SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

M.E-Electronics and Communication Engineering

(Wireless and Mobile Communications)

CURRICULUM and SYLLABI

[For students admitted in 2021-2022]

M.E / M.Tech Regulation 2019

Approved by BOS and Academic Council meetings

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME I Semester under Regulations 2019
Electronics and Communication Engineering
Branch: M.E. Wireless and Mobile Communications

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	P19WMC101	Graph Theory and Combinatorics	3	0	0	3	45
2	P19WMC102	Modern Techniques in Mobile Communication Systems	3	0	0	3	45
3	P19WMC103	Advanced Digital Signal Processing	3	1	0	4	60
4	P19WMC104	Wireless Sensor Networks	3	0	0	3	45
5	P19WMC105	Wireless Communication and Networks	3	0	0	3	45
6	P19GE101	Research Methodology and IPR	2	0	0	2	30
Practical							
7	P19WMC106	Advanced Digital Signal Processing Laboratory	0	0	2	1	30
Audit Course							
8	P19GE702	Stress Management by Yoga	2	0	0	0	30
					Total Credits	**19**	

Approved by

Chairperson, Electronics and Communication Engineering BOS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/ECE, First Semester ME WMC Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME II Semester under Regulations 2019
Electronics and Communication Engineering
Branch: M.E. Wireless and Mobile Communications

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	P19WMC201	Audio, Video Coding and Compression	3	0	0	3	45
2	P19WMC202	RF Active Circuits for Wireless Systems	3	0	0	3	45
3	P19WMC203	Space Time Wireless Communication	3	0	0	3	45
4	P19WMC503	**Elective-** Mobile Computing and Security	3	0	0	3	45
5	P19WMC504	**Elective-** IOT with Wireless Technologies	3	0	0	3	45
6	P19WMC522	**Elective-** Image Analysis and Computer Vision	3	0	0	3	45
7	P19GE701	**Audit Course -**English for Research Paper Writing	2	0	0	0	30
8	P19WMC204	Wireless and Mobile Communication Laboratory	0	0	2	1	30
					Total Credits	**19**	

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Copy to:-
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Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME III Semester under Regulations 2019
Electronics and Communication Engineering
Branch: M.E. Wireless and Mobile Communications

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	P19WMC505	**Professional Elective-** Security of Wireless Communication	3	0	0	3	45
2	P19WMC516	**Professional Elective** -Biomedical Image Processing	3	0	0	3	45
3	P19CEM601	**Open Elective-** Disaster Mitigation and Management	3	0	0	3	45
Practical							
4	P19WMC301	Project Phase - I	0	0	16	8	240
					Total Credits	**17**	

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Copy to:-
HOD/ECE, Third Semester ME WMC Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME IV Semester under Regulations 2019
Electronics and Communication Engineering
Branch: M.E. Wireless and Mobile Communications

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	P19WMC401	Project Phase – II	0	0	28	14	420
					Total Credits	**14**	

Approved by

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Dr.R.Shivakumar

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Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/ECE, Fourth Semester ME WMC Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME I Semester under Regulations 2019
Electronics and Communication Engineering
Branch: M.E. Wireless and Mobile Communications

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	P19WMC101	Graph Theory and Combinatorics	3	0	0	3	45
2	P19WMC102	Modern Techniques in Mobile Communication Systems	3	0	0	3	45
3	P19WMC103	Advanced Digital Signal Processing	3	1	0	4	60
4	P19WMC104	Wireless Sensor Networks	3	0	0	3	45
5	P19WMC105	Wireless Communication and Networks	3	0	0	3	45
6	P19GE101	Research Methodology and IPR	2	0	0	2	30
Practical							
7	P19WMC106	Advanced Digital Signal Processing Laboratory	0	0	2	1	30
Audit Course							
8	P19GE702	Stress Management by Yoga	2	0	0	0	30
					Total Credits	**19**	

Approved by

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Dr.R.S.Sabeenian

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Dr.R.Shivakumar

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Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/ECE, First Semester ME WMC Students and Staff, COE

P19WMC101 GRAPH THEORY AND COMBINATORICS 3 0 0 3

Course Outcomes

At the end of the course, the students should be able to,

1) Apply the counting principles to the real world problems
2) Solve the homogeneous and nonhomogeneous recurrence relations by the method of substitution and generating functions.
3) Compute the shortest path and minimal spanning tree of a weighted graph through algorithms.
4) Analyze the matching and connectivity of a graph
5) Apply the concepts of planarity and coloring of a graph in a network problem

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2					2		3	3	3	2
CO2	3	3	2	2					2		3	3	3	2
CO3	3	3	2	3					2		3	3	3	3

Unit I COMBINATORICS 9

Mathematical Induction – Basics of counting – Permutations and Combinations – Enumeration of permutations and combinations with constrained repetitions – Enumeration of permutations and combinations without constrained repetitions – Principle of inclusion and exclusion.

Unit II RECURRENCE RELATIONS 9

Generating functions of sequences – Calculating coefficients of generating functions – Recurrence relations – Solving recurrence relations by substitution and generating functions – Method of characteristic roots – Solutions of homogeneous and nonhomogeneous recurrence relations.

Unit III GRAPH THEORY 9

Fundamental concepts of graph – Paths – Cycles – Trails – Vertex degrees and counting – Trees and distance – Shortest path algorithm (Dijkstra's &Warshall's algorithm) – Spanning Trees –Optimization and trees (Prim's &Kruskal's algorithm).

Unit IV MATCHING AND CONNECTIVITY **9**

Matching and coverings – Optimal assignment problem – Travelling salesman problem – Vertex and edge connectivity – Network flow problems.

Unit V COLORING AND PLANAR GRAPHS **9**

Vertex coloring – Edge coloring – Chromatic polynomial – Color critical graphs – Planar graphs – Duality – Euler's formula – Characterization of planar graphs – Parameters of planarity.

TOTAL : 45 HOURS

Text Book

1) D. B. West, "Introduction to Graph Theory", Pearson Publishers, 2nd Edition, 2017.

References

1) N. Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publishers, 1st Edition, 2016
2) J. L. Mott, A. Kandel and T. P. Baker, "Discrete mathematics for Computer Scientists and Mathematics", Brady Publishers, 2nd Edition, 1985
3) R. J. Wilson, "Introduction to Graph Theory", Pearson Publishers, 4th Edition, 2009
4) R. Balakrishnan and K. Ranganathan, "A Textbook of Graph Theory", Springer Publishers, 2nd Edition, 2012
5) V. K. Balakrishnan, "Graph Theory", Mc Graw Hill Publishers, 1st Edition, 2004

P19WMC103 ADVANCED DIGITAL SIGNAL PROCESSING 3 1 0 4

Course Outcomes

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

1) Apply discrete random signal processing techniques to estimate and analyze spectral power.
2) Analyze spectrum estimation using parametric methods and non-parametric methods
3) Analyze and interpret the estimation and prediction using Wiener FIR & IIR filters techniques
4) Describe and apply the adaptive filtering concepts for non-stationary environment
5) Analyze the sampling rate conservation using different filter structures

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	2	1		2	1	3	3
CO2	3	3	3	3	3	3	3	2	1		2	1	3	3
CO3	3	3	3	3	3	3	3	2	1		2	1	3	3
CO4	3	3	3	3	3	3	3	2	1		2	1	3	3
CO5	3	3	3	3	3	3	3	2	1		2	1	3	3

Unit I DISCRETE RANDOM SIGNAL PROCESSING **12**

Linear Mean Square Estimation – Parameter Estimation – Bias and Consistency – Ensemble Averages – Wide sense Stationary Processes – Autocorrelation and Auto Covariance Matrices – Power Spectrum – Linear Filtering– Low Pass Filtering of White Noise. Weiner Khitchine relation- Stochastic Models.

Unit II SPECTRUM ESTIMATION **12**

Estimation of Autocorrelation-Non–Parametric Methods – The Periodogram – Performance of the Periodogram – Modified Periodogram – Bartlett and Welch Methods – Blackman-Tukey Method – Performance Comparisons – Minimum Variance Spectrum Estimation – Parametric Methods of AR – MA – ARMA. Parameter estimation using Yule-Walker method.

Unit III LINEAR ESTIMATION AND PREDICTION **12**

Linear Prediction– Forward and Backward Predictions – Solutions of the Normal Equations– Levinson Durbin Algorithms – Least Mean Squared Error Criterion – Wiener Filter for Filtering and Prediction – FIR Wiener Filter – IIR Wiener Filter. Prediction error filters.

Unit IV ADAPTIVE FILTERS **12**

FIR Adaptive Filters – Adaptive Filter based on Steepest Descent Method – LMS Algorithm – Normalized LMS – Adaptive Channel Equalization – Adaptive Echo Cancellation – Adaptive Noise Cancellation – Adaptive Recursive Filters – RLS Adaptive Filters – Exponentially Weighted RLS – Sliding Window RLS. Convergence of adaptive algorithms.

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Unit V MULTIRATE DIGITAL SIGNAL PROCESSING **12**

Mathematical Description of Change of Sampling Rate – Interpolation and Decimation – Decimation by an Integer Factor – Interpolation by an Integer Factor – Sampling Rate Conversion by a Rational Factor – Filter Implementation for Sampling Rate Conversion – Direct Form FIR Structures – Polyphase Filter Structures – TimeVariant Structures – Multistage Implementation of Multirate System – Application to Sub Band Coding – Wavelet Transform, filter bank implementation and Multi Resolution Analysis by the Wavelet Method.

.

TOTAL : 60 HOURS

Text Books

1) Monson H. Hayes , "Statistical Digital Signal Processing and Modeling", John Wiley and Sons, Inc., Singapore, 2013
2) John G. Proakis , Dimitris G. Manolakis, "Digital Signal Processing", Pearson Education, 2002

References

1) Donald G. Givone, "*Digital principles and Design"*, Tata McGraw Hill, 2013.
2) William I. Fletcher, "*An Engineering Approach to Digital Design"*, Prentice Hall India, 2009.
3) Charles H. Roth Jr,,"*Fundamentals of Logic design"*, Thomson Learning, 2004.
4) Nripendra N Biswas, "*Logic Design Theory"*, Prentice Hall of India, 2005.
5) Donald G. Givone, "*Digital principles and Design"*, Tata McGraw Hill, 2013.

P19WMC102 MODERN TECHNIQUES IN MOBILE COMMUNICATION SYSTEMS 3 0 0 3

Course Outcomes

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

1) Describe the fundamental concepts and requirements of advanced mobile communication systems.

2) Analyze the modulation techniques for latest wireless communication methods.
3) Illustrate the multiple antenna transmission and reception methods for modern mobile systems

4) Discuss the role of Internet protocol in wireless networks and the integration of cellular with WLAN

5) Apply the role of OFDM technique in advanced mobile communication systems

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	2	2	3	3	2
CO2	3	3	3	3	3	3	3	3	3	2	2	3	3	2
CO3	3	3	3	3	3	3	3	3	3	2	2	3	3	2
CO4	3	3	3	3	3	3	3	3	3	2	3	3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	3	2

Unit I EVOLUTION OF MODERN WIRELESS COMMUNICATION SYSTEM 9

Overview for various wireless cellular networks 1G to 3G- Cellular –WLAN integration- ALL-IP network- Vision for 4G- Key technologies for 4G- Cellular mobile wireless networks- System design and channel assignment schemes – Mobility management- Radio resource management

Unit II ADVANCED MODULATION FOR WIRELESS COMMUNICATION 9

Orthogonal signal space- geometric representation of transmitted signals- Gram-Schmidt Orthogonalization procedure- Response of the noisy signal at the receiver- Maximum likelihood decision rule- optimum correlation receiver- Concept of M-ary modulation schemes - GMSK schemes- Analysis of modulated signals using vector signal analyzer

Unit III MULTI-ANTENNA COMMUNICATION **9**

Realization of Independent Fading Paths –Receiver Diversity –Selection Combing – Threshold Combing –Maximal-Ratio Combing –Equal -Gain Combing –Transmitter Diversity –Channel known at Transmitter –Channel unknown at Transmitter –-MIMO Systems

.

Unit IV ROLE OF MOBILE IP ON WIRELESS NETWORKS **9**

Brief Overview of IP routing protocols-IP for GPRS-Mobility management in wireless networks-Mobile IP and Wireless Application Protocol - Limitations of current TCP/IP networks for mobility support- Cellular and WLAN integration- Integrated network architecture- step towards 4G networks.

.

Unit V ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING **9**

Concept of multicarrier transmission-OFDM basics- Principles of Orthogonality-Selection parameters for OFDM-Spectral efficiency and pulse shaping- Synchronization in OFDM -guard interval and cyclic prefix-Pilot insertion in OFDM transmission and channel estimation in OFDM systems

TOTAL : 45 HOURS

Text Books

1) Upena Dalal, Wireless communication and Networks, Oxford University Press, 2015.
2) Jiangzhou Wang, "High-Speed Wireless Communications: Ultra-wideband, 3G Long Term Evolution, and 4G Mobile Systems" Cambridge University Press, 2013

References

1) Sung-Mo Kang and Yusuf Leblebici, "*CMOS Digital Integrated Circuits - Analysis and Design",* McGraw Hill Education (India) Pvt. Ltd., 3rd Edition, 2019.
2) Bhaskar J., "*A Verilog HDL Primer",* B. S. Publications, 2nd Edition, 2018.
3) R. Jacob Baker, "*CMOS circuit design, Layout, and Simulation"*, John Wiley and Sons, 2012
4) Neil H.E. Weste and Kamran Eshraghian, "*Principles of CMOS VLSI Design - A System Perspective",* Pearson Education ASIA, 2nd Edition, 2010
5) John P. Uyemura, "*Introduction to VLSI Circuits and Systems",* John Wiley & Sons, Inc., 2006

P19WMC104 **WIRELESS SENSOR NETWORKS** **3 0 0 3**

Course Outcomes

At the end of the course, the student will be able to

1) Analyze the fundamentals, challenges and design issues in sensor networks
2) Illustrate the architecture of sensor networks and categorize the functions and services of sensor nodes..
3) Analyze the MAC layer protocols, QoS and energy management systems
4) Interpret different routing protocols and apply the knowledge in developing security algorithms
5) Assess the network simulators and Tools

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	3	2	2	2	1	2	1	2	2	2	2	2
CO2	1	1	3	2	2	3	2	3	2	2	2	2	2	2
CO3	1	2	3	3	3	3	3	2	2	2	2	2	2	2
CO4	1	1	3	3	3	3	3	2	2	2	2	2	3	2
CO5	1	2	3	3	3	3	3	2	2	2	2	2	3	3

Unit I OVERVIEW OF WIRELESS SENSOR NETWORKS **9**

Introduction to sensor networks - Key definitions of sensor networks - unique constraints and challenges - advantages of sensor network- driving applications - issues in design of sensor network.

Unit II SENSOR NETWORK ARCHITECTURE **9**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes - Operating Systems and Execution Environments - Network Architecture - Sensor Network Scenarios - Optimization Goals and Figures of Merit - Gateway Concepts - Physical Layer and Transceiver Design Considerations.

Unit III MAC PROTOCOLS **9**

MAC Protocols for Wireless Sensor Networks - Low Duty Cycle Protocols And Wakeup Concepts - S-MAC - The Mediation Device Protocol - Wakeup Radio Concepts, Address and Name Management - Assignment of MAC Addresses - QoS and Energy Management -Issues and Challenges in providing QoS -QoS frameworks -need for energy management

Unit IV ROUTING PROTOCOLS **9**

Issues in designing a routing protocol - classification of routing protocols-table-driven, on-demand- hybrid- flooding- hierarchical- and power aware routing protocols..

Unit V SENSOR NETWORK PLATFORMS AND TOOLS **9**

Operating Systems for Wireless Sensor Networks - Sensor Nodes-Berkeley Motes - Network simulators –NS2 and NS3 - Programming Challenges - Node-level software platforms, Node-level Simulators.

TOTAL : 45 HOURS

Text Book

1) Holger Karl & Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005
2) Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007

References

1) C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education - 2008.
2) Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks- Technology, Protocols, And Applications”, John Wiley, 2007.
3) William Stallings, "Wireless Communications and Networks ", Pearson Education – 2004.
4) Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
5) Wayne Tomasi, “Introduction To Data Communication And Networking”, Parson Education, 2007.

P19WMC105 WIRELESS COMMUNICATION AND NETWORKS 3 0 0 3

Course Outcomes

At the end of the course, the student will be able to

1) Illustrate the various wireless networking technologies with routing mechanisms
2) Summarize the fundamental concepts of modern cellular networks and wireless sensor networks.
3) Design and implement wireless network environment for any application using latest wireless protocols and standards
4) Describe the applications of various standards used in wireless communication systems
5) Compare the features of modern wireless communication systems

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	3	2	3	2	1	1	2	2	2	3		
CO2	1	1	3	2	3	2	1	1	2	2	2	3		
CO3	1	1	3	2	3	2	2	1	2	2	2	3		
CO4	1	1	3	2	3	2	2	1	2	2	2	2		
CO5	1	1	3	2	3	2	2	1	2	2	2	3		

Unit I WIRELESS NETWORKING TECHNOLOGIES 9

Introduction-WLAN technologies IEEE 802.11 standard–OSI model, Transmission Control Protocol, Medium Access Control, Routing algorithms- Wireless routing protocols, Transport Control mechanisms- Security aspects- Application layer, Mobile computing.

Unit II REVIEW OF CELLULAR NETWORKS AND NETWORKS 9

GSM enhancements-GPRS channels- CDMA based digital cellular standards- IS 95 to CDMA 2000-UMTS- IEEE 802.16 standard architecture- Wi-Max-Spectrum allocation for WiMax standards-Architecture, Physical layer- Wireless sensor networks-Mobile adhoc networks(MANET)

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Unit III OVERVIEW OF IP AND MOBILE INTERNET PROTOCOL 9

Introduction – Mobile IP- Wireless Application Protocol_ IPV6-Network layer in the internet- Mobile IP session initiation protocol – mobile ad-hoc network: Types of routing- Mobility management issues- Role of IP on wireless networks

Unit IV **WIRELESS COMMUNICATION SYSTEMS AND STANDARDS** **9**

Introduction to broadcast networks-Digital audio broadcasting, Digital video broadcasting, HD radio technology-DTH-WLL-Wi-Fi standards- architecture, security aspects and applications- Evolution of broadband wireless communication-

Unit V **MODERN WIRELESS COMMUNICATION SYSTEMS** **9**

4G features and challenges : Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, 5G- New technologies in cellular data networks- Long term Evolution(LTE)- Requirements and Challenges, network architecture- Cognitive Radio Technology–UWB Wireless channels Mobile satellite communication.

TOTAL : 45 HOURS

Text Book

1) Martin Sauter, "From GSM to LTE-Advanced: An Introduction to Mobile Networks and Mobile Broadband" John Willey & Sons Ltd., 2014

2) Upena Dalal, Wireless communication and Networks, Oxford University Press, 2015

References

1) Vijay Garg , “Wireless Communications and networking”, First Edition, Elsevier 2012

2) ITI Saha Misra, Wireless communications and networks- 3G and beyond, McGraw Hill education Pvt.Ltd. 2014.

P19GE101 RESEARCH METHODOLOGY AND IPR 2 0 0 2

Course Outcomes

At the end of the course, the student will be able to

1) Review the literature of the research problem
2) Choose appropriate data collection and sampling method according to the research problem.
3) Interpret the results of research and communicate effectively with their peers
4) Explain the Importance of intellectual property rights
5) Evaluate trade mark, develop and register patents

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	3	1	2	1	1	3	2	2	2	1
CO2	2	1	2	2	3	1	2	1	1	3	2	2	2	1
CO3	2	1	2	2	3	1	2	1	1	3	2	2	2	1
CO4	2	1	2	2	3	1	2	1	1	3	2	2	2	1
CO5	2	1	2	2	3	1	2	1	1	3	2	2	2	1

Unit I INTRODUCTION TO RESEARCH METHODS 6

Definition and Objective of Research, Various steps in Scientific Research, Types of Research, Criteria for Good Research, Defining Research Problem, Research Design , Case Study Collection of Primary and Secondary Data, Collection Methods: Observation, Interview, Questionnaires, Schedules

Unit II SAMPLING DESIGN AND HYPOTHESIS TESTING 6

steps in Sampling Design, Types of Sample Designs, Measurements and Scaling Techniques - Testing of hypotheses concerning means (one mean and difference between two means -one tailed and two tailed tests), concerning variance – one tailed Chi-square test.

Unit III INTERPRETATION AND REPORT WRITING 6

Techniques of Interpretation, Precaution in Interpretation, Layout of Research Report, Types of Reports, Oral Presentation, Mechanics of Writing Research Report

Unit IV INTRODUCTION TO INTELLECTUAL PROPERTY 6

Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights, Innovations and Inventions trade related intellectual property rights.

Unit V TRADE MARKS, COPY RIGHTS AND PATENTS 6

Purpose and function of trade marks, acquisition of trade mark rights, trade mark registration processes, trademark claims –trademark Litigations- International trademark law

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

TOTAL : 30 HOURS

Text Book

1) C.R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques ,4th Edition, New Age International Publishers, 2019.

2) Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets", Delmar Cengage Learning, 4th Edition, 2012

3) Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy", Tata Mc Graw Hill Education, 1st Edition, 2008.

References

1) Panneerselvam, R., Research Methodology, Second Edition, Prentice-Hall of India, New Delhi, 2013..

2) Ranjith Kumar, Research Methodology – A step by step Guide for Begineers, 4th edition, Sage publisher, 2014...

3) D Llewelyn & T Aplin W Cornish, "Intellectual Property: Patents, Copyright, Trade Marks and Allied Rights", Sweet and Maxwell, 1st Edition, 2016.

4) Ananth Padmanabhan, "Intellectual Property Rights-Infringement and Remedies", Lexis Nexis, 1st Edition, 2012.

5) Ramakrishna B and Anil Kumar H.S, "Fundamentals of Intellectual Property Rights: For Students, Industrialist and Patent Lawyers", Notion Press, 1st Edition, 2017.

6) M.Ashok Kumar and Mohd.Iqbal Ali :"Intellectual Property Rights" Serials Pub

P19WMC106 ADVANCED DIGITAL SIGNAL PROCESSING LABORATORY 0 0 2 1

Course Outcomes

At the end of the course, the student will be able to

1) Implement the adaptive filters, periodogram and multistage multi rate system using DSP Processor
2) Design and simulate the turbo coding and QMF.
3) Simulate wireless channel equalizer design using DSP

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3						3	3	3	3
CO2	3	3	3	3	3						3	3	3	3
CO3	3	3	3	3	3						3	3	3	3
CO4	3	3	3	3	3						3	3	3	3
CO5	3	3	3	3	3						3	3	3	3

List of Experiments

1) Design and simulate the QMF using simulation packages
2) Wireless channel equalizer design using DSP (LMS and RLS).
3) Sampling and quantization of audio signal using Matlab.
4) Design and simulate the Turbo Coder
5) Design and performance analysis of error control encoder and decoder (CRC and Convolution Codes
6) Implementation of linear and cyclic codes
7) Design and simulate the modulation and coding in an AWGN communication channel using simulation packages
8) Echo cancellation and noise cancellation using Matlab
9) Implement the adaptive filters, periodogram and multistage multirate system using DSP Processor
10) Implementation of Matched Filters
11) Simulation of MIMO systems

Total: 30 Hours

P19GE702 **STRESS MANAGEMENT BY YOGA** **2 0 0 0**

Course Outcomes

At the end of the course, the student will be able to

1) Develop physical and mental health thus improving social health
2) Increase immunity power of the body and prevent diseases
3) Accelerate memory power
4) Accelerate memory power
5) Improve stability of mind, pleasing personality and work with awakened wisdom

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	3	3	2	2	3	1		1	3	3	3
CO2	2	1	1	3	3	2	2	3	1		1	3	3	3
CO3	2	1	1	3	3	2	2	3	1		1	3	3	3
CO4	2	1	1	3	3	2	2	3	1		1	3	3	3
CO5	2	1	1	3	3	2	2	3	1		1	3	3	3

Unit I **6**

Yoga-Introduction - Astanga Yoga- 8 parts-Yam and Niyam etc.- Do`s and Don'ts in life-Benefits of Yoga and Asana- Yoga Exercise- and benefits- Pranayam Yoga-Nadisuthi, Practice and Spinal Sclearance Practice- Regularization of breathing techniques and its effects-Practice and kapalapathy practice

Unit II **6**

Neuromuscular breathing exercise and Practice- Magarasa Yoga, 14 points Acupressure techniques and practice- Body relaxation practice and its benefits- Raja Yoga- 1.Agna – explanation and practiceActivation of Pituitary- Raja Yoga-2. Santhi Yoga-Practice-Balancing of physical and mental power.

Unit III **6**

Raja Yoga-3.Sagasrathara yoga –practice- Activation of dormant brain cells-Kayakalpa-theoryKayakalpa –practice-Yogic exercise to improve physical and mental health and practice-Asanas – explanation-Practice-benefits

Unit IV **6**

Sun namaskar- 12 poses-explanation and practice-Yoga –Asana-Padmasana, vajrasana, chakrasana, viruchasanaetc-Stress management with Yoga-Role of women and Yoga Equality, nonviolence, Humanity, Self- control- Food and yoga Aware of self-destructive habits Avoid fault thinking (thought analysis-Practice)-Yoga Free from ANGER (Neutralization of anger)& practice.

Unit V **6**

Moralisation of Desire & practice- Punctuality-Love-Kindness-Compassion Eradication of worries-Practice -Personality development, positive thinking-Good characters to lead a moral life How to clear the polluted mind- Benefits of blessing-Five- fold culture –explanation- Karma Yoga Practice In Geetha- Sense of duty-Devotion, self- reliance, confidence, concentration, truthfulness, cleanliness.

TOTAL : 30 HOURS

References

1) 'Yogic Asanas for Group Training-Part-I" Janardan Swami YogabhyasiMandal, Nagpur
2) "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

P19GE702 **Stress Management by Yoga**

2000

Course Outcomes:

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

1. Develop physical and mental health thus improving social health
2. Increase immunity power of the body and prevent diseases
3. Accelerate memory power
4. Achieve the set goal with confidence and determination
5. Improve stability of mind, pleasing personality and work with awakened wisdom

UNIT – I **6**

Yoga-Introduction - Astanga Yoga- 8 parts-Yam and Niyam etc.- Do`s and Don'ts in life-Benefits of Yoga and Asana- Yoga Exercise- and benefits- Pranayam Yoga- Nadi suthi, Practice and Spinal Sclearance Practice- Regularization of breathing techniques and its effects-Practice and kapalapathy practice.

UNIT – II **6**

Neuromuscular breathing exercise and Practice- Magarasa Yoga, 14 points Acupressure techniques and practice- Body relaxation practice and its benefits- Raja Yoga- 1.Agna – explanation and practice- Activation of Pituitary- Raja Yoga- 2. Santhi Yoga-Practice-Balancing of physical and mental power.

UNIT – III **6**

Raja Yoga- 3. Sagasrathara yoga –practice- Activation of dormant brain cells-Kayakalpa-theory- Kayakalpa –practice-Yogic exercise to improve physical and mental health and practice-Asanas –explanation-Practice-benefits

UNIT –IV **6**

Sun namaskar- 12 poses-explanation and practice-Yoga –Asana-Padmasana, vajrasana,chakrasana, viruchasana etc-Stress management with Yoga-Role of women and Yoga

Equality, nonviolence, Humanity, Self- control- Food and yoga Aware of self-destructive habits

Avoid fault thinking (thought analysis-Practice)-Yoga Free from ANGER (Neutralization of anger)& practice

UNIT – V **6**

Moralisation of Desire & practice- Punctuality-Love-Kindness-Compassion Eradication of worries-Practice -Personality development, positive thinking-Good characters to lead a moral life

How to clear the polluted mind- Benefits of blessing- Five- fold culture –explanation- Karma Yoga Practice In Geetha- Sense of duty-Devotion, self- reliance, confidence, concentration, truthfulness, cleanliness.

Reference Books

1. 'Yogic Asanas for Group Tarining-Part-I" Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

Total: 30 hours

Dr. M. Renuga
BoS – Chairperson,
Science & Humanities
HOD / H&L

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME II Semester under Regulations 2019
Electronics and Communication Engineering
Branch: M.E. Wireless and Mobile Communications

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	P19WMC201	Audio, Video Coding and Compression	3	0	0	3	45
2	P19WMC202	RF Active Circuits for Wireless Systems	3	0	0	3	45
3	P19WMC203	Space Time Wireless Communication	3	0	0	3	45
4	P19WMC503	**Elective-** Mobile Computing and Security	3	0	0	3	45
5	P19WMC504	**Elective-** IOT with Wireless Technologies	3	0	0	3	45
6	P19WMC522	**Elective-** Image Analysis and Computer Vision	3	0	0	3	45
7	P19GE701	**Audit Course -**English for Research Paper Writing	2	0	0	0	30
8	P19WMC204	Wireless and Mobile Communication Laboratory	0	0	2	1	30
					Total Credits	**19**	

Approved by

Chairperson, Electronics and Communication Engineering BOS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/ECE, Second Semester ME WMC Students and Staff, COE

P19WMC201 AUDIO, VIDEO CODING AND COMPRESSION 3 0 0 3

Course Outcomes

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

1) Analyze the basic characteristics of multimedia components
2) Compare the various methods for compression in audio & video.
3) Analyze the different methods for compression in text and images
4) Analyze the concept of audio, video databases and segmentation
5) Examine the media on demand and applications with appropriate operating system

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	1	2	1	2	1	2	2	3	3
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CO3	3	3	3	3	3	1	2	1	2	1	2	2	3	3
CO4	3	3	3	3	3	1	2	1	2	1	2	2	3	3
CO5	3	3	3	3	3	1	2	1	2	1	2	2	3	3

Unit I INTRODUCTION **9**

Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware-Multimedia and Hypermedia- World Wide Web- Multimedia Software Tools-Multimedia Authoring and Tools- Editing and Authoring Tools, Adobe Premiere-Dream Weaver VRML, Macromedia Graphics and Image data Representations

Unit II AUDIO AND VIDEO COMPRESSION **9**

Audio- MIDI- Musical Instrument Digital Interface-Basic Audio Compression Techniques, PCM,DM- MPEG Audio Compression MPEG 2,4,7 and 21 – Video- Analog video – NTSC, PAL, SECAM- Digital video – Chromo subsampling, CCIR, HDTV-Video Compression Techniques- Basic Video Compression Techniques- Video compression based on motion compensation - MPEG Video Coding I: MPEG 1 and MPEG 2- MPEG Video Coding II: MPEG 4, 7 and 21

Unit III TEXT AND IMAGE COMPRESSION **9**

Image- Image model-RGB, CMY -Image Compression Standards JPEG Standard, JPEG 2000 Standard- Image File formats- GIF, TIFF,PNG,WMF,PS, JPEG, EXIF, Graphics and Animation Files, PDF, BMP, PPM text compression – static Huffman coding dynamic coding –arithmetic coding –Lempel ziv-welsh Compression-image compression

Unit IV AUDIO & VIDEO DATABASES **9**

Audio Databases - A General Model of Audio Data - Capturing Audio Content through Discrete Transformation - Indexing Audio Data. Video Databases - Organizing Content of a Single Video - Querying Content of Video Libraries – Video Segmentation.

Unit V MEDIA ON DEMAND AND APPLICATIONS **9**

Storage and Media servers, Voice and video over IP, MPEG -2 over ATM / IP, indexing, synchronization of requests, recording and control. MIME, Peer – to – Peer Computing, shared application, Video conferencing, centralized and distributed conference control, Distributed virtual reality, Light weight sessions philosophy

TOTAL : 45 HOURS

References

1) Fred Halshall, "*Multimedia communication - applications, networks, protocols and standards*", Pearson education, 2007.

2) Nalin K Sharda, "*Multimedia Information Networking*", Prentice Hall of India, 2011.

3) R. Steimnetz, K. Nahrstedt, "*Multimedia Computing, Communications and Applications*", Pearson Education, First edition, 2012.

4) Kurose and W.Ross, "*Computer Networking* "a Top down approach, Pearson education, 3rd ed, 2011

5) KR. Rao,Z S Bojkovic, D A Milovanovic, "*Multimedia Communication Systems: Techniques,Standards, and Networks*", Pearson Education 2012.

P19WMC202 RF ACTIVE CIRCUITS FOR WIRELESS SYSTEMS 3 0 0 3

Course Outcomes

At the end of each unit, the students will be able to

1) Discuss the concepts and general considerations for designing Linear RF amplifier.
2) Analyze the working principles of LNA and PA.
3) Illustrate the behavior of RF active devices and their modelling at microwave frequencies

4) Analyze the design principles of High-Power RF transistor amplifiers
5) Illustrate the operating and design principles of oscillators and mixers

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
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CO3	3	3	3	3	3	1	2			1	2	2	3	3
CO4	3	3	3	3	3	1	2			1	2	2	3	3
CO5	3	3	3	3	3	1	2			1	2	2	3	3

Unit I Linear RF Amplifier Design **9**

Power Gain Definition – Neutralization – Unilateral Transducer Gain - RF Circuit Stability Considerations: RF Oscillation, stability Analysis with arbitrary source and local terminations, two port stability considerations, Stability Circles – Stabilizing an active two port - Stabilization of a bipolar Transistor – The dc bias techniques: Passive DC bias networks, Active dc bias circuits, Feeding dc bias into RF Circuit.

Unit II Linear and Low Noise RF Amplifiers **9**

Bilateral RF Amplifier Design for Maximum Small-Signal Gain, Multistage Amplifiers – Operating Gain Design for Maximum Linear output power – Noise in RF Circuits - Available Gain Design Techniques: Gain Design Outline, Low Noise Amplifier Design Consideration, Design of Single Ended 1.9 GHz LNA, Comparison of Various Amplifier Design and Smith Chart Based Graphical Design aids.

Unit III Active RF Devices and Modeling **9**

The Diode Model – Two Port Design Model: The output terminals of a two port RF Device, The bipolar Transistor, The heterojunction bipolar transistor, The GaAS MESFET, The High Electron Mobility Transistor

Unit IV High Power RF Transistor Amplifier Design **9**

Nonlinear Concepts – Quasi-linear power amplifier design - Categories of Amplifiers: Class A, Class B, Class F Amplifiers, Switching Mode Amplifiers - Power Amplifier Design Examples: Transistor Selection, Transistor Characterization, Matching the input and output of the Device - Bias Considerations: Bias Changes at the input, Bias Changes at the output.

Unit V Oscillators, Mixers **9**

Oscillators - Principles of Oscillator Design: Two Port Oscillator Design Approach, One Port Oscillator Design Approach, Transistor Oscillator Configurations, Characterizing Oscillator Phase Noise – Design examples**.**
Mixers - Applications of Mixers in Systems – Diode Mixers - Single Ended Mixer, Single Balanced Mixer, Double Balanced Mixer, Image Problem in Mixers, Harmonic Components in Mixers - Transistor Mixers – Active transistor mixer

TOTAL : 45 HOURS

References

1) Les Besser and Rowan Gilmore, ―Practical *"RF Circuit Design for Modern Wireless Systems Active Circuits and Systems*", Vol.II, Artech House Publishers, Boston, London 2003.

2) D.M.Pozar, ―"*Microwave Engineering*", John Wiley & Sons, Singapore 2004.

3) R.E.Collin, ―"*Foundations of Microwave Engineering"*, McGraw Hill, 2007.

4) Les Besser and Rowan Gilmore, ―Practical "*RF Circuit Design for Modern Wireless Systems Passive Circuits and Systems"*, Vol 1, Artech House Publishers, Boston, London 2003

P19WMC203 SPACE TIME WIRELESS COMMUNICATION 3 0 0 3

Course Outcomes

At the end of each unit, the students will be able to -

1) Discuss the fundamental concepts of MIMO based OFDM systems.
2) Develop OFDM based MIMO systems
3) Discuss the types of spatial diversity techniques on MIMO systems.
4) Analyze the coding and decoding techniques associated with space time wireless communication.

5) Compare the various modulation schemes for space-time wireless communication.

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	2	2	1	1	2	2	3	3	3
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CO3	3	3	2	3	3	2	2	1	1	2	2	3	3	3
CO4	3	3	2	3	3	2	2	1	1	2	2	3	3	3
CO5	3	3	2	3	3	2	2	1	1	2	2	3	3	3

Unit I INTRODUCTION TO OFDM AND MIMO SYSTEMS 9

Introduction to OFDM –Multicarrier Modulation and Cyclic Prefix –Channel model and SNR –Performance –OFDM issues –Peak to Average Power Ratio –Frequency & Timing offset issues. MIMO based system architecture, MIMO channel capacity-MIMO Spatial Multiplexing –BLAST –-MIMO applications in advanced wireless systems

Unit II CAPACITY OF MULTIPLE ANTENNA CHANNELS 9

Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter, Channel known to the transmitter, capacity of random MIMO channels, Capacity of frequency selective MIMO channels. Singular value Decomposition and Eigen Modes of the MIMO Channel, Channel estimation techniques in MIMO systems

Unit III SPATIAL DIVERSITY **9**

Diversity gain, Receive antenna diversity, Transmit antenna diversity, Diversity order and channel variability, Diversity performance in extended channels, Combined space and path diversity, Indirect transmit diversity, Diversity of a space-time-frequency selective fading channel. MIMO Diversity techniques

Unit IV MULTIPLE ANTENNA CODING AND RECEIVERS **9**

Coding and interleaving architecture, ST coding for flat and frequency selective channels, Antenna considerations for MIMO-Iterative MIMO receivers, Exploiting channel knowledge at the transmitter: linear pre-filtering, optimal pre-filtering for error rate minimization, selection at the transmitter, Exploiting imperfect channel knowledge.

Unit V MIMO MULTIUSER DETECTION **9**

SISO-OFDM modulation, MIMO-OFDM modulation, Signaling and receivers for MIMO-OFDM,SISO-SS modulation, MIMO-SS modulation, Outage performance for MIMO-MU,MIMO-MU with OFDM,CDMA and multiple antennas

TOTAL : 45 HOURS

References

1) PaulrajA, Rohit Nabarand Dhananjay Gore, "*Introduction to Space Time Wireless Communication Systems*", Cambridge University Press, 2013
2) Ezio Biglieriand Robert Calderbank " *MIMO Wireless Communications*", Cambridge University Press, 2011
3) Jiangzhou Wang, "*High-Speed Wireless Communications: Ultra-wideband,3G LongTerm Evolution, and 4G Mobile Systems*" Cambridge University Press, 2009
4) Sergio Verdu " *Multi User Detection*" Cambridge University Press, 2010

P19WMC503 MOBILE COMPUTING AND SECURITY 3 0 0 3

Course Outcomes

At the end of each unit, the students will be able to

1) Analyze the architecture and performance of 3G networks..
2) Analyze the performance of 4G networks.
3) Discuss the various convergence foundations.
4) Summarize the various future upcoming networks.
5) Synthesize a given network and trouble shoots the problems

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	3	2	1				2	2	2	3	3
CO2	3	2	3	3	2	1				2	2	2	3	3
CO3	3	2	3	3	2	1				2	2	2	3	3
CO4	3	2	3	3	2	1				2	2	2	3	3
CO5	3	2	3	3	3	1				2	2	2	3	3

Unit I 3G Network **9**

Foundation - 3G Network architecture- Overall core architecture- Access Stratum and Non-Access Stratum- End to End Security Overview-Radio access network -Physical layer & protocols – Key Network and UE procedures: - Call set-up/release, Mobility management in idle mode and active mode (handover).

Unit II LTE **9**

Specialist - 4G/LTE/LTE-A, Small Cells-Network evolution from 3G to Evolved Packet Core (EPC) and LTE Small Cells-Architecture changes compared to 3G-Air interface upgrades - LTE-pro, SON & HetNets..

Unit III 5 G **9**

Introduction - Evolution of LTE Technology to Beyond 4G - 5G Roadmap - 5G Architecture - Pillars of 5G - Evolution of Existing RATs - Hyperdense Small-Cell Deployment - Self-Organizing Network - Machine Type Communication - Developing Millimetre - Wave RATs - Redesigning Backhaul Links- Energy Efficiency - Allocation of New Spectrum for 5G - Spectrum Sharing - RAN Virtualisation.

Unit IV SMALL CELLS FOR 5G MOBILE NETWORKS **9**

Introduction - Wi-Fi and Femtocells as Candidate Small-Cell Technologies - WiFi and Femto Performance – Indoors vs Outdoors - Capacity Limits and Achievable Gains with Densification - Gains with Multi-Antenna Techniques - Gains with Small Cells - Mobile Data Demand - Approach and Methodology - Demand vs Capacity - Small-Cell Challenges

Unit V **9**

SECURITY FOR 5G COMMUNICATIONS

Introduction - Overview of a Potential 5G Communications - Security Issues and Challenges in 5G Communications Systems - User Equipment - Access Networks -Mobile Operator's Core Network - External IP Networks.

TOTAL : 45 HOURS

References

1) Holma, H., Toskala, A., & Reunanen, J. (Eds.). (2016). "*LTE small cell optimization": 3GPP Evolution to Release 13*. John Wiley & Sons..

2) Venkataraman, H., & Trestian, R. (2017). *"5G Radio Access Networks: centralized RAN"*, cloud-RAN and virtualization of small cells. CRC Press

3) Rodriguez, J. (Ed.). (2015). *'Fundamentals of 5G mobile networks'*. John Wiley & Sons.

4) Anpalagan, A., Bennis, M., & Vannithamby, R. (Eds.). (2016). "*Design and deployment of small cell networks"*. Cambridge University Press.

P19WMC504 IOT WITH WIRELESS TECHNOLOGIES 3 0 0 3

Course Outcomes

At the end of each unit, the students will be able to –

1) Discuss about IOT for cellular internet
2) Discuss on the different standards for wireless technology
3) Elucidate the difference between EC, GSM and IOT
4) Analyze the performance measure for GSM and 4G networks
5) Analyze IOT systems and radio access design principles

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	3	2	2	1	2	1	3	3
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CO3	2	2	3	3	3	2	3	2	3	3	3	2	2	3
CO4	2	2	2	2	3	2	2	2	2	2	3	2	3	3
CO5	1	2	3	3	3	3	2	3	3	3	3	3	2	3

Unit I THE CELLULAR INTERNET OF THINGS 9

Introduction -New Applications and Requirements - Leading up to the Cellular Internet of Things - Massive Machine-Type Communications and Ultra Reliable and Low Latency Communications - Introducing EC-GSM-IoT. NB-IoT. and LTE-M- Low Power Wide Area Networks - Licensed and License Exempt Band Regulations.

Unit II WORLD CLASS STANDARDS 9

Third Generation Partnership Project - From Machine-Type Communications to the Cellular Internet of Things- Access Class and Overload Control- Small Data Transmission-Device Power Savings- Study on Provision of Low-Cost MTC Devices Based on LTE-Study 011 Cellular System Support for Ultra-Low Complexity and Low Throughput Internet of Things.

Unit III EC-GSM-IOT **9**

The History of GSM - Characteristics Suitable for loT-Physical Layer--Physical Layer Numerology- Channel Coding and interleaving - Downlink & Uplink Logical Channels.- Idle and Connected Mode Procedures-Release -New TS Mapping in Extended Coverage.

Unit IV EC-GSM-LOT PERFORMANCE & LTE **9**

Coverage-Data Rate-Latency-Battery Life-Capacity-Device Complexity-Operation in a Narrow Frequency Deployment-3GPP Standardization-Idle and Connected Mode Procedures-Physical Layer- 14 Improvements

Unit V NB-loT **9**

3GPP Standardization-Radio Access Design Principles -Physical Layer .- Idle and Connected Mode Procedure & 14 Improvements -Coverage and Data Rate-loT Connectivity Technologies in Unlicensed Spectrum-Choice of CloT Technology - 5G Vision and Requirements-5G for loT Connectivity- URLLC-mMTC

TOTAL : 45 HOURS

References

1) Liberg, O., Sundberg, M., Wang, E., Bergman, J., & Sachs, J. (2017). *"Cellular Internet of Things: Technologies"*, Standards, and Performance. Academic Press..
2) McEwen, A., & Cassimally, H. (2013). *"Designing the internet of things"*. John Wiley & Sons.

P19WMC204 IMAGE ANALYSIS AND COMPUTER VISION 3 0 0 3

Course Outcomes

At the end of each unit, the students will be able to –

1) Implement image enhancement algorithms.
2) Apply image transforms for different image applications
3) Perform different segmentation and restoration
4) Implement different compression techniques
5) Develop algorithms for computer vision problems

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
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CO4	3	3	2	3	3	1	1			1	2	1	3	3
CO5	3	3	2	3	3	1	1			1	2	1	3	3

Unit I IMAGE ENHANCEMENT 9

Digital Image fundamentals - Image sampling - Quantization - Spatial domain filtering - Image negative - Contrast stretching, Gray level slicing - Histogram equalization - Smoothing filters, Sharpening filters, Maximum filter, Minimum filter, Median filter.

Unit II IMAGE TRANSFORMS 9

2D transforms - DFT - DCT - Walsh - Hadamard - Slant - Haar - KLT - SVD - Wavelet transform.

Unit III IMAGE RESTORATION AND SEGMENTATION 9

Image restoration - degradation model - Unconstrained and Constrained restoration - Inverse filtering - Wiener filtering - Image segmentation - Thresholding - Edge detection - Region based segmentation.

Unit IV IMAGE COMPRESSION 6

Need for data compression - Huffman - Arithmetic coding - LZW technique - Vector Quantization - JPEG – MPEG

Unit V COMPUTER VISION 12

Texture classification - Feature extension - Markov Random Field Matrix – Gray Level Co –occurrence Matrix – Gray Level Weight Matrix , Multi Resolution Combined Statistical and Spatial Frequency method, character recognition- zoning approaches, Medical Image Analysis – Diabetic Retinopathy – Glaucoma.

TOTAL : 45 HOURS

References

1) Rafael C.Gonzalex, Richard E.Woods, "*Digital Image Processing, Pearson Education. Inc"*., Forth Edition, 2018
2) Anil K.Jain, "*Fundamentals of Digital Image Processing*", Prentice Hall of India, 2004
3) Milan Sonka, Vaclav Hlavac and Roger Boyle, "*Image Procesing, Analysis and Machine Vision*", Brookes/Cole, Vikas Publishing House, 2nd edition, 1999
4) Jayaraman S Esakkirajan and Veerakumar, "Digital Image Processing", McGraw Hill Education; July 2017
5) Sid Ahmed, M.A., "*Image Processing Theory, Algorithms and Architectures*", Mc Graw Hill, 1995
6) Richard Szeliski, "*Computer Vision Algorithms and Applications*", Springer Verlag London Limited, 2011
7) Sabeenian R.S., "*Digital Image Processing*", Sonaversity publication, Second Edition, 2010
8) Annadurai S., R. Shanmugalakshmi, "*Fundamentals of Digital Image Processing*", Pearson Education India, 2007
9) Sridhar.S, "*Digital Image Processing*", Oxford University Press, First Edition, 2011
10) Kenneth R. Castleman, "*Digital Image Processing*", Pearson, 2009

P19GE701 ENGLISH FOR RESEARCH PAPER WRITING 2 0 0 0

Course Outcomes

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

1) Demonstrate research writing skills both for research articles and thesis.
2) Frame suitable title and captions as sub-headings for articles and thesis
3) Write each section in a research paper and thesis coherently
4) Use language appropriately and proficiently for effective written communication
5) Exhibit professional proof-reading skills to make the writing error free

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
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CO4	1	1	1	1	1	1	1	3	3	3	3	3	1	1
CO5	1	1	1	1	1	1	1	3	3	3	3	3	1	1

Unit I **6**

Planning and preparation, word order, breaking up long sentences, organising ideas into paragraphs and sentences, being concise and avoiding redundancy, ambiguity and vagueness

Unit II **6**

Interpreting research findings, understanding and avoiding plagiarism, paraphrasing sections of a paper/ abstract.

Unit III **6**

Key skills to frame a title, to draft an abstract, to give an introduction

Unit IV **6**

Skills required to organise review of literature, methods, results, discussion and conclusions

Unit V **6**

Usage of appropriate phrases and key terms to make the writing effective - proof-reading to ensure error-free writing..

TOTAL : 30 HOURS

Text Books :

1) Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2) HighmanN , Handbook of Writing for the Mathematical Sciences, SIAM.Highman's book, 1998.
3) Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
4) Goldbort R, Writing for Science, Yale University Press, 2006. (available on Google Books)

References :

1) Martin Cutts, Oxford Guide to Plain English, Oxford University Press, Second Edition, 2006

P19WMC204 **WIRELESS AND MOBILE COMMUNICATION LABORATORY** **3 0 0 3**

Course Outcomes

At the end of each experiment, the students will be able to –

1) Practice to create the radiation pattern for various antennas, microstrip antennas.
2) Simulate various MAC, Ad hoc routing protocols
3) Analyze the performances of BPSK, QPSK, QAM etc. using MATLAB

CO / PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	3	3	2	1	1	1	3		
CO2	2	2	1	3	3	1	3	2	1	1	1	3		
CO3	2	3	2	3	3	3	3	2	1	1	1	3		

List of Experiments

1) Antenna radiation pattern measurement of Yagi–Uda, dipole, End-Fire and Broad Side Array antennas
2) Radiation pattern measurement of micro strip antennas
3) Performance evaluation of simulated CDMA system
4) Simulation of RF Amplifier and RF Oscillator Circuits
5) Simulation and performance evaluation of MAC protocols for wired and Wireless networks
6) Simulation and performance evaluation of Ad–hoc routing protocols using GLOMOSIM / NS2 (DSR, AODV, ZRP)
7) Simulation of BPSK Modulation and Demodulation techniques
8) Simulation of QPSK Modulation and Demodulation techniques
9) Simulation of DQPSK Modulation and Demodulation techniques
10) Simulation of 8-QAM Modulation and Demodulation techniques

P19GE701 **English for Research Paper Writing**

2 0 0 0

Course Outcomes:

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

- Demonstrate research writing skills both for research articles and thesis
- Frame suitable title and captions as sub-headings for articles and thesis
- Write each section in a research paper and thesis coherently
- Use language appropriately and proficiently for effective written communication
- Exhibit professional proof-reading skills to make the writing error free

Unit – I **6**

Planning and preparation, word order, breaking up long sentences, organising ideas into paragraphs and sentences, being concise and avoiding redundancy, ambiguity and vagueness

Unit – II **6**

Interpreting research findings, understanding and avoiding plagiarism, paraphrasing sections of a paper/ abstract.

Unit- III **6**

Key skills to frame a title, to draft an abstract, to give an introduction

Unit – IV **6**

Skills required to organise review of literature, methods, results, discussion and conclusions

Unit – V **6**

Usage of appropriate phrases and key terms to make the writing effective - proof-reading to ensure error-free writing.

Text Books:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Highman N , Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998.
3. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
4. Goldbort R, Writing for Science, Yale University Press, 2006. (available on Google Books)

REFERENCES

Martin Cutts, Oxford Guide to Plain English, Oxford University Press, Second Edition, 2006

Total: 30 hours

Dr. M. Renuga
BoS – Chairperson,
Science & Humanities
HOD / H&L

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME III Semester under Regulations 2019
Electronics and Communication Engineering
Branch: M.E. Wireless and Mobile Communications

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	P19WMC505	**Professional Elective-** Security of Wireless Communication	3	0	0	3	45
2	P19WMC516	**Professional Elective** -Biomedical Image Processing	3	0	0	3	45
3	P19CEM601	**Open Elective-** Disaster Mitigation and Management	3	0	0	3	45
Practical							
4	P19WMC301	Project Phase - I	0	0	16	8	240
					Total Credits	**17**	

Approved by

Chairperson, Electronics and Communication Engineering BOS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/ECE, Third Semester ME WMC Students and Staff, COE

P19WMC505 SECURITY OF WIRELESS COMMUNICATION 3 0 0 3

Course Outcomes

At the end of each unit, the students will be able to

1) Understand the fundamentals of security principles.
2) Analyze and apply the key encryption techniques
3) Elucidate different multiple access techniques
4) Analyze secrecy communication in OFDMA
5) Understand different channel estimation techniques

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	3	1					1	2	2
CO2	3	2	3	3	3	3	1					1	2	2
CO3	3	3	3	2	2	2	1					1	2	2
CO4	3	2	2	3	2	2	1					1	2	2
CO5	3	2	2	3	3	3	1					1	2	2

Unit I FUNDAMENTALS OF SECURITY **09**

Fundamentals of Physical layer security – Information theoretic secrecy Secret Communication over Noisy channels - Secret-key Generation from Noisy Channels. Coding for Wiretap Channels- Wiretap Coding with Polar Codes- Coding for Gaussian Wiretap Channels

Unit II KEY TECHNIQUES **09**

Information-theoretic Models for Key Generation -Basic Approaches for Key Generation via Wireless Networks- A Joint Source-Channel Key Agreement Protocol-Relay-assisted Key Generation with a Public Channel-Key Agreement with the Presence of an Active Attacker . MIMO Signal Processing Algorithms for Enhanced Physical Layer Security.

Unit III OFDMA & FDMA NETWORKS SECURITY **09**

Secrecy Performance Metrics -Physical Layer Security in OFDMA & FDMA Networks - Power Allocation Law for Secrecy - Multiple Eavesdroppers.

Unit IV SECRECY COMMUNICATIONS **09**

Resource Allocation for Physical Layer Security in OFDMA Networks- Application of Cooperative Transmissions to Secrecy Communications - Stochastic Geometry Approaches to Secrecy in Large Wireless Networks

Unit V CHANNEL ESTIMATION **09**

Channel Estimation- Discriminatory Channel Estimation—Basic Concept- DCE via Feedback and Retraining -Two-Stage Feedback-and-Retraining - Multiple-stage Feedback and Retraining - Discriminatory Channel Estimation via Two-way Training - Two-way DCE Design for Reciprocal Channels- Two-way DCE Design for Nonreciprocal Channels.

TOTAL : 45 HOURS

TEXT BOOKS

1) Lidong Chen and Guang Gong, Communication System Security, Chapman and Hall/CRC, 2012.

2) Xiangyun Zhou, Lingyang Song and Yan Zhang, Physical Layer Security in Wireless Communications, CRC Press, 2013

REFERENCES

1) Ramjee Prasad, OFDM for Wireless Communications Systems, Artech House, 2004

2) Bahai, Saltzberg and Ergen, Multi-Carrier Digital Communications, Theory andApplications of OFDM, Second Edition, Springer, 2004

3) Ye (Geoffrey) Li and Gordon L. Stuber, Orthogonal Frequency Division Multiplexing

For Wireless Communications, Springer, 2006.

P19WMC516 BIOMEDICAL IMAGE PROCESSING 3 0 0 3

Course Outcomes

At the end of each unit, the students will be able to

1) Analyse the different types of medical imaging modalities
2) Apply medical image enhancement techniques in spatial and frequency domain.
3) Analyse the different types of medical images with different features
4) Apply segmentation techniques for medical images
5) Develop Deep Learning architectures for medical image analysis

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3		2				1	2	2
CO2	3	2	3	3	3	3		2				1	2	2
CO3	3	2	3	2	2	3		2				1	2	2
CO4	3	2	3	2	2	3		2				1	2	2
CO5	3	3	3	3	3	3		2				1	2	2

Unit I MEDICAL IMAGING MODALITIES 09

Introduction about medical images - Computer aided diagnosis - Nature of medical images: X-ray imaging – Tomography - Nuclear medicine imaging - SPECT imaging - Positron imaging tomography – Ultrasonography - Magnetic resonance imaging. Removal of artifacts.

Unit II MEDICAL IMAGE ENHANCEMENT 09

Image Enhancement - Enhancement in Spatial and Frequency Domain, Applications: Threshold Based, Region Growing, Active Contours, Level Set, Graph Partitioning, Morphological Features, Textural Features, SIFT, SURF, MSER, HoG, Introduction about Image Registration and Fusion

Unit III MEDICAL IMAGE ANALYSIS **09**

Local Feature Analysis-Edge Detection-Gradient Based Detectors-Laplacian Based zero crossing detectors-Laplacian of Gaussian Based detectors -Line Detectors-Texture Analysis-Markov Random Field Matrix (MRFM)- Gray Level Co-Occurrence Matrix (GLCM)- Gray Level Difference Matrix (GLDM)- Gray Level Weight Matrix (GLWM)-Run Length Matrices

Unit IV MEDICAL IMAGE SEGMENTATION **09**

Parametric Image Based Segmentation-Intensity Based Segmentation-Texture Based Segmentation- Region Based Segmentation-Segmentation via Region Growing-Segmentation via Region Merging-Watershed Based Segmentation- Edge Based Segmentation

Unit V DEEP LEARNING ARCHITECTURE FOR MEDICAL IMAGE APPLICATIONS **09**

Recurrent Neural Networks: Back propagation through time-Problem of Exploding Gradient and Vanishing Gradient-Long Short-Term Memory- Gated Recurrent Units-Bidirectional LSTMs- Bidirectional RNNs Convolutional Neural Networks: Architecture Overview-ConvNet Layers: Convolutional Layer, Pooling Layer, Normalization Layer, Fully Connected Layer, Converting fully connected layer to Convolutional Layer - Case Studies: LeNet, AlexNet

TOTAL : 45 HOURS

TEXT BOOKS

1) Rangayyan R M, Biomedical Image Analysis, Fifth Edition, CRC Press, 2005

2) Jiri Jan,"Medical Image Processing Reconstruction and Restoration",CRC Press, 2006.

REFERENCES

1) Gonzalez R C and Woods R E, Digital Image Processing, Third Edition, Prentice Hall,2010.

2) Reddy D C. "Modern Biomedical Signal Processing – Principles and Techniques", TMH, New Delhi, 2005

3) Tompkins W J "Biomedical Signal Processing", Prentice hall of India, New Delhi, 1999

4) Bronzino J D "The Biomedical Engineering handbook", CRC and Free press, Florida,1995

5) Deep Learning, Ian Good fellow and YoshuaBengio and Aaron Courville, MIT Press, 2016

6) Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.es of deep learning techniques

P19WMC601 MOBILE TECHNOLOGY AND NETWORKS 3 0 0 3

COURSE OUTCOMES:

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

1. Design appropriate mobile communication systems. Apply frequency-reuse concept in mobile communications, and to analyze its effects on interference, system capacity, handoff techniques.
2. Analyze and design CDMA system functioning with knowledge of forward and reverse channel details, advantages and disadvantages of using the technology.
3. Analyze the principles of 3G and UMTS.
4. Analyze the evolutions of 4G.
5. Explain various Wireless Communication networks and roaming concepts.

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	1	1	1		1	1	2	2
CO2	3	3	3	3	3	3	1	1	1		1	1	2	2
CO3	3	3	3	2	2	3	1	1	1		1	1	2	2
CO4	3	3	3	2	2	3	1	1	1		1	1	2	2
CO5	3	3	3	3	3	3	1	1	1		1	1	2	2

UNIT I : 1G and 2G **09**

1G Systems – Cellular Communication Fundamentals: Cellular system design- Frequency reuse- cell splitting, handover concepts- Co channel and adjacent channel interference- interference reduction techniques and methods to improve cell coverage- Frequency management and channel assignment.

2G: GSM architecture and interfaces- GSM architecture details- GSM subsystems- GSM Logical Channels- Data Encryption in GSM- Mobility Management- Call Flows in GSM.

UNIT II: 2.5G GENERATION **09**

Code Division Multiple Access: Introduction to CDMA technology- IS 95 system Architecture- Air Interface- Physical and logical channels of IS 95, Forward Link and Reverse link operation- Physical and Logical channels of IS 95 CDMA- IS 95 CDMA Call Processing- soft Handoff- Evolution of IS 95 (CDMA One) to CDMA 2000.

2.5 G Standards: High speed Circuit Switched Data (HSCSD)- General Packet Radio Service (GPRS)- 2.75 G Standards: EDGE.

UNIT III: 3G GENERATION **09**

Introduction- Universal Mobile Telecommunications Service (UMTS)- UMTS Services- The UMTS Air Interface- Overview of the 3GPP Network Architecture- Overview CDMA2000- Commonality Between WCDMA/CDMA2000/CDM

Universal Mobile Telecommunications Service (UMTS): Introduction- UMTS Basics- The WCDMA Air Interface- The UTRAN Architecture- Handover- UMTS Core Network Evolution.

UNIT IV: 4G AND BEYOND **09**

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- Objectives of 5G- Architecture- Features and benefits.

UNIT V: WIRELESS COMMUNICATION NETWORKS **09**

Wireless Personal Area Networks (Bluetooth, UWB and ZigBee)- Wireless Local Area Networks (IEEE 802.11, network architecture, medium access methods, WLAN standards), Wireless Metropolitan Area Networks (WiMAX)- Ad-hoc Wireless Networks.Roaming in a GSM Network: Inter-PLMN Signaling Network- Communication between a VPLMN VLR and HPLMN HLR- Roaming Procedures- Roaming call scenarios.

Total: 45 Hours

REFERENCE BOOKS

1. Clint Smith,P.E, Dannel Collins, "3G Wireless Networks" 2nd edition, Tata McGraw-Hill, 2008
2. T.S Rapp port, "Wireless Communications" Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint, 2013..
3. Vijay K.Garg, "Wireless Network Evolution- 2G & 3G" Pearson, 2013
4. V.K.Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009
5. P Jochen H.Schiller, "Mobile Communications", 2/e, Pearson, 2014.
6. Sassan Ahmadi, "LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies", Elsevier, 2014.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for ME IV Semester under Regulations 2019
Electronics and Communication Engineering
Branch: M.E. Wireless and Mobile Communications

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Practical							
1	P19WMC401	Project Phase – II	0	0	28	14	420
					Total Credits	**14**	

Approved by

Chairperson, Electronics and Communication Engineering BOS
Dr.R.S.Sabeenian

Member Secretary, Academic Council
Dr.R.Shivakumar

Chairperson, Academic Council & Principal
Dr.S.R.R.Senthil Kumar

Copy to:-
HOD/ECE, Fourth Semester ME WMC Students and Staff, COE