MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code   : CO

Programme Name : M.E. – COMMUNICATION SYSTEMS

Regulation   : R-2019

MUTHAYAMMAL ENGINEERING COLLEGE

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(Approved by AICTE, Accredited by NAAC & NBA, Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

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MUTHAYAMMAL ENGINEERING COLLEGE
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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Estd. 2000

INSTITUTION VISION &MISSION

INSTITUTION VISION

To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards

INSTITUTION MISSION

- To prepare the students with high professional skills and ethical values
- To impart knowledge through best practices
- To instill a spirit of innovation through Training, Research and Development
- To undertake continuous assessment and remedial measures
- To achieve academic excellence through intellectual, emotional and social stimulation

INSTITUTION MOTTO

Rural upliftment through Technical Education

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DEPARTMENT VISION & MISSION

DEPARTMENT VISION

To empower the electronics and communication engineering students on basics and advanced technologies in both theoretical and experimental practices with research attitude and ethics

DEPARTMENT MISSION

- To impart need based education in electronics and communication engineering to meet the requirements of academic, industry and society
- To establish the state-of-art laboratories to prepare the students for facing the challenges ahead
- To prepare the students for employment, higher education and research oriented activities

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DEPARTMENT PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES

& PROGRAM SPECIFIC OUTCOMES

PROGRAM EDUCATIONAL OBJECTIVES

The Electronics and Communication Engineering Graduates should be able to

PEO1: Pursue as an engineer with necessary conceptual, analytical and theoretical knowledge in the domain of electronics and communication engineering

PEO2: Acquire the practical knowledge through basics and advanced laboratories in the field of electronics and communication engineering

PEO3: Demonstrate the leadership skills through entrepreneurship, employment and higher studies and to practice ethical values for the benefit of society and environment

PROGRAM OUTCOMES

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

3. **Design/Development solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: Design and analyze electronic circuits and systems for various applications

PSO2: Apply the acquired knowledge and analytical skills for modeling and simulation of advanced communication systems

PSO3: Ascertain the use of software and hardware tools for developing variety of electronics and communication systems

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M.E. – COMMUNICATION SYSTEMS

GROUPING OF COURSES

Foundation Courses (FC) :

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	19MSA01	Advanced Numerical Methods	FC	5	3	2	0	4
2.	19MSA02	Applied Mathematics	FC	5	3	2	0	4
3.	19MSA03	Applied Probability and Statistics	FC	5	3	2	0	4

Professional Core (PC) :

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	19MSB01	Radiation Systems	PC	5	3	2	0	4
2.	19MSB02	Information Theory and Coding	PC	3	3	0	0	3
3.	19MSB03	Statistical Signal Processing	PC	3	3	0	0	3
4.	19MSB04	Optical Communication Networks	PC	3	3	0	0	3
5.	19MSB05	Mobile Communication Networks	PC	3	3	0	0	3
6.	19MSB06	Modern Digital Communication Techniques	PC	5	3	2	0	4
7.	19MSB07	RF System Design	PC	3	3	0	0	3
8.	19MSB08	Electromagnetic Interference and Compatibility	PC	3	3	0	0	3
9.	19MSB09	Microwave Integrated Circuits	PC	3	3	0	0	3
10.	19MSB10	Communication Network Design	PC	3	3	0	0	3
11.	19MSB11	Wireless Networks	PC	3	3	0	0	3
12.	19MSB12	DSP Processor Architecture and Programming	PC	3	3	0	0	3
13.	19MSB13	Statistical Signal Processing Laboratory	PC	2	0	0	2	1
14.	19MSB14	RF System Design Laboratory	PC	2	0	0	2	1

Professional Electives (PE):

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	19MSC01	Multimedia and Compression Techniques	PE	3	3	0	0	3
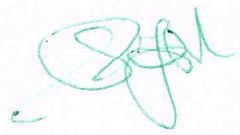
2.	19MSC02	Routing Algorithms	PE	3	3	0	0	3
3.	19MSC03	Adaptive Beam Forming	PE	3	3	0	0	3
4.	19MSC04	Biological Effects of Microwaves	PE	3	3	0	0	3
5.	19MSC05	Soft Computing	PE	3	3	0	0	3
6.	19MSC06	Wireless Security System	PE	3	3	0	0	3
7.	19MSC07	RTOS and its Applications	PE	3	3	0	0	3
8.	19MSC08	Optical Signal Processing in Communication	PE	3	3	0	0	3
9.	19MSC09	High Speed Switching Architecture	PE	3	3	0	0	3
10.	19MSC10	Mobile Adhoc Networks	PE	3	3	0	0	3
11.	19MSC11	RF MEMS	PE	3	3	0	0	3
12.	19MSC12	Satellite Remote Sensing	PE	3	3	0	0	3

Employability Enhancement Courses (EEC):

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	19MSD01	Project Work Phase -I	EEC	12	0	0	12	6
2.	19MSD02	Project Work Phase -II	EEC	24	0	0	24	12

Audit Courses (AC) :

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/week			Credit
					L	T	P	C
1.	19MSE01	English for Research Paper Writing	AC	2	2	0	0	0
2.	19MSE02	Disaster Management	AC	2	2	0	0	0
3.	19MSE03	Sanskrit for Technical Knowledge	AC	2	2	0	0	0
4.	19MSE04	Value Education	AC	2	2	0	0	0
5.	19MSE05	Constitution of India	AC	2	2	0	0	0
6.	19MSE06	Pedagogy Studies	AC	2	2	0	0	0
7.	19MSE07	Stress Management by Yoga	AC	2	2	0	0	0
8.	19MSE08	Personality Development through Life Enlightenment Skills.	AC	2	2	0	0	0

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	MUTHAYAMMAL ENGINEERING COLLEGE (Autonomous) (Approved by AICTE & Affiliated to Anna University), RASIPURAM – 637 408	CURRICULUM PG R - 2019

Department	Electronics and Communication Engineering
Programme	M.E. – Communication Systems

SEMESTER - I

SI. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	19MSA02	Applied Mathematics	3	2	0	4	5
2.	19MSB01	Radiation Systems	3	2	0	4	5
3.	19MSB02	Information Theory and Coding	3	0	0	3	3
4.	19MSB03	Statistical signal processing	3	0	2	4	5
5.	19MSB04	Optical Communication Networks	3	0	0	3	3
6.	19MSB05	Mobile Communication Networks	3	0	0	3	3
7.		Audit Course 1	2	0	0	0	2
PRACTICAL							
8.	19MSB13	Statistical signal processing Laboratory	2	0	0	1	2
		Total Credits				**21**	

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Department	Electronics and Communication Engineering
Programme	M.E. – Communication Systems

SEMESTER - II

SI. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	19MSB06	Modern Digital Communication Techniques	3	2	0	4	5
2.	19MSB07	RF System Design	3	0	0	3	3
3.	19MSB08	Electromagnetic Interference and Compatibility	3	0	0	3	3
4.		Elective I	3	0	0	3	3
5.		Elective II	3	0	0	3	3
6.		Elective III	3	0	0	3	3
7		Audit Course 2	2	0	0	0	2
PRACTICAL							
8.	19MSB14	RF System Design Laboratory	2	0	2	1	2
		Total Credits				**20**	

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CURRICULUM PG R - 2019

Department	Electronics and Communication Engineering
Programme	M.E. – Communication Systems

SEMESTER - III

Sl. No.	Course Code	Course Name	L	T	P	C	Contact Hours
THEORY							
1.		Elective IV	3	0	0	3	3
2.		Elective V	3	0	0	3	3
3.		Open Elective I	3	0	0	3	3
PRACTICAL							
4.	19MSD01	Project Work Phase -I	0	0	12	6	12
		Total Credits				**15**	

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CURRICULUM PG R - 2019

Department	Electronics and Communication Engineering
Programme	M.E. – Communication Systems

SEMESTER - IV

Sl. No.	Course Code	Course Name	L	T	P	C	Contact Hours
PRACTICAL							
1.	19MSD02	Project Work Phase -II	0	0	24	12	24
		Total Credits				**12**	

Total Credits to be earned for the Award of Degree: 68

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Professional Core (PC)

19MSA01	ADVANCED NUMERICAL METHODS	L T P C
		3 2 0 4

COURSE OBJECTIVES :

- To learn the algebraic equations which finds applications in many engineering branches.
- To make the student acquire sound knowledge of computational techniques in solving ordinary differential equations that model engineering.
- To solve Elliptic equations by using computational techniques.
- To introduce numerical tools for the solutions of partial differential equations that model several physical processes
- To deal with interpolation and approximation for the application of finite element analysis.
- To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology.

COURSE OUTCOMES :

- Demonstrate understanding and implementation of numerical solution algorithms applied to solve algebraic equations.
- Be familiar with numerical solutions of ordinary differential equation and partial differential equations.
- Be competent with finite difference method and finite element method.
- Understanding the theoretical and practical aspects of the use of numerical methods. Implementing numerical methods for a variety of multidisciplinary applications. Establishing the limitations, advantages, and disadvantages of numerical methods.
- The students will have a clear perception of the power of numerical Techniques. This will also serve as a precursor for future research.
- Students would be able to demonstrate the applications of numerical techniques to problems drawn from industry, management and other engineering fields.

UNIT I : ALGEBRAIC EQUATIONS   9+6

Systems of linear equations: Gauss Elimination method, pivoting techniques, Thomas algorithm for tridiagonal system – Jacobi, Gauss Seidel, SOR iteration methods - Systems of nonlinear equations: Fixed point iterations, Newton Method, Eigenvalue problems: power method, inverse power method, Faddeev – Leverrier Method.

UNIT II : ORDINARY DIFFERENTIAL EQUATIONS   9+6

Runge Kutta Meth ods for system of IVPs, numerical stability, Adams - Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, galerkin finite element method.

UNIT III : FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS
                                                                                         9+6
Parabolic equations: explicit and implicit finite difference methods, weighted average approximation - Dirichlet and Neumann conditions – Two dimensional parabolic equations – ADI method; First order hyperbolic equations – method of characteristics, different explicit and implicit methods; numerical stability analysis, method of lines – Wave equation: Explicit scheme - Stability of above schemes.

UNIT IV : FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS   9+6

Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes, Leibmann's iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes – approximation of derivatives near a curved boundary while using a square mesh.

UNIT V : FINITE ELEMENT METHOD   9+6

Partial differential equations – Finite element method – orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

TOTAL: 45 + 30 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.K. Jain , S.R.K. Iyengar, R.K. Jain	Computational Methods for Partial Differential Equations, 2nd Edition	New Age Publishers	2019
2.	S. K. Gupta	Numerical Methods for Engineers, 3rd Edition	New Age International Pvt Ltd Publishers	2015
3.	Saumyen Guha and Rajesh Srivastava	Numerical methods for Engineering and Science	Oxford Higher Education, New Delhi	2010
4.	M.K. Jain	Numerical Methods for Scientific & Engineering Computation, 6th Edition	New Age International Publishers	2010
5.	Burden, R.L., and Faires, J.D.	Numerical Analysis –Theory and Applications	Cengage Learning, India Edition, New Delhi	2009

WEB URLs :

1. http://nptel.ac.in/courses/103101111/downloads/Lecture-notes/Module_4_Solving_Ax=b.pdf
2. www.youtube.com/watch?v=FmhMUTmUjhM
3. https://mat.iitm.ac.in/home/sryedida/public_html/caimna/pde/fifth/example.html
4. www.youtube.com/watch?v=BERb9PRiVB4
5. www.math.tifr.res.in/~publ/ln/tifr49.pdf

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19MSA02	APPLIED MATHEMATICS	L T P C
		3 2 0 4

COURSE OBJECTIVES :

- To realize the use of matrix theory techniques in engineering applications and to develop for future applications.
- To analyze and solve the fundamental problem with prescribed or free boundary conditions in simple cases
- Demonstrate knowledge of mathematics and mechanics to construct, analyze and interpret real world problems
- Provide a foundation and motivation for exposure to statistical ideas subsequent to the course.
- To formulate and construct a mathematical model for a linear programming problem in real life situation
- To introduce Fourier series analysis which is central to many applications in engineering

COURSE OUTCOMES :

- Explain geometrical concepts related to orthogonality and least squares solutions and perform calculations related to orthogonality.
- The variation calculus makes access to mastering in a wide range of classical results of variational calculus. Students get up apply results in technical problem solutions
- The students will have a basic knowledge of the main fields of mathematics and mechanics, including differential equations, elasticity theory, fluid mechanics.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable
- The knowledge gained on this course helps the students to do engineering optimization.
- Demonstrate an understanding of the basic concepts of Fourier series analysis

UNIT – I : MATRIX THEORY 9+6

The Cholesky decomposition - Generalized Eigen vectors, Canonical basis - QR factorization - Least squares method - Singular value decomposition.

UNIT – II : CALCULUS OF VARIATIONS 9+6

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – problems with constraints - Direct methods: Ritz and Kantorovich methods.

UNIT – III: ONE DIMENSIONAL RANDOM VARIABLES 9+6

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT – IV: LINEAR PROGRAMMING 9+6

Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models

UNIT – V: FOURIER SERIES AND EIGEN VALUE PROBLEMS 9+6

Fourier Trigonometric series: Periodic function as power signals – Convergence of series – Even and odd function: cosine and sine series – Non-periodic function: Extension to other intervals - Power signals: Exponential Fourier series – Parseval's theorem and power spectrum – Eigen value problems and orthogonal functions – Regular Sturm-Liouville systems – Generalized Fourier series.

TOTAL: 45 + 30 Hours

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mital.K.V. Mohan and Chander	Optimization Methods in Operations Research and Systems Analysis, 4th Edition	New Age International Publishers	2019
2.	Stark. H., and Woods. J.W.	Probability and Random Processes with Applications to Signal Processing, 4th Edition	Pearson Education, Asia	2014
3.	Hamdy ATaha	Operations Research, 9th Edition (Asia)	Pearson Education, Asia	2014
4.	Gupta, A.S.	Calculus of Variations with Applications	Prentice Hall of India Pvt. Ltd., New Delhi	2011
5.	Richard Bronson	Matrix Operation, Schaum's outline series, 2nd Edition	McGraw Hill	2011

WEB URLs

1. http://nptel.ac.in/courses/111108066/ http://www.cs.utexas.edu/~pingali/CS378/2011sp/lectures/chol4.pdf
2. http://www.math.uni-leipzig.de/~miersemann/variabook.pdf
3. http://nptel.ac.in/courses/IIT-MADRAS/Principles_of_Communication1/Pdfs/1_5.pdf
4. http://nptel.ac.in/courses/111104027/
5. http://nptel.ac.in/courses/111106046/

19MSA03	**APPLIED PROBABILITY AND STATISTICS**		**L**	**T**	**P**	**C**

19MSA03   APPLIED PROBABILITY AND STATISTICS   L   T   P   C
                                                              3   2   0   4

COURSE OBJECTIVES :

- To introduce the basic concepts of one dimensional and two dimensional Random Variables.
- To gain knowledge in the application of family of random variables in real life situations
- To provide information about Correlation and Regression
- Learn about maximum likelihood estimation, unbiased estimation and least square methods.
- To understand concepts of testing of hypothesis
- To enable the students to use the concepts of multivariate normal distribution and principle components analysis.

COURSE OUTCOMES :

- Analyze random or unpredictable experiments and investigate important features of random experiments. Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
- Associate random variables by designing joint distributions and correlate the random variables
- Perform and interpret correlation and regression analysis and develop correlation models to predict changes in processes and products for linear and non-linear relationships
- Provides knowledge to apply testing of hypothesis to real life problems.
- Be familiar with multivariate analysis.
- The student will able to acquire the basic concepts of Probability and Statistical techniques for solving mathematical problems which will be useful in solving Engineering problems.

UNIT I : ONE DIMENSIONAL RANDOM VARIABLES   9+6

Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II: TWO DIMENSIONAL RANDOM VARIABLES   9+6

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III : ESTIMATION THEORY   9+6

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines..

UNIT IV: TESTING OF HYPOTHESES   9+6

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V: MULTIVARIATE ANALYSIS   9+6

Random Vectors and Matrices - Mean vectors and Covariance matrices - Multivariate Normal density and its properties - Principal components Population principal components – Principal components from standardized variables.

TOTAL: 45 + 30 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version), 6th Edition	John Wiley & Sons, Inc.	2019
2.	Richard A. Johnson and Dean W. Wichern,	Applied Multivariate Statistical Analysis. 6th Edition	Pearson Education, Asia	2015

3.	Gupta S.C. and Kapoor V.K	Fundamentals of Mathematical Statistics	Sultan Chand & Sons	2014
4.	HweiP.Hsu,	Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes	Tata Mc Graw Hill Edition, New Delhi	2014
5.	Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., ,	Probability and Statistics for Engineers and Scientists, 8th Edition	Pearson Education, Asia	2013

WEB URLs:

1. http://www.maths.qmul.ac.uk/~pettit/MAS109/chp4.pdf
2. http://nptel.ac.in/courses/117104117/
3. http://www.efunda.com/math/leastsquares/leastsquares.cfm
4. http://nptel.ac.in/courses/111105041/33
5. http://nptel.ac.in/courses/110105060/

19MSB01	RADIATION SYSTEMS	L T P C
		3 2 0 4

COURSE OBJECTIVES:

- To understand the relation between the fields and antenna Fundamentals.
- To understand the of study aperture antennas.
- To introduce the basics of Microstrip and Patch Antennas .
- To design Array antennas
- To know the design of special Antennas
- To know how to measure antenna Parameters

COURSE OUTCOMES:

- Learn to understand the relation between the fields and antenna Fundamentals.
- Learn to understand the of study aperture antennas.
- Learn to introduce the basics of Microstrip and Patch Antennas .
- Learn to design Array antennas
- Learn to know the design of special Antennas
- Learn to know how to measure antenna Parameters

UNIT I : ANTENNA FUNDAMENTALS   9

Antenna fundamental parameter-half wave dipole, Broadband antennas and matching techniques, Balance to unbalance transformer, Introduction to numerical techniques.

UNIT II: APERTURE ANTENNAS   9

Huygens' Principle- Radiation Equation- Directivity- Rectangular Aperture- TE10-Mode- Circular Aperture- TE11-Mode- Design Considerations- Fourier Transforms in Aperture Antenna Theory. E-Plane Sectoral Horn- H-Plane Sectoral Horn- Pyramidal Horn-Conical Horn –applications.

UNIT III : ANALYSIS AND DESIGN OF MICROSTRIP   9

Configurations- Excitations and radiation mechanism of microstrip patch antennas- Radiation resistance- Power and input impendence. Modeling of rectangular and circular microstrip patch antennas - Transmission line model and cavity model method. Circular polarization and bandwidth of microstrip patch antennas. Simulation of microstrip antennas using Simulation Software-Case studies.

UNIT IV : ARRAY ANTENNAS   9

Linear array and Planar array- Characteristics, synthesis techniques – Fourier Transform method, and Taylor Line Source synthesis and Dolph-Chebyshev distributions.,binomial Arrays, Circular array antennas.

UNIT V : SPECIAL ARRAY ANTENNAS AND ITS APPLICATIONS   9

Conformal and Phased array antennas- sequential rotation and phasing, reactive loading. Array antenna measurement- Impedance, coupling, radiation pattern, scan element pattern, Gain Directivity,EIRP.Smart Antennas.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	C.A Balanis.,	Antenna Theory	Wiley	Edition 4 2019
2.	Robert J. Mailloux	Phased Array Antenna Hanbook	Artech House	Edition 2 2005
3.	HubRegtJ. Visser	Array and Phased Array Antenna Basics	John Wiley and Sons	2005.

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| 4. | Debatosh Guha, Yahia M.M. Antar | Microstrip and Printed Antennas: New Trends, Techniques and Applications | Wilcy | 2013 |
| 5. | J.R James and P.S Hall | Handbook of Microstrip Antennas | Peter peregrinus | 1989 |

WEB URLs :

1. www.cv.nrao.edu/course/astr534/PDFnewfiles/AntennaTheory.pdf
2. www.ece.mcmaster.ca/faculty/nikolova/antenna_dload/current.../L18_Horns.pdf
3. anteny.jeziorski.info/wp-content/uploads/2011/10/2011_Alsager.pdf
4. https://www.ece.nus.edu.sg/stfpage/.../Lecture%20Notes%5CAntenna%20Arrays.pdf
5. drdo.gov.in/drdo/pub/dss/2009/main/13-ARDE.pdf

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19MSB02	**INFORMATION THEORY AND CODING**	**L T P C** **3 0 0 3**

COURSE OBJECTIVES:

- To get started in practice of Information Theory
- To provide idea of Channels and channel capacity
- To have a complete understanding of source coding
- To understand encoding and decoding of digital data streams
- To understand the practical implementation of Error control coding, Convolution code
- To know the applications of Coding Techniques.

COURSE OUTCOMES:

- To focus on the application of Information Theory to communications in general and on channel coding and capacity in particular.
- To focus basics of discrete channel.
- Analysis of various source coding and channel coding techniques.
- Able to design encoding and decoding of digital data.
- To analyze Various error Detection and Correction Codes
- Able to understand the practical implementation issues, such as Error control coding. Convolution code

UNIT I : INFORMATION THEORY   **9**

Concept of amount of information -units, Entropy -marginal, conditional and joint entropies -relation among entropies Mutual information, information rate, channel capacity, redundancy and efficiency of channels.

UNIT II : DISCRETE CHANNELS   **9**

Symmetric channels, Binary Symmetric Channel, Binary Erasure Channel, Cascaded channels, Repetition of symbols. Binary unsymmetrical channel, and Shannon theorem. Continuous channels –Capacity of band limited Gaussian channels, Shannon-Hartley theorem, Tradeoff between band width and signal to noise ratio, Capacity of a channel with infinite band width, Optimum modulation system.

UNIT III : SOURCE CODING   **9**

Encoding techniques, Purpose of encoding, Instantaneous codes, Construction of instantaneous codes,Kraft's inequality, Coding efficiency and redundancy, Noiseless coding theorem. Construction of basic source codes –Shannon-Fano algorithm, Huffman coding, Arithmetic coding, ZIP coding.

UNIT IV : ERROR DETECTION AND CORRECTION   **9**

Parity check coding, Linear block codes, Error detecting and correcting capabilities, Generator and Parity check matrices, Standard array and Syndrome decoding, Hamming codes, Encoding and decoding of systematic and unsystematic codes. Cyclic codes – Generator polynomial, Generator and Parity check matrices, Encoding of cyclic codes, Syndrome computation and error detection, Decoding of cyclic codes, BCH codes, RS codes, Burst error correction.

UNIT V : CONVOLUTIONAL CODES   **9**

Encoding-State, Tree and Trellis diagrams, Maximum likelihood decoding of convolutional codes -Viterbi algorithm, Sequential decoding -Stack algorithm. Interleaving techniques –Block and convolutional interleaving, Error Control and Signal Space Coding.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Simon Haykin	Communication Systems	5th Edition , Wiley	2009
2.	Taub & Schilling,	Principles of Communication Systems,	2nd Edition Tata McGraw-Hill	2007

3.	R Bose	Information Theory, Coding and Cryptography	TMH	2007
4.	RezaF.M.	An Introduction to Information Theory	McGrawHill,New,Delhi	2002
5.	KR.Rao,ZSBojkovic,DAMilovanovic	Multimedia Communication Systems:Techniques Standards and Networks	Pearson Education	2007

WEB URLs :

1. nptel.ac.in/courses/IIT-MADRAS/Principles_Of.../Lecture35-37_SourceCoding.pdf
2. www.tutorialspoint.com/computer_logical_organization/error_codes.htm
3. http://www.unilim.fr/pages_perso/vahid/codage/ch3_capacity.pdf
4. http://nptel.ac.in/courses/117101053/
5. nptel.ac.in/courses/117106031/

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19MSB03	STATISTICAL SIGNAL PROCESSING	L T P C
		3 0 0 3

COURSE OBJECTIVES:
- To explore the concepts of multi rate signal processing .
- To study multi rate filters
- To learn Linear Estimation and Prediction.
- To study the adaptive filters and its applications.
- To learn fundamental concepts on signal processing in power spectrum estimation.
- To learn the application of Multirate Signal Processing

COURSE OUTCOMES:

- Able to design and implement decimator and interpolator.
- Able to design multi rate filter bank and acquires knowledge of how a multi rate system work
- Understanding different spectral estimation techniques and linear prediction.
- Ability to design LMS and RLS adaptive filters for signal enhancement, channel equalization.
- Able to understand fundamental concepts on signal processing in power spectrum estimation.
- Able to learn the application of Multirate Signal Processing

UNIT I : MULTIRATE SIGNAL PROCESSING   9

Introduction-Sampling and Signal Reconstruction-Sampling rate conversion – Decimation by an integer factor interpolation by an integer factor –Sampling rate conversion by a rational factor –poly-phase FIR structures – FIR structures with time varying coefficients - Sampling rate conversion by a rational factor- Multistage design of decimator and interpolator.

UNIT II: MULTIRATE FIR FILTER DESIGN   9

Design of FIR filters for sampling rate conversion –Applications of Interpolation and decimation in signal processing –Filter bank implementation –Two channel filter banks-QMF filter banks –Perfect Reconstruction Filter banks – tree structured filter banks - DFT filter Banks – M-channel filter banks octave, filter banks.

UNIT III: LINEAR ESTIMATION AND PREDICTION   9

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 and Wiener IIR filters, Discrete Kalman filter.

UNIT IV: ADAPTIVE FILTERS   9

FIR Adaptive filters - Newton's steepest descent method – Adaptive filters based on steepest descent method -LMS Adaptive algorithm – other LMS based adaptive filters- RLS Adaptive filters - Exponentially weighted RLS - Sliding window RLS – Simplified IIR LMS Adaptive filter.

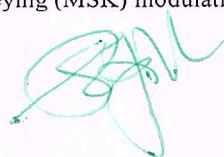**UNIT V   POWER SPECTRAL ESTIMATION**   9

Estimation of spectra from finite duration observations of a signal –The Periodogram-Use of DFT in Power spectral Estimation –Non-Parametric methods for Power spectrum Estimation – Bartlett.Welch and Blackman–Tukey methods –Comparison of performance of Non – Parametric power spectrum Estimation methods –Parametric Methods - Relationship between auto correlation and model parameters, Yule-Walker equations, solutions using Durbin's algorithm,AR, MA, ARMA model based spectral estimation

TOTAL: 45 Hours

LIST OF EXPERIMENTS :

1. Implementation of LMS, RLS adaptive filters, to remove noise and estimation of Channel.
2. Compare Gaussian minimum shift keying (GMSK) and minimum shift keying (MSK) modulation schemes.
3. Simulation of Linear, Convolution and Cyclic Codes.
4. Design and simulation of Multirate systems.
5. Simulation and analysis of speech and image compression algorithms.
6. Design and implementation of source coding technique.
7. Implementation of Pulse Coded Modulation using Simulink.
8. Implementation of OFDM physical link using Simulink.

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	H.Monson Hayes	Statistical Digital Signal Processing and Modeling	John Wiley and Sons, Inc	2008.
2.	G.. John Proakis and G. DimitrisManolakis	Digital Signal Processing	Pearson Education	2006.
3.	P.P.Vaidyanathan	MultirateSyatems and Filter Banks	Pearson Education	2008.
4.	N.J.Filege	Multirate Digital Signal Processing	John Wiley and Sons	2000.
5.	A.Anandkumar	Digital Signal Processing	PHI	2013

WEB URLs :

1. nptel.ac.in/courses/108105059/12
2. https://www.youtube.com/watch?v=z3d1yByn1m4
3. textofvideo.nptel.iitm.ac.in/108105055/lec34.pdf
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5. https://www.lsv.uni-saarland.de/fileadmin/teaching/dsp/ss15/.../ADF_intro.pdf

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19MSB04	OPTICAL COMMUNICATION NETWORKS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To understand architecture, protocols and applications, of major optical networking technologies.
- To provide an exposure to solve numerical or analytical problems pertaining to the optical networking technologies
- To design WDM Network Elements
- To understand Network and Management
- To develop the necessary background to perform projects involving optical networks.
- To learn the Application of OSN

COURSE OUTCOMES:

- Understanding of various loss mechanisms and Non-Linear effects in optical communication.
- Knowledge of optical components and WDM network elements.
- Discussion about Optical access network architectures
- Comparison of layered architecture of, IP and MPLS over SONET network.
- Awareness of the advantages of Photonic packet switching, the impediments involved and the available techniques like switching, buffering, multiplexing & synchronization.
- Able to learn the Application of OSN

UNIT I :OPTICAL SIGNAL PROPAGATION AND SYSTEM COMPONENTS   9

Propagation in optical fibers – Loss & bandwidth windows, Intermodal dispersion, Optical fiber as waveguide, Chromatic dispersion, , Non-Linear effects; Solitons; Optical Network Components– Couplers, Isolators &Circulators, Multiplexers & Filters, Optical Amplifiers,Switches, Wavelength Converters.

UNIT II : CLIENT LAYERS OF OPTICAL LAYER   9

SONET / SDH-Multiplexing, CAT & LCAS, SONET/SDH Layers, SONET Frame structure,Elements of SONET/SDH infrastructure, Optical Transport Network- Hierarchy, Frame structure multiplexing, Generic Framing Procedure, Ethernet-Framing structure, switches, IP over WDM routing and forwarding, QoS, MPLS-Labels and forwarding, QoS, signaling and routing,. Carrier transport, resilient packet ring, storage area networks.

UNIT III : WDM NETWORK ELEMENTS AND DESIGN   9

WDM Network elements - Optical line terminals, Optical line amplifiers, Optical Add/drop multiplexers-Architectures, Reconfigurable OADMs,, Optical cross connects, All optical OXC configurations. WDM Network Design – Cost Trade-Offs: A detailed ring network example, LTD and RWA problems, dimensioning Wavelength routing networks, Stastical dimensioning Models, Maximum load dimensioning models.

UNIT IV: PACKET SWITCHING AND ACCESS NETWORKS   9

Photonic Packet Switching – OTDM, Multiplexing and De-multiplexing, Synchronization, Header processing, Buffering, Burst switching, OTDM Access Networks – Network Architecture Overview, Enhanced HFC, FTTC, PON – Evolution.

UNIT V :NETWORK DESIGN AND MANAGEMENT   9

Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization ; Overall design considerations; Control and Management – Network management functions, Optical layer services and interfacing, Layers within optical layer, Multivendor interoperability, Performance and fault management, Configuration Management.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rajiv Ramaswami and Kumar Sivarajan	Optical Networks	A Practical Perspective, Morgan Kaufmann	2010
2.	VivekAlwayn	Optical Network Design and Implementation	Pearson Education	2006.

3.	Hussein T. Mouftab and Pin-Han Ho	Optical Networks	Architecture and Survivability, Kluwer Academic Publishers	2002.
4.	Biswanath Mukherjee	Optical Communication Networks	Tata McGraw Hill	2004
5.	Biswanath Mukherjee	Survivable Optical WDM Networks	Tata McGraw Hill	2005

WEB URLs :

1. nptel.ac.in/courses/117101002/downloads/Lec01.pdf
2. nptel.ac.in/srt/106105081/Lec-12.srt
3. csc.unl.edu/~byrav/Kluwer2000/newtoc.pdf
4. https://www.utdallas.edu/~torlak/courses/ee4367/lectures/packet.pdf
5. nptel.ac.in/courses/106105081/37

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19MSB05	**MOBILE COMMUNICATION NETWORKS**	L T P C 3 0 0 3

COURSE OBJECTIVES:

- To understand the basic cellular system concepts.
- To have an insight into the various propagation models and the multiple access techniques in Mobile communication.
- To Understand the concepts of 2G and 3G Networks
- To understand the various protocols in networks.
- To gain knowledge of the various cellular mobile standards.
- To learn Applications of Mobile Communication

COURSE OUTCOMES:
- Understand the concepts of Cellular, Mobile Radio propagation and multiple access techniques and solve engineering problems.
- Outline the organization of Cellular networks and appreciate the differences with fixed networks
- Infer on the evolution of cellular networks and evaluate 2G and 3G networks
- Analyze the protocols in networks
- Understand the concepts of 4G Networks
- Able to learn Applications of Mobile Communication

UNIT I: CELLULAR CONCEPTS AND SYSTEM DESIGN FUNDAMENTALS   9
Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications. Cellular Concepts: Frequency reuse, Channel assignment, Hand off strategies, Interference and system capacity, tracking and grade of service.

UNIT II: MOBILE RADIO PROPAGATION   9
Free space propagation model, reflection, diffraction, scattering, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Small scale Multipath measurements, parameters of Mobile multipath channels, fading and its types.

UNIT III: MODULATION AND MULTIPLE ACCESS TECHNIQUES SEQUENTIALLOGIC   9
Minimum Shift Keying (MSK), Gaussian MSK, Orthogonal Frequency Division Multiplexing, Multiple Access Techniques: TDMA, FDMA, CDMA, SDMA.

UNIT IV: 2G AND 2.5G NETWORKS   9
Evolution of Cellular networks – AMPS, DECT and TETRA. GSM - GSM Network Architecture, Air Interface, Channel Organization, Protocols and signaling, Authentication and security, Routing of a call to Mobile Subscriber, Handover in GSM 2.5G-GPRS Network Architecture, Mobility Management, Location Management and Roaming .

UNIT V :3G NETWORKS AND BEYOND   9
UMTS Network Architecture, UMTS Interfaces, Channels, FDD and TDD, Time Slots, UMTS Network protocol architecture and transport network, Mobility Management, UMTS Handover. Concepts of Wi-Fi and WiMAX, Spectrum allocation for 3G, Wi-Fi, WiMAX, 4G and beyond.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Iti Saha Misra,	Wireless Communications and Networks: 3G and Beyond	McGraw Hill Education (India) Pvt Ltd	2013
2.	W.C.Y.Lee,	Wireless And Cellular Telecommunications	Third Edition, McGraw- Hill International	2003

3.	T.S.Rappaport,	Wireless Communications: Principles and Practice	Second Edition, Pearson Education/ Prentice Hall of India	Third Indian Reprint 2003.
4.	T.S.Rappaport and Viswanath	Fundamentals of wireless communication	Cambridge Press	2009
5.	T.G Palanivelu. R.Nakkeeran	Wireless and Mobile Communication	Cambridge University	2005

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2. www.ietf.org/internet-drafts/draft-ietf-manet-aodv-11.txt 19
3. https://etd.ohiolink.edu/rws_etd/document/get/csu1323224057/inline
4. https://accessengineeringlibrary.com/browse/2-5g-mobile-networks-gprs-and-edge
5. www.wiley.com, Mobile & Wireless Communications

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19MSB06	MODERN DIGITAL COMMUNICATION TECHNIQUES	L T P C 3 2 0 4

COURSE OBJECTIVES :

- To have an introduction on different receiver design in the Pulse code modulation scheme.
- To understand basics of detection and estimation theory.
- To Design and analyze optimum detection schemes.
- To Study different estimation schemes such as ML and MMSE estimators.
- To understand the concept of third generation error correction and detection codes.
- To learn the applications of Digital Communication

COURSE OUTCOMES :

- Able to design Analog communication systems
- Able to evaluate fundamental communication system parameters
- Able to design equalizer.
- Able to understand the practical implementation of non-ideal filters.
- Able to detect aliasing and inter symbol-interference (ISI).
- Able to understand the concept of third generation error correction and detection codes.

UNIT I:BASEBAND DATA TRANSMISSION   9

Baseband PAM –One Shot Minimum Distance Receiver –Minimum Distance Sequence Detection ––M-ary signaling scheme-shaping of the transmitted signal spectrum-Noise in Baseband System -Coherent and Non coherent Technique, Orthogonal Modulation – OFDM modulation and Demodulation –Multidimensional Modulation-Modulation with Memory

UNIT II: BAND-LIMITED CHANNELS   9

Pulse shape design for channels with ISI: Nyquist pulse, Partial response signaling (duobinary and modified duobinary pulses), demodulation; Channel Models: Fading Dispersive channel, Time and Frequency Selective, Rayleigh channel, karhunen- Loeve Expansion; Diversity Technique: Space, polarization, path, angle, Time and frequency, Diversity Combining Technique.

UNIT III: EQUALIZATION   9

Optimal Zero-Forcing Equalization- Generalized Equalization Methods- Fractionally Spaced Equalizer –Transversal Filter Equalizer – ISI and Channel Capacity –Constrained –complexity Equalizers – Adaptive Linear Equalizer – Adaptive DFE.

UNIT IV: DETECTION   9

Detection of a Single Real-Valued Symbol- Detection of a Signal Vector –Known Signals in Gausian Noise –ML Sequence Detection with the Viterbi Algorithm – A Posteriori Probability Detection with BCJR- Symbol Error Probability for MLSD – incoherent Detection –Shot Noise Signal with known Intensity. Hypothesis Testing and the MAP Criterion, Bayes Criterion, Minimax Criterion, Neyman-Pearson Criterion, Sequential Detection.

UNIT V : FUNDAMENTALS OF ESTIMATION THEORY   9

Formulation of the General Parameter Estimation Problem, Relationship between Detection and Estimation Theory,Types of Estimation Problems, Properties of Estimators, Bayes Estimation, Minmax Estimation, Maximum-Likelihood Estimation, Comparison of Estimator Parameters

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John R Barry, Edward Lee and David G. Messerschmitt	Digital Communication	Springe	2008.
2.	John G. Proakis	Digital Communications	McGraw –Hill International Edition	2009.

3.	Simon Haykin	Communication Systems,	PHI	2008.
4.	BemardSklar	Digital Communications: Fundamentals and Applications	Prentice Hall	2001.
5.	R.N.Mutagi	Digital Communication: Heory, Techniques and Applications	Oxford,2 edition	2013

WEB URLs :

1. www.ece.mcmaster.ca/faculty/reilly/ee3tr4/bband.pdf
2. www.ece.ubc.ca/~elec564/chapter5.pdf
3. www.math.uci.edu/icamp/courses/math77c/demos/hist_eq.pdf
4. https://lear.inrialpes.fr/people/triggs/pubs/Dalal-cvpr05.pdf
5. https://www2.spsc.tugraz.at/www-archive/.../WS04-DSPPrinciples/SarwarPaper.pdf

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19MSB07	RF SYSTEM DESIGN	L	T	P	C
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COURSE OBJECTIVES:

- To learn RF design and circuit board components
- To understand various impedance transformers and biasing networks
- To acquire knowledge of RF filters and RF synthesizer
- To study the basic RF components
- To study the basic RF mixers and oscillators
- To Learn Applications of RF Circuit

COURSE OUTCOMES :

- Understand of various RF issues
- Analysis of impedance transformation
- Know about active RF component, matching and biasing networks
- Design the concepts of RF filter design and their implementation using software
- Learn the operation of RF oscillators and mixers and their design
- To Learn Applications of RF Circuit

UNIT I:RF ISSUES   9

Importance of RF design, Electromagnetic Spectrum, RF behavior of passive components, Chip Components and Circuit Board considerations, Scattering Parameters, Smith Chart and applications.

UNIT II:RF FILTER DESIGN   9

Overview, Basic resonator and filter configuration, Special filter realizations, Filter implementations, Coupled filter.

UNIT III:ACTIVE RF COMPONENTS & APPLICATIONS   9

RF diodes, BJT, RF FETs, High electron mobility transistors; Matching and Biasing Networks – Impedance matching using discrete components, Microstripline matching networks, Amplifier classes of operation and biasing networks.

UNIT IV:RF AMPLIFIER DESIGNS   9

Characteristics, Amplifier power relations, Stability considerations, Constant gain circles, Constant VSWR circles, Low Noise circuits, Broadband , high power and multistage amplifiers.

UNIT V:OSCILLATORS, MIXERS & APPLICATIONS   9

Basic Oscillator model, High frequency oscillator configuration, Basic characteristics of Mixers; Phase Locked Loops; RF directional couplers and hybrid couplers ; Detector and demodulator circuits.

TOTAL: 45 Hours

LIST OF EXPERIMENTS :

1. Measurement of transmission line parameters.
2. S-parameter estimation of Microwave devices.
3. Characteristics of $\lambda/4$ and $\lambda/2$ transmission lines.
4. Channel equalizer design (LMS, RLS)
5. Antenna Radiation Pattern measurement
6. Performance Evaluation of digital modulation schemes
7. OFDM transceiver design
8. Performance evaluation of simulated CDMA System.

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Reinhold Ludwig and Powel Bretchko,	RF Circuit Design – Theory and Applications	Pearson Education Asia	First Edition, 2001
2.	Joseph. J. Carr	Secrets of RF Circuit Design	McGraw Hill Publishers	Third Edition, 2000
3.	Mathew M. Radmanesh	Radio Frequency & Microwave Electronics	Pearson Education Asia	Second Edition, 2002
4.	William F. Egan	RF System Design of Transceivers for Wireless Communications	Gu, Qizheng	2005
5.	William F. Egan,	Practical RF System Design	Wiley-IEEE Press	April 2003

WEB URLs :

1. www.radio-electronics.com/info/rf...design/rf-filters/rf-filter-basics-tutorial.php
2. nptel.ac.in/courses/117101119
3. www.ssc.pe.titech.ac.jp/materials/VLSICS03_shortcourse_matsu_homepage.pdf
4. www.rgcetpdy.ac.in/ECE-2014-15_syllabus.pdf
5. https://www.youtube.com/watch?v=GDTcvS-o2yk

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19MSB08 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY   L   T   P   C
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COURSE OBJECTIVES:

- To understand the concepts related to Electromagnetic interference in PCBs learn RF design and circuit board components
- To provide solutions for minimizing EMI in PCBs
- To learn EMI standards in the design of PCBs
- To learn various EMI coupling principles, EMI standards and measurements
- To provide knowledge on EMI control techniques and design procedures to make EMI Compatible PCBs
- To learn EMI Environment

COURSE OUTCOMES:
- Analyze Electromagnetic interference effects in PCBs
- Propose solutions for minimizing EMI in PCBs
- Analyze Electromagnetic environment, EMI coupling
- Able to understand the EMI standards and measurement
- Able to design a EMI Control techniques
- Able to learn EMI Environment

UNIT I: EMI ENVIRONMENT   9

EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD.

UNIT II: EMI COUPLING PRINCIPLES   9

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling.

UNIT III: EMI/EMC STANDARDS AND MEASUREMENTS   9
Civilian standards - FCC,CISPR,IEC,EN,Military standards - MIL STD 461D/462, EMI Test Instruments Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures.

UNIT IV: EMI CONTROL TECHNIQUES   9
Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting.

UNIT V: EMC DESIGN OF PCBs   9
PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models

<div align="right">TOTAL: 45 Hours</div>

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Clayton Paul	Introduction to Electromagnetic Compatibility	Wiley Interscience	2006
2.	Henry W.Ott	Noise Reduction Techniques in Electronic Systems	John Wiley and Sons,NewYork	1988.
3.	V.P.Kodali	Engineering EMC Principles, Measurements and Technologies	IEEE Press, Newyork	2001
4.	Dr Kenneth L Kaiser	The Electromagnetic Compatibility Handbook	CRC Press	2005

5.	Henry W. Ott,	Electromagnetic Compatibility Engineering	John Wiley & Sons	2009

WEB URLs :

1. https://www.environment.gov.za/projectsprogrammes/emi
2. studyvlsidesign.blogspot.com/2014/10/electromagnetic-interference-and.html
3. shodhganga.inflibnet.ac.in/bitstream/10603/28123/10/11_chapter6.pdf
4. https://www.youtube.com/watch?v=krk4_89em48
5. https://www.svce.ac.in/departments/ece/archives/.../EMI%20EMC%20pt%204.ppt

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19MSB09	MICROWAVE INTEGRATED CIRCUITS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To understand the Technology of hybrid mics
- To learn monolithic MICS
- To Analyze the microstrip line
- To understand Coupled microstrips, slot line and coplanar waveguides
- To learn Lumped elements and non-reciprocal components
- To learn the applications of MIC

COURSE OUTCOMES:

- Able to understand the Technology of hybrid mics
- Able to learn monolithic MICS
- Able to Analyze the microstrip line
- Able to understand Coupled microstrips, slot line and coplanar waveguides
- Able to learn Lumped elements and non-reciprocal components
- Able to learn the applications of MIC

UNIT I :TECHNOLOGY OF HYBRID MICS 9

Dielectric substrates - thick film technology and materials - thin film technology and materials – methods of testing – encapsulation of devices for MICs – mounting of active devices.

UNIT II :TECHNOLOGY OF MONOLITHIC MICS 9

Processes involved in fabrication – epitaxial growth of semiconductor layer – growth of dielectric layer – diffusion-ion implantation – electron beam technology.

UNIT III :ANALYSIS OF MICROSTRIP LiNE 9

Methods of conformal transformation – numerical method for analysis – hybrid mode analysis – coupled mode analysis- method of images – losses in miscrostrips.

UNIT IV:COUPLED MICROSTRIPS, SLOT LINE AND COPLANAR VEGUIDES 9

Coupled microstrips – even and odd mode analysis – microstrip directional couplers – branch line couplers– periodic branch line couplers – synchronous branch line couplers.

UNIT V:LUMPED ELEMENTS AND NON-RECIPROCAL COMPONENTS 9

Design and fabrication using microstrips – flat resistors – flat inductors – interdigital capacitors – sandwich capacitors – ferromagnetic substrates for non-reciprocal devices – microstrip circulators – latching circulators – isolators – phase shifters.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	L Maloratsky	Passive RF and Microwave Integrated Circuits	John Wiley & Sons 1st Edition	2003
2.	Amarjit Singh	Microwave Integrated Circuits	John Wiley & Sons	-
3.	ChrisJ. Georgopoulos	Microwave Integrated Circuits And Interfaces	-	-
4.	Gupta,K.C, and Amarjit singh	Microwave Integrated Circuits	John Wiley and sons – Wiley Eastern Reprint	1978
5.	Hoffmann, R.K	Handbook of Microwave Integrated Circuits	Artech House	1987

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2. textofvideo.nptel.iitm.ac.in/117105082/lec1.pdf
3. link.springer.com/chapter/10.1007%2F978-3-662-08740-4_1
4. nptel.ac.in/courses/117101057/downloads/lec2.pdf
5. https://www.youtube.com/watch?v=a_FIbChQThg

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19MSB10	COMMUNICATION NETWORK DESIGN	L T P C
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COURSE OBJECTIVES:

- To learn security mechanisms and techniques to provide security services.
- To be exposed to symmetric & asymmetric key algorithms and key management aspects.
- To be aware of the need for security in different layers .
- To be aware of the need network security ,firewalls and web security
- To be aware of the need wireless network security
- To Learn the applications of network security

COURSE OUTCOMES:

- Able to learn security mechanisms and techniques to provide security services.
- Able to be exposed to symmetric & asymmetric key algorithms and key management aspects.
- Able to be aware of the need for security in different layers .
- Able to be aware of the need network security ,firewalls and web security
- Able to be aware of the need wireless network security
- Able to learn the applications of network security

UNIT I: SECURITY SERVICES AND MECHANISMS 9
Security Goals, Types of Attacks: Passive attack, active attack, attacks on confidentiality, attacks on Integrity and availability. Security services – Confidentiality, Integrity, Authentication, Non repudiation& Access control and Mechanisms

UNIT II: SYMMETRIC & ASYMMETRIC KEY ALGORITHMS 9
Substitutional Ciphers, Transposition Ciphers, Stream and Block Ciphers, Data Encryption Standards (DES), Advanced Encryption Standard (AES), RC4, Principle of Asymmetric key algorithms, RSA Cryptosystem.

UNIT III : INTEGRITY, AUTHENTICATION AND KE MANAGEMENT 9
Message Integrity, Hash functions: SHA, Digital signatures: Digital signature standards, Authentication: Entity Authentication: Biometrics, Key management Techniques.

UNIT IV :NETWORK SECURITY, FIREWALLS AND WEB SECURITY 9
Introduction on Firewalls, Types of Firewalls, Firewall Configuration and Limitation of Firewall.IP Security Overview, IP security Architecture, authentication Header, Security payload, security associations, Key Management.

UNIT V :WIRELESS NETWORK SECURITY 9
Security Attack issues specific to Wireless systems: Worm hole, Tunnelling, DoS. WEP for Wi-Fi network, Security for 4G networks: Secure Ad hoc Network, Secure Sensor Network

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Behrouz A. Forouzan ,Debdeep Mukhopadhyay	Cryptography and Network security	Tata McGraw- Hill	Second Edition, 2011
2.	William Stallings	Cryptography and Network security: Principles and Practice	Prentice Hall of India, New Delhi	Sixth Edition, 2013
3.	AtulKahate	Cryptography and Network security: Principles and Practice	Prentice Hall of India, New Delhi	Sixth Edition, 2013

4.	H. Yang et al	Security in Mobile Ad Hoc Networks: Challenges and Solution	IEEE Wireless Communications	Feb. 2004
5.	Mischa Schwartz	Computer-Communication Network Design and Analysis Margin	Notes Edition	2000

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2. https://www.ciphercloud.com/.../cloud-information-protection-symmetric-vs-asymmet...
3. https://www.cwnp.com/uploads/802-11i_key_management.pdf
4. https://www.tutorialspoint.com/network_security/network_security_firewalls.htm
5. https://en.wikipedia.org/wiki/Wireless_security

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19MSB11	WIRELESS NETWORKS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To learn network mechanisms and techniques to provide the better communication.
- To be aware of the need different layers and wireless network.
- To be aware of framing and wep
- To learn management operations
- To learn the physical-layer architecture.
- To learn the applications OFDM

COURSE OUTCOMES:

- The students understand the state of art techniques in wireless communication.
- Students are enriched with the knowledge of present day technologies to enable them to face the world and contribute back as researchers.
- Able to be aware of framing and wep
- Able to learn Management Operations
- Able to learn the Physical-Layer Architecture
- Able to learn the applications OFDM

UNIT I: WIRELESS NETWORKS INTRODUCTION   9
IEEE 802- Wireless LANs- A brief history of 802.11- RF spectrum- Radio waves- Direct path- Absorption-Reflection- Diffraction-Refraction- scattering- Multipath- Radio frequency regulations- spectrum Management- IEEE 802 network technology family tree-802.11 nomenclature and design- 802.11 Network operations- Mobility support.

UNIT II: 802.11 MAC   9
Challenges for the MAC- MAC access mode and timing- Contention based access using DCF- Fragmentation and reassembly- Frame format- encapsulation of higher layer protocols within 802.11- Contention based data service.

UNIT III: FRAMING AND WEP   9
802.11 framing in detail- Data frames- Control frames- Management frames- Frame transmission, Association and authentication- Wired Equivalent Privacy(WEP)- Cryptographic Background to WEP- WEP Cryptographic Operations- Problems with WEP- The Extensible Authentication Protocol- 802.1x: Network Port Authentication-802.1x on Wireless LANs.

UNIT IV: MANAGEMENT OPERATIONS   9
Management Architecture- Scanning- Authentication- Association- Power Conservation Timer-Synchronization- Contention-Free Access Using the PCF- Detailed PCF Framing- Power Management and the PCF.

UNIT V: PHYSICAL LAYER AND NETWORK DEPLOYMENT   9
Physical-Layer Architecture-The Radio Link- RF and 802.11- 802.11 FH PHY- 802.11 DS PHY- 802.11b: HR/DSSS PHY- 802.11a: 5-GHz OFDM PHY- Orthogonal Frequency Division Multiplexing (OFDM)- OFDM as Applied by 802.11a- OFDM PLCP- OFDM PMD- Characteristics of the OFDM PHY; 802.11 Network deployment topology- Project planning- The site survey- Installation and the final roll-out

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Matthew Gast	802.11® Wireless Networks: The Definitive Guide	Reilly	2002
2.	Alan Holt, Chi-Yu Huang	802.11Wireless Networks	Springer	2010

3.	Jeffrey G. Andrews, Arunabha Ghosh and Riaz Muhamed	Fundamentals of WIMAX: Understanding broadband wireless networking	Prentice Hall Inc., NJ	1st Edition, 2007
4.	Rappaport, T.S.	Wireless Communications	Principles and Practice, Prentice Hall, NJ	1996
5.	William Stallings	Wireless Communication and Networking	Pearson Education	2002

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2. www.cs.tut.fi/kurssit/TLT-6556/Slides/Lecture2.pdf
3. https://technet.microsoft.com/en-us/library/cc757419(v=ws.10).aspx
4. https://books.google.co.in/books?isbn=1449319521
5. www.ciscopress.com/articles/article.asp?p=31731&seqNum=4

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19MSB12 DSP PROCESSOR ARCHITECTURE AND PROGRAMMING

L T P C
3 0 0 3

COURSE OBJECTIVES :
- To provide in depth knowledge on Digital Signal Processor
- To implement the signal processing algorithms in DSPs
- To learn various third generation DSP architecture and programming skills
- To learn about the advanced DSP architectures
- To know the applications of DSP Processor.
- To learn the applications of advanced DSP Processor

COURSE OUTCOMES :
- Illustrate the features of on-chip peripheral devices and its interfacing along with its programming details.
- Analyze and learn to implement the signal processing algorithms in DSPs
- Design and implement signal processing modules in DSPs
- Able to design Digital Signal Processor specialized engineer
- Able to develop DSP based System
- Able to learn the applications of advanced DSP Processor

UNIT I: FUNDAMENTALS OF PROGRAMMABLE DSPs   9
Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in PDSPs – Multiple access memory – Multiport memory – VLIW architecture Pipelining – Special Addressing modes in PDSPs – On chip Peripherals.

UNIT II: TMS320C5X PROCESSOR   9
Architecture – Assembly language syntax Addressing modes – Assembly language Instructions Pipeline structure, Operation – Block Diagram of DSP starter kit – Application Programs for processing real time signals.

UNIT III: TMS320C6X PROCESSOR   9
Architecture of the C6x Processor Instruction Set DSP Development System: Introduction – DSP Starter Kit Support Tools Code Composer Studio Support Files Programming Examples to Test the DSK Tools – Application Programs for processing real time signals.

UNIT IV: ADSP PROCESSORS   9

Architecture of ADSP21XX and ADSP210XX series of DSP processors Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V: ADVANCED PROCESSORS
9
Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C6X Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

REFERENCE BOOKS: TOTAL: 45 Hours

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.Venkataramani and M.Bhaskar,	Digital Signal Processors – Architecture, Programming and Applications	Tata McGraw	2003.
2.	Avtar Singh and S. Srinivasan,	Digital Signal Processing– Implementations using DSP Microprocessors with Examples from TMS320C54xx	Tata McGraw	2012
3.	Rulph Chassaing,	Digital Signal Processing and Applications with the C6713 and C6419 DSK	John Wiley & sons,	2005

| 4. | Sen M. Kuo, Woon-Seng S. Gan | Digital Signal Processors: Architectures, Implementations, and Applications | United States Edition | 2004 |
| 5. | Peter Pirsch | Architectures for Digital Signal Processing | John Wiley & sons, | 2007 |

WEB URLs :

1. homes.esat.kuleuven.be/~iverbauw/Courses/HJ94/lectures04/HJ94slides8DSP.pdf
2. www.dspguide.com/CH28.PDF
3. ee.cgu.edu.tw/ezfiles/7/1007/img/476/DSPLab100_Architecture.pdf
4. nptel.ac.in/courses/108102045/8
5. www.ti.com/lit/ug/spru056d/spru056d.pdf

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	L	T	P	C

19MSB13 STATISTICAL SIGNAL PROCESSING LABORATORY   L T P C
                                                        0 0 2 1

LIST OF EXPERIMENTS :

1. Implementation of LMS, RLS adaptive filters, to remove noise and estimation of Channel.
2. Compare Gaussian minimum shift keying (GMSK) and minimum shift keying (MSK) modulation schemes.
3. Simulation of Linear, Convolution and Cyclic Codes.
4. Design and simulation of Multirate systems.
5. Simulation and analysis of speech and image compression algorithms.
6. Design and implementation of source coding technique.
7. Implementation of Pulse Coded Modulation using Simulink.
8. Implementation of OFDM physical link using Simulink.

19MSB14   **RF SYSTEM DESIGN LABORATORY**   L T P C
                                                            0 0 2 1

LIST OF EXPERIMENTS :

1. Measurement of transmission line parameters.
2. S-parameter estimation of Microwave devices.
3. Characteristics of $\lambda/4$ and $\lambda/2$ transmission lines.
4. Channel equalizer design (LMS, RLS)
5. Antenna Radiation Pattern measurement
6. Performance Evaluation of digital modulation schemes
7. OFDM transceiver design
8. Performance evaluation of simulated CDMA System.

Professional Electives (PE)

19MSC01 MULTIMEDIA AND COMPRESSION TECHNIQUES	L T P C
	3 0 0 3

COURSE OBJECTIVES:

- Understand error–control coding
- Understand encoding and decoding of digital data streams
- Be familiar with the methods for the generation of these codes and their decoding techniques
- Be aware of compression and decompression techniques
- Learn the concepts of multimedia communication
- To learn applications of video compression

COURSE OUTCOMES:

- Explain Scalar quantization theory and
- Rate distribution Theory
- Understand different coding techniques
- Describe Contour based compression and Motion estimation techniques
- Learn the concepts of multimedia communication
- Able to learn applications of video compression

UNIT I : INTRODUCTION   9

Special features of Multimedia – Graphics and Image Data Representations Fundamental Concepts in Video and Digital Audio – Storage requirements for multimedia applications Need for Compression Taxonomy of compression techniques – Overview of source coding, source models, scalar and vector quantization theory – Evaluation techniques – Error analysis and methodologies

UNIT II: TEXT COMPRESSION   9

Compaction techniques – Huffmann coding – Adaptive Huffmann Coding – Arithmatic coding – ShannonFano coding – Dictionary techniques – LZW family algorithms

UNIT III: AUDIO COMPRESSION   9

Audio compression techniques µ Law and A Law companding. Speech compression waveform codes source codes hybrid codes Shorten compressor, Frequency domain and filtering – Basic subband coding – Application to speech coding – G.722 –Application to audio coding – MPEG audio. progressive encoding for audio – Silence compression, speech compression techniques – Formant and CELP Vocoders.

UNIT IV: IMAGE COMPRESSION   9

Predictive techniques – DM, PCM, DPCM: Optimal Predictors and Optimal Quantization– Contour based compression – Transform Coding – JPEG Standard – Subband coding algorithms: Design of Filter banks – Wavelet based compression: Implementation using filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG, JBIG2 Standards

UNIT V: VIDEO COMPRESSION   9

Video compression techniques and standards – MPEG Video Coding I: MPEG – 1 and 2 MPEG Video Coding II: MPEG – 4 and 7 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – PLV performance – DVI real time compression – Packet Video.

REFERENCE BOOKS: **TOTAL: 45Hours**

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Khalid Sayood	Introduction to Data Compression	Morgan Kauffman Harcourt India	2000
2.	David Salomon	Data Compression	Springer Verlag New York Inc	2001
3.	Yun Q.Shi, Huifang Sun	Image and Video Compression for Multimedia Engineering Fundamentals, Algorithms & Standards	CRC press	2003

4.	Peter Symes	Digital Video Compression	McGraw Hill Pub	2004
5.	Mark S.Drew, Ze-Nian Li	Fundamentals of Multimedia	PHI, 1st Edition	2003

WEB URLs :

1. http://www.nptel.ac.in/courses/117105083/pdf/ssg_m1l1.pdf
2. http://textofvideo.nptel.iitm.ac.in/106105082/lec37.pdf
3. https://www.cs.princeton.edu/~rs/AlgsDS07/20Compression.pdf
4. http://nptcl.ac.in/courscs/111104027/
5. http://nptel.ac.in/courses/111106046/

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19MSC02	ROUTING ALGORITHMS	L T P C
		3 0 0 3

COURSE OBJECTIVES :

- To understand the state-of-the-art in network protocols, routing algorithms and applications
- To introduce the various internet routing algorithms
- To familiarize the various aspects of routing algorithm
- To gain depth knowledge about the routing protocol and congestion controls.
- To study the concept of mobile Ad-Hoc networks.
- To study the concept of Mobile IP networks.

COURSE OUTCOMES:

- Understand and recognize the architectures, Designing MAC,TCP,IP and security protocols
- Learn the routing algorithm and its applications in enabling technologies.
- Understand the architecture and elements of WLANS
- Get an idea on routing protocols on networking field.
- Understand the concept Mobile IP Networks.
- Identify the technical issues related to Ad-hoc sensor networks

UNIT I: LAYER ARCHITECTURE AND ROUTING   9

ISO OSI Layer Architecture, TCP/IP Layer Architecture, Functions of Network layer, General Classification of routing, Routing in telephone networks, Dynamic Non hierarchical Routing (DNHR), Trunk status map routing (TSMR), real-time network routing (RTNR), Distance vector routing, Link state routing, Hierarchical routing.

UNIT II: INTERNET ROUTING   9

Interior protocol: Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Bellman Ford Distance Vector Routing. Exterior Routing Protocols: Exterior Gateway Protocol (EGP) and Border Gateway Protocol (BGP). Multicast Routing: Pros and cons of Multicast and Multiple Unicast Routing, Distance Vector Multicast Routing Protocol (DVMRP), Multicast Open Shortest Path First (MOSPF), MBONE, Core Based Tree Routing.

UNIT III :ROUTING IN OPTICAL WDM NETWORKS   9

Classification of RWA algorithms, RWA algorithms, Fairness and Admission Control, Distributed Control Protocols, Permanent Routing and Wavelength Requirements, Wavelength Rerouting-Benefits and Issues, Light path Migration, Rerouting Schemes, Algorithms-AG, MWPG.

UNIT IV: MOBILE -IP NETWORKS   9

Macro-mobility Protocols, Micro-mobility protocol: Tunnel based: Hierarchical Mobile IP, Intra domain Mobility Management, Routing based: Cellular IP, Handoff Wireless Access Internet Infrastructure (HAWAII).

UNIT V : MOBILEAd-HocNETWORKS   9

Internet-based mobile ad-hoc networking communication strategies, Routing algorithms –Proactive routing: destination sequenced Distance Vector Routing (DSDV), Reactive routing: Dynamic Source Routing (DSR), Ad hoc On-Demand Distance Vector Routing (AODV),Hybrid Routing: Zone Based Routing (ZRP).Study of Network Simulator NS-2

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William Stallings	High speed networks and Internets Performance and Quality of Service	IInd Edition, Pearson Education Asia	2002
2.	C.E Perkins	Ad Hoc Networking	Addison–Wesley	2001

3.	C. Siva Ram Murthy and B. S. Manoj	Ad Hoc Wireless Networks: Architectures and Protocols	Prentice Hall	2004
4.	William Stallings	Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud	1st Edition	2003
5.	William Stallings	Wireless Communications & Net works	2nd edition, Prentice-Hall Pearson	2005

WEB URLs :

1. https://en.wikibooks.org/wiki/Communication_Networks/Routing
2. www.computer.howstuffworks.com/routing-algorithm.html
3. www.sciencedirect.com/science/article/pii/S138912861100377X
4. www.ccs.neu.edu/home/rraj/Courses/6710/S10/Lectures/CellularNetworks.pdf
5. www.olsr.org/docs/wos3-olsr.pdf

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19MSC03	ADAPTIVE BEAM FORMING	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of Beam forming.
- To understand the concepts of adaptive Beam forming
- To learn Sub band adaptive Beam forming.
- To introduce to the students the design techniques of beam forming
- To learn the effects of DBF.
- To learn the effects of error in DBF

COURSE OUTCOMES:

- Understanding of application of Beam forming.
- Understand the operation of adaptive antenna array system and algorithms
- Knowledge of various Beam forming techniques.
- Discussion about design and simulation of various beam formers using software
- Learn the effects DBF and methods of reducing it.
- To learn the effects of error in DBF

UNIT I : INTRODUCTION TO BEAM FORMING   9
Array signal processing- narrowband Beam forming-wideband Beam forming- wideband beam steering- multiple access- digital Beam forming- fundamentals of digital Beam forming introduction to antenna arrays, analog Beam forming, phased arrays, element-space Beam forming, beam-space Beam forming, two dimensional Beam forming.

UNIT II : ADAPTIVE BEAM FORMING   9
Basic concepts- criteria for optimal weights- adaptive algorithms- LMS algorithm, direct sample covariance matrix inversion, RLS algorithm, neural networks. Partial adaptivity- Reference signal based beam former- linearly constrained minimum variance Beam forming- constraints in LCMV Beam forming- generalized side lobe canceller-soft constrained minimum variance beamformer correlation constrained minimum variance beamformer- robust Beam forming.

UNIT III : SUBBAND ADAPTIVE BEAMFORMING   9
Fundamentals of filter banks- Subband adaptive filtering- generalized Subband adaptive Beam forming- Generalized Subband Canceller (GSC)- Subband adaptive GSC- temporally/spatially Subband selective Beam forming-frequency domain adaptive Beam forming- transform domain adaptive Beam forming.

UNIT IV : DIGITAL BEAMFORMING   9
Iterative optimization- least squares approach- Eigen filter approach- digital Beam forming networks element-space and beam-space networks- DBF with multiple access schemes- DBF with TDMA,DBF with FDMA and DBF with CDMA
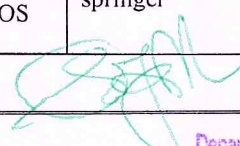
UNIT V: ERROR EFFECTS IN DBF   9
Error sources in DBF antenna arrays- random errors and nonlinearities in receivers- quantization errors in DBF arrays- complex signal quantization error and quantization noise in Beam forming random errors in DBF arrays-beam pattern, fractional loss in main beam gain, pointing error, side lobes and effect of element failure-nonlinearities in DBF arrays- modeling of nonlinearities, receiver nonlinearity effects on fixed Beam forming and receiver nonlinearity effects on adaptive Beam forming. Application of Beam forming in Wireless Location Estimation, Signal Enhancement Using Beam forming and Nonstationarity with Applications to Speech- Beam forming in LTE

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Wei Liu and Stephen Weiss	Wideband Beamforming-concepts and techniques	John Wiley and Sons	2010
2.	Yikun. Yu, Petrus Gerardus Maria Baltus, Arthur H. M. Van, Roermund	Integrated 60GHz RF Beamforming in CMOS	springer	2011

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3.	Jian Li, Petre Stoica	Robust Adaptive Beamforming (Hardback)	John Wiley and Sons Ltd, United States,	2005
4.	T.S.Rappaport&J.C.Liberti	Smart antennas for wireless Communication	Printice Hall	1999
5.	John Litva and Titus Kwok-Yeung Lo	Digital Beamforming in Wireless Communication Artech House, 1996.	Artech House	1996

WEB URLs :

1. ethesis.nitrkl.ac.in/4386/1/A_Study_of_Adaptive_Beamforming.pdf
2. https://en.wikipedia.org/wiki/Adaptive_beamformer
3. nptel.ac.in/courses/117107035/module7/lecture1/lecture1.pdf
4. sites.ieee.org/benelux-comvt/files/2012/02/IEEEWorkshop_Roeloffzen.ppt
5. https://www.youtube.com/watch?v=ZS4pllfhBH4

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19MSC04	BIOLOGICAL EFFECTS OF MICROWAVES	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To understand the various Action of Radiation.
- To know the Application of Radiation.
- To know the techniques of Genetic Effects of Radiation.
- To study the Effect of Microwave and RF with Matters.
- To carry out UV Radiation.

COURSE OUTCOMES:

- To be able to understand the various Action of Radiation.
- To be able to know the Application of Radiation.
- To be able to know the techniques of Genetic Effects of Radiation.
- To be able to study the Effect of Microwave and RF with Matters.
- To be able to carry out UV Radiation.

UNIT I: ACTION OF RADIATION IN LIVING CELLS   9
Various theories related to radiation at cellular level - DNA and chromosomal damages.

UNIT II: SOMATIC APPLICATION OF RADIATION   9
Radio sensitivity protocols of different tissues of human - LD50/30 effective radiation on skin - Bone marrow – eye - endocrine glands, and basis of radio therapy.

UNIT III : GENETIC EFFECTS OF RADIATION   9
Threshold and linear dose- gene control hereditary diseases effect of dose.

UNIT IV : EFFECT OF MICROWAVE AND RF WITH MATTERS   9
Effects of various human organs and systems- Wavelength in tissue- non thermal interaction- Standards of protection- national and international standards and precautions.

UNIT V: UV RADIATION   9
Classification of sources - measurement - photo medicine - UV radiation safety visible and infrared radiation.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Yan-Hui Hao,LiZhao, Rui-Yun Peng	Effects of microwave radiation on brain energy metabolism and related mechanisms	McGraw-Hill Education	2015
2.	Andre Vander Vorst, Arye Rosen, Youji Kotsuka	RF / Microwave Interaction with Biological Tissues	Wiley-IEEE Press	2006
3	Lita Lee	Health Effects of Microwave Radiation - Microwave Ovens	IEEE	1999

| 4. | James C. Lin | Biological Effects of Microwave Radiation | Xulon Press | 1998 |
| 5. | Moselly H | Non ionizing Radiation | Adam- Hilgar , Bristol | 1988 |

WEB URLs :

1. nptel.ac.in/courses/102103047/module2/lec4/3.html
2. nptel.ac.in/courses/102103019/8
3. nptel.ac.in/courses/117102012/
4. youtube/qa-PQOjS3Za
5. youtube/n1go03oIyos

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19MSC05	SOFT COMPUTING	L P T C
		3 0 0 3

COURSE OBJECTIVES :

- To study different types of optimization techniques in soft computing
- To Learn Fundamentals of fuzzy logic.
- To Learn Fundamentals of neural networks .
- To understand the concepts of genetic algorithm, which have their roots
- To Learn Fundamentals of Artificial Intelligence.
- To understand the concepts of Hybrid Systems

COURSE OUTCOMES :

- Identify and describe soft computing techniques and their roles in building intelligent machines
- Recognize the feasibility of applying a soft computing methodology for a particular problem
- Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
- Apply genetic algorithms to combinatorial optimization problems
- Apply neural networks to pattern classification and regression problems
- Analysis feature enhancement and optimization methods using soft computing techniques.

UNIT I : INTRODUCTION TO SOFT COMPUTING 9

Introduction, Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Applications.

UNIT II : FUNDAMENTALS OF NEURAL NETWORKS 9

Introduction, Model of Artificial Neuron, Architectures, Learning Methods, Taxonomy of NN Systems, Single-Layer NN System, Applications. Back Propagation Network Background, Back-Propagation Learning, Back-Propagation Algorithm. Associative Memory : Description, Auto-associative Memory, Bi-directional Hetero-associative Memory. Adaptive Resonance Theory : Recap - supervised, unsupervised, backprop algorithms; Competitive Learning; Stability-Plasticity Dilemma (SPD)

UNIT III : FUZZY SET THEORY 9

Introduction, Fuzzy set : Membership, Operations, Properties; Fuzzy Relations. Fuzzy Systems : Introduction, Fuzzy Logic, Fuzzification, Fuzzy Inference, Fuzzy Rule Based System, Defuzzification

UNIT IV : FUNDAMENTALS OF GENETIC ALGORITHMS 9

Introduction, Encoding, Operators of Genetic Algorithm, Basic Genetic Algorithm.

UNIT V : HYBRID SYSTEMS 9

Integration of Neural Networks, Fuzzy Logic and Genetic Algorithms, GA Based Back Propagation Networks, Fuzzy Back Propagation Networks, Fuzzy Associative Memories, Simplified Fuzzy ARTMAP

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. Rajasekaran and G.A. Vijayalaksmi Pai	Neural Network, Fuzzy Logic, and Genetic Algorithms – Synthesis and Applications	Prentice Hall	2005
2.	S. Haykin	Neural Networks	Pearson Education	2001
3.	Kishan Mehrotra, Chilukuri K. Mohan and Sanjay Ranka,	Elements of Artificial Neural Network	MIT Press	1996

| 4. | Melanie Mitc hell | An Introduction to Genetic Algorithm | MIT Press | 1998 |
| 5. | James A. Anderson | An Introduction to Neural Network James | MIT Press | 1997 |

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1. users.du.se/~jwe/fuzzy/NFL/F9.PDF
2. www.csee.wvu.edu/~xiawang/courses/cpe520/title.pdf
3. www.mv.helsinki.fi/home/niskanen/zimmermann_review.pdf
4. www.myreaders.info/09_Genetic_Algorithms.pdf
5. www3.nd.edu/~isis/techreports/isis-2001-003.pdf

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		L T P C
19MSC06	**WIRELESS SECURITY SYSTEM**	3 0 0 3

COURSE OBJECTIVES:

- To explore variety of attacks and threats and its impact on MAC layer and Network layer
- To study characteristics, vulnerabilities and challenges of ad hoc networks
- To provide solution for covering the security principles and flaws of popular wireless technologies
- To evaluate the performance of secured routing protocols in MANETs.
- To compare the performance of the MAC layer.
- To study Challenges in Routing Security

COURSE OUTCOMES:

- Ability to identify the various attacks and threads of wireless Networks.
- Understand and recognize the architectures, vulnerabilities and challenges of mobile protocols.
- Analyze the solutions for covering the security principles of wireless networks.
- Analyze and design security systems for wireless networks.
- Apply in-depth knowledge of wireless communications principles, systems
- Apply in depth knowledge of networks to the solution of wireless engineering problems.

UNIT I: ATTACKS ON ROUTING PROTOCOLS   9
Vulnerability of MANET to attack -review of AODV and DSR -type of attack -active and passive –internal and external -behavior of malicious node -black hole, DoS, Routing table overflow, Impersonation, Energy consumption, Information Disclosure -Misuse type –Misuse goals –Security flaw in AODV -attack on AODV -wormhole and rushing attack -Performance analysis of AODV in the presence of malicious node.

UNIT I : INTRUSION DETECTION IN WIRELESS   9
Ad Hoc Networks Problem in current IDS techniques -requirements of IDS -classification of IDS –Network and host based -anamoly detection, misuse detection, specification based - intrusion detection in MANETs using distributed IDS and mobile agents -AODV protocol based IDS -Intrusion resistant routing algorithms -Comparison of IDS.

UNIT III: MITIGATING TECHNIQUES FOR ROUTING MISBEHAVIOR   9
Watchdog – Parthrater - Packet leashes and RAP.

UNIT IV: SECURE ROUTING PROTOCOLS   9
Self organized network layer security in MANETs - mechanism to improve authentication and integrity in AODV using hash chain and digital signatures - on demand secure routing protocol resilent to Byzantine failures -ARIADNE, SEAD, SAR, and ARAN.

UNIT V: CHALLENGES IN ROUTING SECURITY   9
Security -Challenges and solutions -Providing Robust and Ubiquitous security support -Adaptive security for multilevel Ad Hoc Network -Denial of service Attack at the MAC layer - Detection and handling of MAC layer Misbehavior. Opportunistic routing to mitigate attacks in MANET-The Security of Vehicular Adhoc Networks-Asymmetric and dynamic encryption for routing security in MANET.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	C.Siva Ram Murthy and B.S.Manoj	AdHoc Wireless Networks Architectures and Protocols	Prentice Hall PTR	2004
2	Ivan Stojmenović	Handbook of Wireless Networks and Mobile Computing	Wiley	2002
3.	Michael Miller	Wireless Networking Absolute Beginner's Guide	Miller	2013

4.	Hongmei Deng, Wei Li and Dharma P.Agrawal	Routing Security in Wireless Ad Hoc Networks	IEEE Communication Magazine	Oct 2002
5.	Amitabh Mishra	Intrusion Detection in Wireless Ad Hoc Networks	IEEE Wireless Communication	February 2004

WEB URLs :

1. nptel.ac.in/courses/102693047/module2/lec4/3
2. you tube/n1go03oIyos
3. nptel.ac.in/courses/1021087w419/8
4. nptel.ac.in/courses/117102012/
5. https://www.cs.columbia.edu/~smb/talks/routesec.pdf

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19MSC07	RTOS AND ITS APPLICATIONS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To understand the OS and RTOS
- To know Process Management of OS /RTOS
- To know the Process Synchronization
- To study the Effect of Memory & I/O Management
- To carry out RTOS Application Domains
- To understand RTOS and its Applications.

COURSE OUTCOMES:

- To be able to understand the OS and RTOS
- To be able to know Process Management of OS / RTOS
- To be able to know the Process Synchronization
- To be able to study the Effect of Memory & I/O Management
- To be able to carry out RTOS Application Domains
- To be able to apply the concept in real time RTOS.

UNIT I:INTRODUCTION TO OS AND RTOS   9
Architecture of OS (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of O. S. & hardware architecture, Evolution of operating systems, Batch, multi programming. Multitasking, Multiuser, parallel, distributed & real –time O.S.

UNIT II:PROCESS MANAGEMENT OF OS/RTOS   9
Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept, Real Time Scheduling concepts.

UNIT III:PROCESS SYNCHRONIZATION   9
Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, software approaches, Semaphores and Mutex, Message Passing, Monitors, Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategies.

UNIT IV:MEMORY & I/O MANAGEMENT   9
Memory Management requirements, Memory partitioning: Fixed, dynamic, partitioning, Buddy System Memory allocation Strategies (First Fit, Best Fit, Worst Fit, Next Fit), Fragmentation, Swapping, Segmentation, Paging, Virtual Memory, Demand paging. Page Replacement Policies (FIFO, LRU, Optimal, clock) ,Thrashing, Working Set Model.I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), Disk Caches.

UNIT V:RTOS APPLICATION DOMAINS
Comparison and study of RTOS: Vxworks and µCOS – Case studies: RTOS for Image Processing – Embedded RTOS for voice over   9
IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Wayne Wolf	Computers as Components: Principles of Embedded Computing System Design	Kindle Publishers	2005
2	Tanenbau M	Modern Operating Systems	3/e, Pearson Edition	2007

3.	A Burns and A Wellings	Real Time Systems and Programming Languages	4/e, Addison Wesley	2009
4.	Jim Cooling	Real-time Operating Systems	Kindle Edition	2000
5.	Elecia White	Making Embedded Systems: Design Patterns for Great Software	Kindle Edition	2011

WEB URLs :

1. youtu.be/qa-PQOjS3zA Etc., minimum three web address
2. nptel.ac.in/courses/1021087w419/8
3. nptel.ac.in/courses/102693047/module2/lec4/3.html
4. youtu.be/n1go03oIyos
5. nptel.ac.in/courses/117102012/

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19MSC08	OPTICAL SIGNAL PROCESSING IN COMMUNICATION	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To learn the basic signal parameters of Optical signal processing.
- To explore the concept of different Spatial Filtering techniques
- To understand the basic operation s of spectral analysis.
- To analyse the power spectrum of various Optic devices
- To study about the design of homodyne and heterodyne spectrum analyzers
- To be known the importance of Optical signal processing in communication.

COURSE OUTCOMES:

- Able to analyse optical signal processing systems using its signal parameters.
- Able to understand the spectral filtering and spatial filtering operations in optics.
- Able to get an idea over operation s of spectral analysis.
- Able to get an idea over acousto-optic devices and its applications
- Able to the design of homodyne and heterodyne spectrum analyzers
- Able to get the knowledge of optical signal processing in communication   .

UNIT I: BASIC SIGNAL PARAMETERS   9
Characterization, Sample function, geometrical optics, basic laws, refraction by prisms, lens formula, imaging condition, optical invariants, physical optics, Transforms: Fresnel, Fourier, Inverse Fourier and Extended Fourier.

UNIT II: SPECTRAL ANALYSIS   9
Spatial light modulation, spatial light modulators, detection process, system performance process, dynamic range, raster format, spectral analysis.

UNIT III: SPATIAL FILTERING AND FILTERING SYSTEM   9
Types of spatial filters, optical signal processing and filter generation, read out module, orientation and sequential search, applications of optical spatial filter.

UNITIV:ACOUSTO-OPTIC DEVICES AND POWER SPECTRUM ANALYSIS   9
Acousto - optic cells, spatial light modulators , Raman – Nath and Bragg mode, basic spectrum analyzer, aperture weighting, dynamic range and SNR, photo detector, geometric considerations, and radiometer.

UNIT V: HOMODYNE AND HETERODYNE SPECTRUM ANALYSERS   9
Overlapping of waves, photo detector size, and optimum photo detector size for 1D and 2D structure, optical radio, spatial and temporal frequencies, Distributed and local oscillator, Dynamic range comparison of heterodyne and   power spectrum analyzers.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	P.K. Das	Optical Signal Processing Fundamentals	Narosa Publishing	2012
2.	G. Boone	Signal processing wing optics Bradley	Oxford University Press	2005
3.	Vanderlught	Optical Signal Processing	John Wiley & Sons	2005

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4.	Mahlke Gunther, and Goessing Peter	Fiber optic cables:Fundamentals, Cable Engineering, System, planning	John Wiley	2001
5.	M. N. Bandyopadhyay	Optical Communication And Networks	PHI Learning Pvt Ltd	2014

WEB URLs :

1. nptel.ac.in/courses/IIT-MADRAS/ Principles Of.../Lecture35-37_SourceCoding.pdf
2. www.tutorialspoint.com/computer_logical_organization/error_codes.htm
3. http://www.unilim.fr/pages_perso/vahid/codage/ch3_capacity.pdf
4. http://nptel.ac.in/courses/117101053/
5 .nptel.ac.in/courses/117106031/

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19MSC09	HIGH SPEED SWITCHING ARCHITECTURE	L T P C 3 0 0 3

COURSE OBJECTIVES:

- To understand the concept of various switching
- To analysis the blocking networks
- To learn about the Queuing networks
- To understand the architecture of internet switches
- To analysis the IP
- To learn about high speed switching network.

COURSE OUTCOMES:

- Gain Knowledge of blocking &non blocking networks based on the switches
- Understand about ATM switches and various switching types
- Get an idea on LAN Routing Technology on networking field.
- Understand the concept IP switching Networks.
- Understand the Packet switching architecture.
- Apply the concepts of switching networks in real time.

UNIT I: NETWORKING 9

Introduction-LAN, WAN, Network evolution through ISDN to B-ISDN, Transfer mode and control of B-ISDN, SDH multiplexing structure, ATM standard, ATM adaptation layers.

UNIT II: ATM SWITCHING ARCHITECTURE 9

Blocking networks -basic -and-enhanced banyan networks, sorting networks-merge sorting, re-arrangable networks-full-and-partial connection networks, non blocking networks -Recursive network construction, comparison of non-blocking network, Switching with deflection routing -shuffle switch, tandem banyan switch.

UNIT III : QUEUES IN ATM SWITCHES 9

Internal Queuing -Input, output and shared queuing, multiple queuing networks –combined Input, output and shared queuing-performance analysis of Queued switches.

UNIT IV : PACKET SWITCHING ARCHITECTURES 9

Architecture of internet switches and routers-Buffer less and buffered crossbar switches, Multi-stage switching, Optical Packet switching; switching fabric on a chip; Internally buffered Crossbars.
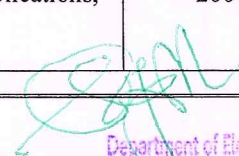
UNIT V: IP SWITCHING & LAN SWITCHING TECHNOLOGY 9

Addressing model, IP Switching types -flow driven and topology driven solutions, IP over ATM address and next hop resolution, multicasting, Ipv6 over ATM. Switching Concepts, switch forwarding techniques, switch path control, LAN Switching, cut through forwarding, store and forward, virtual LANs.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	AchillePattavina	Switching Theory: Architectures and performance in Broadband ATM networks	John Wiley & Sons Ltd	1998
2	Elhanany M. Hamdi	High Performance Packet Switching architectures	Springer Publications,	2007

3	Rainer Handel, Manfred N Huber, Stefan Schroder	ATM Networks: Concepts, Protocols, Applications	3/e, Addison Wesley	1999
4	IrvanPepelnjk Jim Guichard and Jeff Apcar	MPLS and VPN Architecture	Cisco Press	2003
5	Hu, Xiuwen	Architecture and performance evaluation of high-speed optical and electronic switches	CRC press	2012

WEB URLs :

1. www.springer.com/us/book
2. data.epo.org/.../EP0593609A1-HIGH-SPEED-SWITCHING-ARC
3. www.prnewswire.co.uk/.../kabira-supports-high-speed-volume-switching
4. www.cs.virginia.edu/~cs757/slidespdf/757-08-switcharchp2.pd
5. en.wikipedia.org/wiki/LAN_switching

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19MSC10	MOBILE ADHOC NETWORKS	L T P C
		3 0 0 3

COURSE OBJECTIVES :

- To study characteristics, vulnerabilities and challenges of ad hoc networks
- To explore issues and challenges in designing MAC and TCP Protocols
- AdHoc networks To understand adaptation of the routing protocols in mobile networks
- To explore issues and challenges variety of attacks and threats over different layer
- To evaluate the performance of MAC, routing protocols in MANETs.
- To learn the importance of Mobile AdHoc networks

COURSE OUTCOMES :

- Ability to identify the various challenges and vulnerabilities in MANET
- Obtain an awareness cyber attacks and threads in mobile networks.
- Understand and recognize the architectures, designing MAC, TCP, IP and security protocols
- Analyze the solutions for covering the security principles of wireless networks.
- Apply in-depth knowledge of wireless communications principles, systems, and networks to the solution of wireless engineering problems
- Apply the concepts in real time mobile networks

UNIT I: WIRELESS LAN, PAN, WAN AND MAN　　　　　　　　　　　　　　　9

Characteristics of wireless channel - Fundamentals of WLANs - IEEE 802.11 standard - HIPERLAN – WLL - Wireless ATM - IEEE 802.19 standard – HIPERACCESS- AdHoc Wireless Internet.

UNIT II: MAC AND ROUTING PROTOCOLS　　　　　　　　　　　　　　　　9

MAC: Design issues - Goals and classification - Contention–based MAC protocols: MACAW, DPRMA, DPSMA.MAC protocols using directional antenna- Routing protocols: AODV, DSR, ZRP, LAR, CHGSR, FSR and power-aware routing protocols.

UNIT III: TRANSPORT LAYER AND SECURITY　　　　　　　　　　　　　　9

Transport layer Protocol: Design issues - Goals and classification - TCP over AdHoc wireless Networks – Security - Security requirements - Issues and challenges in security provisioning - Network security attacks - Security routing.

UNIT IV: ENERGY MANAGEMENT　　　　　　　　　　　　　　　　　　　9

Need - Classification of battery management schemes - Transmission power management schemes - System power management schemes. Wireless Sensor Networks: Architecture - Data dissemination - Date gathering - MAC protocols - Location discovery - Quality of a sensor network.

UNIT V: PERFORMANCE ANALYSIS　　　　　　　　　　　　　　　　　　9

ABR beaconing - Performance parameters - Route-discovery time - End-to-end delay performance - Communication throughput performance - Packet loss performance - Route reconfiguration/repair time - TCP/IP based applications.

REFERENCE BOOKS:　　　　　　　　　　　　　　　　　　　　　　**TOTAL: 45 Hours**

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	C.Siva Ram Murthy and B.S.Manoj	AdHoc Wireless Networks: Architectures and protocols	Prentice Hall PTR	2007
2.	C.K.Toh	AdHoc Mobile Wireless Networks: Protocols and Systems	Prentice Hall PTR	2008
3.	Mohammad Ilyas	The Handbook of AdHoc Wireless Networks	CRC press	2002

4.	Charles E. Perkins	AdHoc Networking	Addison – Wesley	2008
5.	Jonathan Loo, Jaime Loret Mauri and Jesus Hamilton Ortiz	Mobile AdHoc Networks: Current status and Future Trends	CRC press	2012

WEB URLs :

1. www.ietf.org/internet-drafts/draft-ietf-manet-dsr-07.txt 21
2. www.ietf.org/internet-drafts/draft-ietf-manet-aodv-11.txt 19
3. searchsecurity.techtarget.com › SSL and TLS VPN Security › Network security
4. https://en.wikipedia.org/wiki/Energy_management
5. www.businessdictionary.com/definition/performance-analysis.html

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19MSC11	**RF MEMS**	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To study the action mechanisms of MEMS Switches and relays.
- To study the modeling of MEMS Inductors and Capacitors
- To study the modeling of Micro-Machined RF Filters
- To study the modeling of MEMS phase shifters
- To present basic overview of Microstrip antennas and design parameters
- To be able to understand the concepts of MEMS in different fields.

COURSE OUTCOMES:

- Able to analyse and design RF MEMS relays and switches
- Able to understand the operations of MEMS Inductors and Capacitors
- Able to model Micro-Machined RF Filters
- Able to model MEMS phase shifters and its applications
- Able to know the design and architecture of Micro machined Antennas
- Able to know the importance of RF MEMS in real time applications.

UNIT I: RFMEMS RELAYS AND SWITCHES   9

Introduction-Switch parameters Action Mechanisms of RF MEMS Switches –Electro Static, Magnetic & electromagnetic Bi-stable Relays and micro actuators –Dynamics of Switching Operation MEMS Switch Modeling, design evaluation

UNIT II: MEMS INDUCTORS AND CAPACITORS   9

Micromachining-Micromachining as a Fabrication process, Fabrication techniques- actuator mechanism- pull-in voltage-Micromachined Passive elements pros and cons-MEMS Inductors-Micromachined inductor-Effect of inductor layout-Approaches for Improving quality factor-Modeling and design issues of planar inductor- Polymer based inductor-MEMS capacitors gap tuning and area tuning capacitors-Dielectric tunable capacitors.

UNIT III : MICRO-MACHINED RF FILTERS   9

Introduction-Modeling of Mechanical Filters-Micro-machined filters-Electrostatic comb drive-Micromechanical filters using comb drives, electrostatic coupled beam structures –SAW filters Basic /s –Design of Inter Digital Transducers-Capabilities, Limitations and applications-Micromachined filters for mmwave frequencies.

UNIT IV : MEMS PHASE SHIFTERS   9

Introduction-Types of Phase shifters-Limitations-MEMS phase shifters-Switched delay line, Distributed and polymer based-Ferro electric Phase shifters-Distributed and bilateral Interdigitated-Micromachined transmission lines: Losses in Transmission Lines-Coplanar lines- Microshield and membrane supported transmission lines- Micromachined directional; coupler & Mixer. Design, Fabrication and evaluation.

UNIT V : MICROMACHINED ANTENNAS   9

Introduction-Overview of Microstrip antenna-Design parameters-Micromachining to improve antenna performance--Reconfigurable antennas.

TOTAL: 45 Hours

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	V.K. Varadan, K.J. Vinoy and K.A. Jose	RF MEMS and their applications	John Wiley & Sons Inc	2006
2	G.M. Rebeiz	RF MEMS: THEORY, Design and Technology	John Wiley & Sons Inc	2003
3	Hector J. De Santos	RF MEMS circuit Design for Wireless Communications	Artech House	2002

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| 4 | Ville Kaajakari | Practical MEMS: Design of microsystems, accelerometers, gyroscopes, RF MEMS, optical MEMS, and microfluidic systems " | Small Gear Publishing | 2009 |
| 5 | Joel A. Kubby | A Guide to Hands-on MEMS Design and Prototyping | Cambridge University Press | 2011 |

WEB URLs :

1. www.uio.no/studier/emner/matnat/ifi/INF5490/v12/.../LN05.pdf
2. freevideolectures.com › Electrical Engineering › IISc Bangalore
3. nptel.ac.in/courses/112108092/module1/lec01.pdf
4. nptel.ac.in/video.php?subjectId=117105082
5. www.nptelvideos.in/2012/12/mems-microsystems.html

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4	Ville Kaajakari	Practical MEMS: Design of microsystems, accelerometers, gyroscopes, RF MEMS, optical MEMS, and microfluidic systems "	Small Gear Publishing	2009
5	Joel A. Kubby	A Guide to Hands-on MEMS Design and Prototyping	Cambridge University Press	2011

WEB URLs :

1. www.uio.no/studier/emner/matnat/ifi/INF5490/v12/.../LN05.pdf
2. freevideolectures.com › Electrical Engineering › IISc Bangalore
3. nptel.ac.in/courses/112108092/module1/lec01.pdf
4. nptel.ac.in/video.php?subjectId=117105082
5. www.nptelvideos.in/2012/12/mems-microsystems.html

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19MSC12	SATELLITE REMOTE SENSING	L T P C
		3 0 0 3

COURSE OBJECTIVES:

- To study about the Satellite Data and Remote Sensing
- To study about the acquisition of satellite images
- To understand about the processing methodologies of satellite images
- To analyze and extract information from them, using signal and image processing
- To analyze the Compression of data
- To know the importance of satellite remote sensing.

COURSE OUTCOMES:

- Understanding of remote sensing process and spectral reflectance curve
- Knowledge of preprocessing techniques
- Discussion of satellite image enhancement techniques
- Learn the various data fusion
- Learn the various data compression techniques
- Understanding of Satellite remote sensing in real time applications.

UNIT I: SATELLITE DATA AND REMOTE SENSING 9

Remote sensing process, Radiation principles, Spectral reflectance curve, EMR interactions with-atmosphere-earth surface features. Satellite Image Characteristics, Resolution types, Pre-processing-Geometric Correction, Radiometric Correction.

UNIT II: SATELLITE IMAGE ENHANCEMENT 9

Radiometric Enhancement-Histogram Based Enhancements, Density Slicing, Stretching, Geometric Enhancement-Neighborhood Operations, Template Operation

UNIT III : DATA TRANSFORMATION 9

Spectral Transforms-Multispectral Ratios-Vegetation Indexes, Components, Tasseled- CapComponent, Color-Space Transforms, Spatial Transforms-Convolutions, Fourier Transform, Scalespace Transforms.

UNIT IV: IMAGE ANALYSIS AND DATA FUSION 9

Feature Extraction-Statistical, Structural, Training -Supervised, Unsupervised, Hybrid Training, Feature Space fusion, Spatial domain fusion, Scale space fusion

UNIT V : DATA COMPRESSION 9

Compression by coding, Fractal Compression, Wavelet Compression.

TOTAL: 45 Hours

REFERENCE BOOKS:

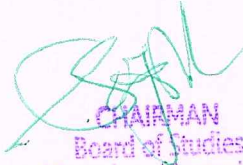| Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Thomas M.Lillesand,Ralph W.Kiefer	Remote Sensing And Image Interpretation	Willy India	2007
2	Robert A.Schowengerdt	Remote Sensing Models & Methods For Image Processing	Prentice Hall PTR	2004
3	Rafael C.Gonzalez,Richard E.Woods	Digital ImageProcessing	Prentice Hall PTR	2007

| 4 | Jian Guo Liu, Philippa J. Mason | Image Processing and GIS for Remote Sensing: Techniques and Applications | Prentice Hall | 2006 |
| 5 | Shane Cloude | Polarisation: Applications in Remote Sensing | Prentice Hall | 2007 |

WEB URLs :

1. nptel.ac.in/courses/105108077/10
2. nptel.ac.in/courses/105108077/module4/lecture19.pdf
3. nptel.ac.in/courses / Webcourse-contents/IIT%20Kharagpur/.../Pdf/Lesson-4.pdf
4. www.nptelvideos.in/2012/12/digital-image-processing.html
5. nptel.ac.in/syllabus/117101001/

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AUDIT COURSES (AC)

19MSE01	ENGLISH FOR RESEARCH PAPER WRITING	L T P C
		2 0 0 0

Course objectives: Students will be able to:
1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title
Ensure the good quality of paper at very first-time submission

Syllabus

Units	Contents	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction 4 3 Review of the	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature	4
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions first- time submission	4

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .

4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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19MSE02	DISASTER MANAGEMENT	L T P C
		2 0 0 0

Course Objectives:-Students will be able to:
1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work .

Syllabus

Units	Contents	Hours
1	**Introduction Disaster:** Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards:** Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4
3	**Disaster Prone Areas In India Study Of Seismic Zones:** Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4
4	**Disaster Preparedness And Management Preparedness:** Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment Disaster Risk:** Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global CoOperation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation:** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.

2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

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19MSE03	SANSKRIT FOR TECHNICAL **KNOWLEDGE**	L T P C
		2 0 0 0

Course Objectives :

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
2. Learning of Sanskrit to improve brain functioning.
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Syllabus		
Units	Contents	Hours
1	Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences	8
2	Order Introduction of roots Technical information about Sanskrit Literature	8
3	Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Suggested reading

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to
1. Understanding basic Sanskrit language.
2. Ancient Sanskrit literature about science & technology can be understood.
3. Being a logical language will help to develop logic in students.

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19MSE04	VALUE EDUCATION	L T P C
		2 0 0 0

Course Objectives
Students will be able to
1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Course Objectives :

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
2. Learning of Sanskrit to improve brain functioning.
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature.

Syllabus		
Units	**Contents**	**Hours**
1	• Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. • Moral and non- moral valuation. Standards and principles. • Value judgements	4
2	• Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism.Love for nature ,Discipline	4
3	• Personality and Behavior Development - Soul and Scientific • attitude. Positive Thinking. Integrity and discipline. • Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labour. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	4
4	• Character and Competence –Holy books vs Blind faith. • Self-management and Good health. • Science of reincarnation. • Equality, Nonviolence ,Humility, Role of Women. • All religions and same message. Mind your Mind, Self-control. • Honesty, Studying effectively	4

Suggested reading

1 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

Course outcomes

Students will be able to
1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

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19MSE05	CONSTITUTION OF INDIA	L T P C
		2 0 0 0

Course Objectives:
Students will be able to:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

	Syllabus	
Units	Contents	Hours
1	**History of Making of the Indian Constitution:** History Drafting Committee, (Composition & Working)	4
2	**Philosophy of the Indian Constitution:** Preamble Salient Features	4
3	**Contours of Constitutional Rights & Duties:** Fundamental Rights Right to Equality Right to Freedom Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.	4
4	**Organs of Governance:** Parliament Composition Qualifications and Disqualifications Powers and Functions Executive President Governor Council of Ministers Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions	4
5	**Local Administration:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	4
6	**Election Commission:** Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:
1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
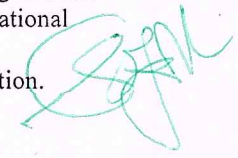4. Discuss the passage of the Hindu Code Bill of 1956.

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19MSE06	PEDAGOGY STUDIES	L T P C
		2 0 0 0

Course Objectives:
Students will be able to:
1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

	Syllabus	
Units	**Contents**	**Hours**
1	**Introduction and Methodology:** Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions. Overview of methodology and Searching.	4
2	Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.	4
3	Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.	4
4	Professional development: alignment with classroom practices and follow-up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes	4
5	**Research gaps and future directions** Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.	4

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation. Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

19MSE07	STRESS MANAGEMENT BY YOGA	L T P C
		2 0 0 0

Course Objectives
1. To achieve overall health of body and mind
2. To overcome stress

Course Objectives:
Students will be able to:
4. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
5. Identify critical evidence gaps to guide the development.

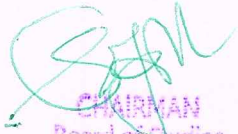| Syllabus		
Units	**Contents**	**Hours**
1	Definitions of Eight parts of yog. (Ashtanga)	8
2	Yam and Niyam. Do's and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects- Types of pranayam	8

Suggested reading

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

Course Outcomes:

Students will be able to:
1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

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19MSE08 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

L T P C
2 0 0 0

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Units	Syllabus	
	Contents	Hours
1	Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont's) • Verses- 71,73,75,78 (do's)	8
2	• Approach to day to day work and duties. • Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, • 23, 35, • Chapter 18-Verses 45, 46, 48.	8
3	• Statements of basic knowledge. • Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad Bhagwad Geeta: • Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39 • Chapter18 – Verses 37,38,63	8

Suggested reading

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to
1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

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