machines and Digital radiography, Biological effect of NMR imaging and Ultrasound, Medical Thermography, Endoscope unit, Laser in medicine, Cryogenic application, Computer tomography

	Total:	**45 Hours**

Further Reading:

1. HumanAnatomy
2. BiologicalElectrodes
3. Recent trend in medical application.

Course Outcomes:

After completion of the course, Student will be able to

1. Explain Bio-Signals and Waveform in internal and external organs of human body.
2. Explain the Biochemical and Non-electrical parameters inhuman anatomy.
3. Choose a suitable assist devices for the treatment of heart & Kidney diseases.
4. Examine diathermy techniques for functioning of kidney.
5. Demonstrate medical diagnostic equipment for treating the Human diseases.

References:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hallof India, NewDelhi, 2007.
2. JohnG.Webster, “Medical Instrumentation Application and Design”,3rd Edition, WileyIndia Edition, 2007.
3. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, TATA McGraw-Hill, NewDelhi, 2003.
4. Joseph J.Carr and John M.Brown, “Introduction to Biomedical Equipment Technology”, John Wiley and Sons, NewYork,2004.
5. Joseph D.Bronzino, “The Biomedical Engineering HandBook”, SecondEdition,CRCPress,2000.

1903EC010	INFORMATION CODING TECHNIQUES	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Analog communication systems
2. Digital communication systems

COURSE OBJECTIVES:

1. To introduce the principles and applications of information theory.
2. To have complete understanding coding schemes, including error correcting codes.
3. To understand Source coding and Channel coding theorem.

UNIT I INTRODUCTION TO INFORMATION THEORY **9 Hours**

Measure of information – Entropy–Properties –Mark-off statistical model for information source – Information rate – Continuous and discrete cases – Conditional entropies – Basic relationship among different entropies – Mutual information and Trans information, Properties – Redundancy and Efficiency.

UNIT II CHANNEL CLASSIFICATION AND CAPACITY **9 Hours**

Continuous and discrete communication channels – Discrete memoryless channels – Channel representations – noiseless channel, lossless channel, deterministic, Binary Symmetric channel, Binary Erasure channel and their capacities – Continuous and discrete channels with noise – Shannon Hartley theorem and its implications – Channel coding theorem – Channel capacity Theorem.

UNIT III SOURCE CODING ALGORITHMS **9 Hours**

Purpose of encoding – Uniquely decipherable codes – Code efficiency and redundancy –Shannon's first and second fundamental theorem – Shannon's encoding algorithm – Shannon Fano code – Huffman code – LZ coding – Transform coding – Arithmetic coding.

UNIT IV BLOCK CODES AND CYCLIC CODES **9 Hours**

Linear block codes – Hamming codes – Binary Cyclic codes – Algebraic structure – Syndrome decoding –
Standard Cyclic codes – BCH codes, RS codes, Golay codes, CRC codes, Burst and Random Error correcting codes –Problems

UNIT V ERROR CORRECTING CODES **9 Hours**

Convolutional codes – Time domain approach –Transform domain approach –State diagram – Trellis code structure – Viterbi algorithm – Problems – Maximum likelihood detector – Turbo codes.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Error free communication on noisy channels
2. Data compression - Cryptography

COURSE OUTCOMES:

At the end of this course, students will be able to,

CO1	Apply information theory and linear algebra in source coding and channel coding.
CO2	Generalize the discrete concepts with signal and noise on continuous channels.
CO3	Analyze the source coding techniques using different algorithms.
CO4	Construct efficient codes for data on block codes.
CO5	Analyze the performance of various error control coding techniques.

REFERENCES:

1. 1. Simon Haykin, "Digital Communications", John Wiley, 2015.
2. 2. J.G. Proakis, "Digital Communications", McGraw Hill, 5th edition,2007
3. A.J.Viterbi and J.K.Omura, "Principles of Digital Communication and Coding", McGraw Hill.
4. Ranjan Bose, "Information theory, coding and cryptography" McGraw Hill, 2nd edition.
5. R. G. Gallager, "Information Theory and Reliable Communication", Wiley, 1966
6. Nptel link: https://nptel.ac.in/courses/117101053/