JSS MAHAVIDYAPEETHA

JSS SCIENCE AND TECHNOLOGY UNIVERSITY, MYSURU

SRI JAYACHAMARAJENDRA COLLEGE OF ENGINEERING, MYSURU

M.TECH PROGRAMME IN
NETWORKING AND INTERNET ENGINEERING

SCHEME I TO IV SEMESTER: 2017-2018

&

SYLLABUS I TO IV SEMESTER: 2017-2018

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Scheme of Teaching and Examination for M.Tech

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Scheme of Teaching and Examination for M.Tech (Networking and Internet Engineering)

SEMESTER	CREDITS
I	28
II	28
III	04
IV	40
TOTAL	100

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Scheme of Teaching and Examination for M.Tech (Networking and Internet Engineering)

SEMESTER I

SL No	Code	Course Title	L	T	P	Total credits	Contact hours	CIE	SEE	Total Marks	Exam duration
1	17PG M1X	Mandatory Course 1	3	0	0	3	3	50	50	100	3 hours
2	17PG M2X	Mandatory Course 2	2	0	0	2	2	50		50	
3	17LNI 130	Advanced Communication Networks	4	1	0	5	6	50	50	100	3 hours
4	17LNI 140	Cryptography and Network security	4	1	0	5	6	50	50	100	3 hours
5	17LNI 14X	Elective 1 Group A				5	6	50	50	100	3 hours
6	17LNI 15X	Elective 2 Group B				5	6	50	50	100	3 hours
7	17LNI 16L	Networking Lab-1	0	0	1.5	1.5	3	50		50	
8	17LNI 17S	Design and implementation -1	0	0	1.5	1.5	3	50		50	
		TOTAL				**28**	**35**	**350**	**250**	**650**	

Mandatory Courses-1

Course code	Course title	Credit pattern
17PGM11	Linear Algebra	3:0:0
17PGM12	Graph Theory	3:0:0
17PGM13	Data Analytics	3:0:0
17PGM14	Transform Techniques	3:0:0
17PGM15	Object Oriented Programming	3:0:0
17PGM16	Advanced Microcontrollers and Applications	3:0:0
17PGM17	Mathematical modeling and simulation	3:0:0

Mandatory Course - 2

Course code	Course title	Credit pattern
17PGM21	Technical report writing and documentation	2:0:0
17PGM22	Research Methodology	2:0:0
17PGM23	Sustainable technologies	2:0:0
17PGM24	Social implications of technology	2:0:0
17PGM25	Entrepreneurship and Project Management	2:0:0
17PGM26	Electronic waste management	2:0:0
17PGM27	Internet and Society	2:0:0

PROGRAM CORE COURSES: (Two courses from among 1 to 5 will be offered)

Sl No	Course Title	Credit Pattern
1	Advanced communication networks	4:0:1
2	Cryptography and network security	4:1:0
3	Network programming	4:1:0
4	Wireless Networks	4:1:0
5	Network Architecture, analysis and design	4:1:0
6	Physical and practical networking	0:0:1.5
7	Design and Implementation lab	0:0:1.5

PROGRAM ELECTIVES FOR NETWORKING AND INTERNET ENGINEERING (LNI)

FIRST SEMESTER (Two electives to be chosen)

	Sl No	Course Title	Credit Pattern
Group1	1	Storage area networks	4:1:0
	2	Big data systems	4:1:0
	3	Software defined Radio	4:1:0
	4	Telecommunication management and regulation	4:1:0
Group 2	1	Cyber forensics and information security	4:1:0
	2	Cloud computing and virtualization	4:1:0
	3	Underwater Communication	4:1:0
	4	Optical and DWDM networks	4:1:0
	5	Quantum Communications and computing	4:1:0

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Scheme of Teaching and Examination for M.Tech (Networking and Internet Engineering)

SEMESTER II

SL No	Code	Course Title	L	T	P	Total credits	Contact hours	CIE	SEE	Total Marks	Exam duration
1.	17LNI210	Mobile Computing	4	1	0	5	6	50	50	100	3 hours
2.	17LNI220	Protocol Engineering	4	1	0	5	6	50	50	100	3 hours
3.	17LNI230	Web Services	4	0	1	5	6	50	50	100	3 hours
4.	17LNI 24X	Elective 1	4	1	0	5	6	50	50	100	3 hours
5.	17PGOLX	Open Elective	4	1	1	5	6	50	50	100	3 hours
6.	17LNI 16L	Networking Lab-2	0	0	1.5	1.5	3	50		50	
7.	17LNI 17S	Design and implementation -2	0	0	1.5	1.5	3	50		50	
		TOTAL				**28**	**36**	**350**	**250**	**600**	

PROGRAM CORE COURSES: SECOND SEMESTER (Three courses from among 1 to 6 will be offered)

Sl. No	Course Title	Credit Pattern
1	Mobile computing	4:1:0
2	Protocol engineering	4:1:0
3	Web services	4:0:1
4	Cognitive radio and networks	4:1:0
5	Ubiquitous Networking	4:1:0
6	Network Planning, Implementation and Administration	4:0:1
7	Networking Simulation and analysis lab	0:0:1.5
8	Design and Implementation lab	0:0:1.5

PROGRAM ELECTIVES: SECOND SEMESTER (one elective to be chosen)

Sl No	Course Title	Credit Pattern
1	5G technologies	4:1:0
2	Photonic systems and technologies	4:1:0
3	Vehicular networks	4:1:0
4	Cyber Physical systems	4:1:0
5	Data center Management	4:1:0
6	Disaster recovery and High availability Techniques	4:1:0
7	Telecommunication software design	4:1:0

LIST OF OPEN ELECTIVE COURSES:

Students from any specialization have to register for ONE course in the even semester among these courses depending on which course is offered by the department

Course Code	Course Title	Credit pattern
17PGOL1	IOT	4:1:0
17PGOL2	Solar Energy Systems	4:1:0
17PGOL3	Machine learning	4:1:0
17PGOL4	Six Sigma and manufacturing	4:1:0
17PGOL5	Heuristics for optimization	4:1:0
17PGOL6	Organizational Behavior and Financial Management	4:1:0
17PGOL7	Deep learning	4:1:0
17PGOL8	MEMS	4:1:0
17PGOL9	Artificial Neural Networks	4:1:0

SCHEME OF STUDY AND SYLLABUS FOR M.Tech in NETWORKING AND INTERNET ENGINEERING

PG PROGRAM STRUCTURE (COMMON TO ALL PG PROGRAMS)

The following program structure shall be followed for all the PG Programs in the department..

Total credits **100**

Semester 1: 2 mandatory courses (3+2 credits) **= 05** credits

2 core subjects (5 credits X 2) = **10** credits(4:0:1 or (4:1:0)

2 Electives (5 credits X 2) = **10** (4:0:1 or (4:1:0)

1 Design Lab (1.5) + LAB (1.5) = **03**

TOTAL **28 credits**

Semester 2:

3 core subjects (5 credits X 3) = **15** (4:0:1 or (4:1:0)

1 Electives (5 credits X 1) = **05** (4:0:1 or (4:1:0)

1 Open Elective (5 credits X 1) = **05** credits

1 Design Lab (1.5) + LAB (1.5) = **03**

TOTAL **28 credits**

TOTAL **56 credits**

Industrial training 8 weeks **04 credits**

Project work and dissertation **40 credits**

TOTAL **100 credits**

Academic schedule:

Course work :(16 weeks + 1 week preparation+ 2 weeks exams+ 2 weeks vacation)21 X 2 = **42 weeks**

Training = 08 weeks

PROJECT work and dissertation: 40 weeks

Report preparation, submission, viva voce, result: 14 weeks

TOTAL 104 weeks

CONTINOUS EVALUATION SCHEDULE FOR PROJECT WORK

Event	**Credits**	**Marks**	**Schedule**
III Sem			
Industrial Training	04	100	Within 8th week
Synopsis Evaluation	02	50	Within 6th week
Mid term Evaluation 1	02	50	Within 18th week
	Total	**200**	
IV Sem			
Mid term Evaluation 2	02	50	Within 30th Week
Final internal seminar and demonstration	04	100	Within 40th Week
Report preparation	02	50	Within 44th Week
Evaluation of Project work External evaluation and Viva voce exam	28	200	Within 52nd Week
Declaration of results	**Total**	**400**	Within 54th Week

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Subject Name & Code	**Linear Algebra 17PGM11**
No. of Teaching Hours – 40	**Credits : 3:0:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

Course Outcomes:

Upon completion of this course, students should be able to:

1. Solve systems of linear equations and homogeneous systems of linear equations by different methods
2. Obtain solutions for signal processing applications using vector space concepts
3. Explain the concept of a linear transformation as a mapping from one vector space to another.
4. Apply the concepts of factorization, SVD and Optimisation to formulate and solve engineering problems.
5. Communicate and understand mathematical statements, ideas and results both verbally and in writing with correct use of mathematical definitions, terminology and symbolism by working collaboratively.

Syllabus:

Unit 1

Linear equations: Fields; system of linear equations, and its solution sets; elementary row operations and echelon forms; matrix operations; invertible matrices, LU-factorization.

Vector spaces: Vector spaces; subspaces; bases and dimension; coordinates; summary of row-equivalence; computations concerning subspaces.

Unit 2

Linear Transformations:; Algebra of linear transformations; isomorphism; representation of transformations by matrices; linear functionals; transpose of a linear transformation.

Unit 3

Canonical Forms: Characteristic values; annihilating polynomials; invariant subspaces; direct-sum decompositions; invariant direct sums; primary decomposition theorem; cyclic bases; Jordan canonical form. Iterative estimates of characteristic values.

Unit 4

Inner Product Spaces: Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.

Unit 5

Symmetric Matrices and Quadratic Forms: Digitalization; quadratic forms;; singular value decomposition.

References:

1. Gilbert Strang**,** "Linear Algebra and its Applications," 3rd edition, Thomson Learning Asia, 2003.
2. Kenneth Hoffman and Ray Kunze, "Linear Algebra," 2nd edition, Pearson Education (Asia) Pvt. Ltd/ Prentice Hall of India, 2004.
3. David C. Lay, "Linear Algebra and its Applications," 3rd edition, Pearson Education (Asia) Pvt. Ltd, 2005.
4. S. K. Jain and A. D. Gunawardena**,** "Linear Algebra, An Interactive Approach", Thomson, Brooks/Cole, 2004.

Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Applications," Pearson Education (Asia) Pvt. Ltd, 7th edition, 2003

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Subject Name & Code	**Graph Theory 17PGM12**
No. of Teaching Hours – 40	**Credits : 3:0:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

This course covers the theory of graphs and networks for both directed and undirected graphs. Topics include graph isomorphism, Eulerian and Hamiltonian graphs, matching, covers, connectivity, coloring, and planarity. There is an emphasis on applications to real world problems and on graph algorithms such as those for spanning trees, shortest paths, and network flows.

Definitions, Notation, Terminology, History Paths and Circuits, Connectedness, Isomorphism Trees, Binary trees, Spanning trees, and Fundamental Circuits Adjacency and Incidence Matrices Matchings and Covers Vertex and Edge Connectivity Coloring Planar Graphs and Duality Directed Graphs Applications and Computer Algorithms

Reference:

1. **West. D. B, Introduction to Graph Theory, Prentice Hall, Upper Saddle River, NJ.**
2. **Bondy, J. A. and Murty, U.S.R., Graph Theory, GTM Springer, New York, NY**.
3. **Narasingh Deo: Graph theory**

Subject Name & Code	**Data Analytics 17PGM13**
No. of Teaching Hours – 40	**Credits : 3:0:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

.**DATA ANALYSIS**

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics – Rule induction – Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

MINING DATA STREAMS

Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Realtime Analytics Platform(RTAP) applications – case studies – real time sentiment analysis, stock market predictions.

FREQUENT ITEM SETS AND CLUSTERING

Mining Frequent item sets – Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

FRAMEWORKS AND VISUALIZATION

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications:

TEXT BOOKS:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.

2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

REFERENCES:

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics, John Wiley & sons, 2012.

2. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O'Reilly, 2011.

3. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.

Subject Name & Code	**Transform Techniques 17PGM14**
No. of Teaching Hours – 40	**Credits : 3:0:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

Fourier Transform: The direct and inverse FT, existence of FT, Properties of FT, The Frequency Spectrum.

Laplace Transform: The direct LT, Region of convergence, existence of LT, properties of LT. The inverse LT, Solution of differential equations, system transfer function. Linear Convolution: Graphical interpretation, properties of convolution, Correlation: Auto and Cross correlation, graphical interpretation, properties of correlation.

Discrete-time signals and systems: Sampling, classification of DT signals, Discrete-time energy and power signals, Linear Shift invariant systems, Stability and Causality, Linear constant coefficient systems, Frequency domain representation of discrete time systems and signals.

Linear Convolution: Graphical interpretation, properties of convolution. Correlation: Auto and Cross correlation, graphical interpretation, properties of
correlation.

Z-Transform: The direct ZT, Region of convergence, Z-plan e and S-plane correspondence. Inverse ZT, Properties of Z-transforms, Solution to linear difference equations, System transfer function.

Discrete Fourier series, Sampling the z-transform, Discrete Time Fourier Transform (DTFT), properties of DTFT, Discrete Fourier Transform(DFT), properties of DFT, Linear convolution using DFT.

***Suggested Reading*:**

1. 1.B.P. Lathi, *Signals, Systems and Communication*, BS Publications, 2006.

1. 2.Luis F. Chaparro, *Signals and Systems using MATLAB*, Academic press, 2011

1. 3.Alan V. Oppenheim and Ronald W. Schafer, *Digital Signal Processing*, PHI, 2008.

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Subject Name & Code	**Object Oriented Programming 17PGM15**
No. of Teaching Hours – 40	**Credits : 3:0:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

Course Outcomes:

1. Develop programs that leverage the object-oriented features of the Java language
2. Implement error-handling techniques and I/O functionalities
3. Demonstrate an ability to employ data structures to addressvarious types of selection constructs
4. Employ a hierarchy of Java classes to and give an effective presentation

Why Object-Oriented Programming in C++ - Native Types and Statements –Functions and Pointers- Implementing ADTs in the Base Language.

BASIC CHARACTERISTICS OF OOP

Data Hiding and Member Functions- Object Creation and Destruction- Polymorphism data abstraction: Iterators and Containers.

ADVANCED PROGRAMMING

Templates, Generic Programming, and STL-Inheritance-Exceptions-OOP Using C++.

OVERVIEW OF JAVA

Data types, variables and arrays, operators, control statements, classes, objects, methods – Inheritance

EXCEPTION HANDLING

Packages and Interfaces, Exception handling, Multithreaded programming, Strings, Input/Output

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Subject Name & Code	**Advanced Microcontrollers and applications 17PGM16**
No. of Teaching Hours – 40	**Credits : 3:0:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

Introduction to microcontrollers, Generic architectures and trends

Comparative study of PIC, ATMEGA, ARM, Raspberry and TI microcontrollers and development systems. Applications Programming techniques, IDE

Applications to control systems ,process control, IOT, embedded systems etc.,

Focus on applications and case studies

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Subject Name & Code	**Mathematical Modeling and Simulation 17PGM17**
No. of Teaching Hours – 40	**Credits : 3:0:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

This course is designed as an introductory graduate-level course to the concepts and techniques used in building mathematical models of physical systems. These ideas will be introduced together with the numerical techniques required to carry out simulation and optimization calculations.

The focus will be on continuous-time, macroscopic system modeling, but the discussion will be generic and the concepts can be easily extended to different space and time scales.

Case studies and examples from Chemical, Biological, Mechanical and Electrical Engineering will be discussed. Upon completing this course, the students are expected to gain the following abilities and skills: Ability to identify the scope and structure of the mathematical model of a physical system. Ability to develop first-principles or empirical equations relating the model inputs, states and outputs. Ability to implement the model equations in an equation-oriented computer modeling and simulation language Ability to carry out numerical simulation and optimization calculations. Ability to estimate unknown model parameters from available experimental data.

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Subject Name & Code	**Technical report writing and documentation 17PGM21**
No. of Teaching Hours – 30	**Credits : 2:0:0 L-T-P**
CIE Marks: 50	

1. Technical report formats and standard practices using LATEX software'
2. Preparing Technical papers according to standard IEEE guidelines
3. Project report writing, technical presentations and seminars
4. Introduction to technical writing and technical literature
5. Case studies and exercises

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Subject Name & Code	**Research Methodology 17PGM22**
No. of Teaching Hours – 30	**Credits : 2:0:0 L-T-P**
CIE Marks: 50	

1. Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, ductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process

2. Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance

3. Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

4. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.

5 .Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.

5. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

6. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism..

7. Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like

LaTeX/MS Office, Software for detection of Plagiarism (10) Books Recommended:-

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition

2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.

3. Research Methodology – C.R.Kothari

4. Select references from the Internet

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Subject Name & Code	**Sustainable Technologies 17PGM23**
No. of Teaching Hours– 30	**Credits : 2:0:0 L-T-P**
CIE Marks: 50	

Topics covered:

Technology, Sustainability & Development: Definitions, Dimensions, Interpretations, Concepts and Principles; Current Issues and debates (examples, case studies and mini-assignment/project); Science, Engineering and Technology – concepts and interrelationship. Science, Technology and Design - Socio-Environmental and Economic Implications. Integrated (systemic) Sustainability Assessment, Modeling and Forecasting; Integrated Life-Cycle Studies; Identification and Selection of Appropriate Design/Technologies (examples, case studies and mini-assignment/project).

References:

1. Bell, Simon and Stephen Morse (1998) Sustainability Indicators: Measuring the immeasurable; Earthscan, London.
2. Technology Management Newsletter www.techmotivator.iitm.ac.in
3. Mani, M., Ganesh, L.S., and Varghese, K (2005) Sustainability and Human Settlements: Fundamental Issues, Modeling and Simulations, Sage Pub., New Delhi.
4. Petroski, Henry (1994) The Evolution of Useful Things; Vintage Books, New York.
5. DeGregori, Thomas R. (1989) A Theory of Technology: Continuity and change in human development; Affiliated East-West, New Delhi.
6. Rhodes, Richard (Ed.) (1999) Visions of Technology; Simon and Schuster, New York.

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Subject Name & Code	**Social Implications of Technology 17PGM24**
No. of Teaching Hours – 30	**Credits : 2:0:0 L-T-P**
CIE Marks: 50	

This course is divided into three main sections:

1) After a brief introduction to the bi-directional relationship between technology and society, we begin by looking at the policy implications of the collision between the proliferation of increasingly powerful technologies and the unavoidable vulnerability imposed by human error and malevolence (including terrorism). We will pay special attention to the case of "dangerous technologies", those capable of creating catastrophic destruction by design or by accident.

2) We then analyze the linkage between scientific/technological progress and economic factors. How does the nature and pace of technological advance affect industrial competitiveness and the ability of the economy to provide a growing standard of living? How are the market structure of and degree of competition in the private sector related to the character and rate of technological development? In what ways does public policy affect technological development? How does the nature of technological development affect the public policies we pursue? What are the appropriate roles of the public and private sectors?

3) Finally, we explore and critique the wider literature on the interaction of technology and society in the light of the analysis of sections one and two, through student presentations.

Reference: IEEE transactions on SIT

Subject Name & Code	**Entrepreneurship and Management 17PGM25**
No. of Teaching Hours – 30	**Credits : 2:0:0 L-T-P**
CIE Marks: 50	

Entrepreneurship: Entrepreneur characteristics – Classification of Entrepreneurships – Incorporation of Business – Forms of Business organizations –Role of Entrepreneurship in economic development –Start-ups.

Idea Generation and Opportunity Assessment: Ideas in Entrepreneurships – Sources of New Ideas – Techniques for generating ideas – Opportunity Recognition – Steps in tapping opportunities.: Project Formulation and Appraisal : Preparation of Project Report –Content; Guidelines for Report preparation – Project Appraisal techniques –economic – Steps Analysis; Financial Analysis; Market Analysis; Technical Feasibility. Institutions Supporting Small Business Enterprises: Central level Institutions: NABARD; SIDBI, NIC, KVIC; SIDIO; NSIC Ltd; etc. – state level Institutions –DICs- SFC- SSIDC- Other financial assistance. Government Policy and Taxation Benefits: Government Policy for SSIs- tax Incentives and Concessions – Non-tax Concessions –Rehabilitation and Investment Allowances.

Reference Books:

1. Arya Kumar, Entrepreneurship, Pearson, Delhi, 2012.

2. Poornima M.CH., Entrepreneurship Development –Small Business Enterprises, Pearson, Delhi,2009

3. Michael H. Morris, ET. al., Entrepreneurship and Innovation, Cen gage Learning, New Delhi, 2011

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Subject Name & Code	**Electronic Waste management 17PGM26**
No. of Teaching Hours – 30	**Credits : 2:0:0 L-T-P**
CIE Marks: 50	

Objective:

In an approach to bridge the digital divide, it is necessary to get an affordable, equitable and quality access to ICT. It is estimated that two third of world's population is still offline so there is a need to provide affordable access to internet for all. For developing countries, it has become a priority area to alleviate poverty by promoting access to ICT. At the same time, tremendous growth in use of ICT devices and services, faster change of technology and frequent innovations in ICT sector, had left the world with a threat of deterioration in environmental conditions and human health as the-waste of electronic and electrical equipment, which contains hazardous components, is still handled in an environmentally unfriendly manner mainly in developing nations. It is huge challenge for the nations to handle e-waste in responsible manner and protect the environment.

E waste management rules and guidelines
Environmental impacts
Waste disposal and management
Case studies and field survey
National and global figures and statistics

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Subject Name & Code	**Internet and Society 17PGM27**
No. of Teaching Hours – 30	**Credits : 2:0:0 L-T-P**
CIE Marks: 50	

1. Systematical and critical discussion, evaluation, and reflections on the key issues, debates, principles, concepts, and theories of Internet Research;
2. Employ and apply a wide range of concepts relating to Internet, social media and society;
3. Demonstration of an understanding and an ethical and critical appreciation of the importance ot the Internet and social media in contemporary society;
4. Usage of social media for disseminating journalistic information to the public and reflect on the journalistic use of social media;
5. Analysis and reflections on complex material in individual and group work;

Subject Name & Code	Advanced Communication Networks 17LNI130
No. of Teaching Hours – 52	Credits : 4:1:0 L-T-P
CIE Marks: 50	SEE Marks: 100

Course Outcomes:

On successful completion of the course, the students will be able to:

1. Demonstrate the importance and significance of Communication network concepts, models and techniques
2. Apply the concepts of switching, multiplexing, and routing issues
3. Analyse various Transmission protocols and addressing schemes.
4. Analyse various queuing techniques and disciplines
5. Demonstrate an awareness and familiarity about recent trends and techniques in Communication networks, systems, technologies and applications

Syllabus:

Unit 1

Review of fundamental concepts in networking and communication. Packet switching techniques and types, Foundations of networking protocols, Internet protocols and addressing **10 hours**

Unit 2

Basics of wireless Networks and Mobile IP. Routers, Routing and internetworking, network layer routing, Least cost path algorithms, Non least cost algorithms, Intra domain routing protocols, inter domain routing protocols, Congestion control in network layer **10 hours**

Unit 3

Transport and end to end protocols: Transport layer, TCP, UDP, Mobile transport protocols, TCP congestion control, Applications and network management **10 hours**

Unit 4

Packet Queues and delay analysis, Queuing disciplines, Markovian systems, Non Markovian systems, Networks in Queues, Basics of QoS and resource allocation **10 hours**

Unit 5

VPNs, Tunneling and Overlay networks, VPN, MPLS, P2P networks, Basics of VOIP, mobile ad hoc networks and wireless sensor networks. Recent trends in networking **10 hours**

References:

1. ***Nader Mir* :** Computer and communication networks , Pearson Education 2007
2. ***Leon Garcia and IndraWidjaja:***CommuincationNetworks,TMH Second Edition
3. ***Wayne Tomasi***: Introduction to data communications and networking, Pearson Education, 2007
4. ***Kurose and Ross***: Computer networking, 3rd Edition, Pearson education, 2007

Subject Name & Code	**Cryptography and Network security 17LNI140**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Acquire and demonstrate the knowledge of Cryptographic and Network Security Architecture.
2. Analyze and implement Cryptographic Algorithms.
3. Write and test codes related to cryptographic tasks
4. Validate network security procedures using tools.
5. Demonstrate an ability to work individually or in a team to carry out assigned tasks, by effectively managing resources adhering to standard practices and ethics.

Syllabus

Unit :1

Overview : Services, Mechanisms and attacks, OSI security architecture, Model for network security. Classsical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transportation techniques, Rooter machine, Steganography, Problems. **10hrs**

Unit :2

Block Ciphers and DES (Data Encryption Standards): Simplified DES, Block cipher principles, DES, Strength of DES, Block cipher design principles, Block cipher modes od operation, Problems. **10hrs**

Unit:3

Public Key Cryptography and RSA: Principles of public key cryptosystems, RSA algorithm, Problems.

Other Public Key crypto Systems and Key Management: Key management, Diffie-Hellman key exchange, Elliptic cuve arithmetic, Elliptic curve cryptography, Problems. **10hrs**

Unit:4

Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hah Functions, Security od Hash functions and MAC's, Problems.

Digital Signature and Authentication Protocol: Digital signature, Authentication protocols, igital signature standard.

Authentication Applications: Kerberos, X.509 authentication services, Authentication protocols, Digital Signature standard. **10hrs**

Unit:5

Electronic Mail Security: Pretty good privacy, S/MINE, Data compression using ZIP, Radix-64 conversion, PGP random number generator.

IP Security: Overview, IP security architecture, Authentication header, ESP (Encapsulating security pay load), Security associations, Key management, Problems.

Firewalls: Firewall design principles, trusted systems, System viruses

Problems and new research / advanced topics **10hrs**

References:

1. **William Stallings**, "Cryptography and network Security – principles and practice",6th edition, Pearson Education(Asia)Pvt. Ltd. Prentie Hall of India, 2013.

2. **C. Kaufman, R. Perlman and M. Speciner**, "Network Security: Private Communication in a Public World", 2nd edition, Pearson Education(Asia) Pvt.Ltd , 2002.

3. **Atul Kahte,"** Cryptography and Network security", 3rd Ed, McGrawhill Education(India), 2013

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Subject Name & Code	**Network Programming**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Explain basic networking concepts using Unix network models, processesand demonstrate the working of different communication modules.
2. Develop codes to demonstrate client-server model of interaction and networking applications.
3. Implement specific network programming constructs on UNIX platforms to create robust real-world sockets-based applications.
4. Analyse and Evaluatean understanding of the design considerations in building network applications considering multitasking and interoperability
5. Work individually or in a group to implement assigned tasks,manage resources efficiently, communicate effectively and document the work adhering to standard practices and ethics

Syllabus:

Unit 1:

Introduction History, Layering, OSI Model, Processes, a Simplified Model, Client-Server Model.

The UNIX Model: Introduction, Basic Definitions, Input and Output, Signals, Process Control, Daemon Processes

Unit 2:

Interprocess Communication

Introduction, File and Record Locking, A Simple Client-Server Example, Pipes, FIFOs, Streams and Messages, Name Spaces, System V IPC: Message Queues, Semaphores, Shared Memory, Sun RPC

Unit 3:

Introduction Transport Layer Sockets Introduction Elementary TCP Sockets TCP Client/Server Example Elementary SCTP Sockets SCTP Client/Server Example Name and Address Conversions

Unit 4:

IPv4 and IPv6 Interoperability, Daemon Processes and the inetdSuper server, Advanced I/O Functions Unix Domain Protocols, Non blocking I/O, ioctl Operations

Unit 5:

Routing Sockets, Key Management Sockets, Broadcasting, Multicasting, Advanced UDP Sockets, Advanced SCTP Sockets, Out-at-Band Data, Signal-Driven I/O, Threads, IP Options, Raw Sockets, Data link Access, Client/Server Design Alternatives

References:

1. Richard Stevens**:***UNIX Network Programming*, 3rd edition, Prentice Hall, 2014.

2. Richard Stevens: *UNIX Network Programming, Volume 2, Second Edition: Interprocess Communications*, Prentice Hall, 1999.

3. Richard Stevens*: UNIX Network Programming, Volume 1, Second Edition: Networking APIs: Sockets and XTI*, Prentice Hall, 1998

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Subject Name & Code	**Network planning, architecture and Analysis**
No. of Teaching Hours – 52	**Credits : 4:0:1 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

Course Objective: This course covers the principles of network analysis, architecture, and design. These principles help in identifying and applying the services and performance levels that a network must satisfy. Principles of network analysis include network service characteristics, performance characteristics, network requirements analysis, and network flow analysis. Principles of network architecture and design include addressing and routing, network management architecture, performance architecture and design, security and privacy architecture, and quality of service design.

Unit I

Introduction – Overview of Analysis, Architecture and Design Processes – A Systems Methodology – System Description – Service Description – Service Characteristics – Performance Characteristics – Network Supportability. Requirements Analysis: Concepts – User Requirements – Application Requirements – Device Requirements – Network Requirements – Other Requirements – The Requirements Specification and Map.

Unit II

Requirements Analysis: Process – Gathering and Listing Requirements – Developing Service Metrics – Characterizing Behavior – Developing RMA Requirements – Developing Delay Requirements – Developing Capacity Requirements – Developing Supplemental Performance Requirements – Environment-Specific Thresholds and Limits – Requirements for Predictable and Guaranteed Performance – Requirements Mapping – Developing the Requirements Specification – Flow Analysis: Flows – Identifying and Developing Flows – Data Sources and

Sinks – Flow Models – Flow Prioritization – Flow Specification – Example Application of Flow Analysis.

Unit III

Network Architecture: Component Architectures – Reference Architecture – Architectural Models – Systems and Network Architectures – Addressing and Routing Architecture: Addressing Mechanisms – Routing Mechanisms – Addressing Strategies – Routing Strategies – Architectural Considerations.

Unit IV

Network Management Architecture: Defining Network Management – Network Management Mechanisms – Architectural Considerations – Performance Architecture: Developing Goals for Performance – Performance Mechanisms – Architectural Considerations – Security and Privacy Architecture: Developing a Security and Privacy Plan – Security and Privacy Administration – Security and Privacy Mechanisms – Architectural Considerations.

Unit V

Network Design: Design Concepts – Design Process – Vendor, Equipment, and Service Provider Evaluations – Network Layout – Design Traceability – Design Metrics - Selecting Technologies for Network Design: Developing Goals for Network Design – Developing Criteria for Technology Evaluation – Guidelines and Constraints on technology Evaluations – Making Technology Choices for the Network Design – Interconnecting Technologies within the Network Design: Shared medium (No Interconnection) – Switching – Routing – Hybrid Mechanisms – Applying Interconnection Mechanisms to the Design.

Text Book:

James D. McCabe, Network Analysis, Architecture and Design, Third Edition, Elsevier, 2007. ISBN: 978-0-12-370480-1.

Reference Books:

1. James D. McCabe, Network Analysis, Architecture and Design, Second Edition, Elsevier, 2003.

2. Andrew S. Tanenbaum, Computer Networks, Fifth Edition, Prentice Hall, Upper Saddle River, New Jersey, 2013.

Subject Name & Code	**Wireless Networks**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

UNIT I WIRELESS LAN

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer, Link manager Protocol, security – IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

UNIT II MOBILE NETWORK LAYER Introduction – Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet-Mobile IP session initiation protocol – mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing

UNIT III MOBILE TRANSPORT LAYER TCP enhancements for wireless protocols – Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility – Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP – TCP over 3G wireless networks**.**

UNIT IV WIRELESS WIDE AREA NETWORK

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

UNIT V 4G/5G NETWORKS Introduction – 4G vision – 4G features and challenges – Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

TEXT BOOKS:

1. Jochen Schiller, ”Mobile Communications”, Second Edition, Pearson Education 2012.(Unit I,II,III)

2. Vijay Garg , “Wireless Communications and networking”, First Edition, Elsevier 2007.(Unit IV,V)

Subject Name & Code	**Networking Laboratory– I 17LNI 16L**
No. of Teaching Hours – 40	**Credits : 0:0:1.5 L-T-P**
CIE Marks: 50	

Course outcomes:

Upon completion of this course, student should be able to:

1. Verify practicallythe significance of Communication network principles, and techniques
2. Demonstrate various scenarios in switching, routing and troubleshootingusing Simulators.
3. Analyse various Transmission protocols and addressing schemes by creating various network configurations
4. Work in a group to complete the task adhering to schedule and communicate effectively in written and oral formats.

Experiments and Exercises:

1. Network configurations, layered approach using CISCO packet tracer
2. Addressing schemes, VLANs, Switch configurations
3. Router configuration, routing protocols testing
4. Basic experiments with EXATA simulator, Network scenarios, testing and validation of results
5. Wireless LAN scenarios and protocols using EXATA and PT
6. Exercises related to IPv6
7. Exercises on Network Programming and Cryptography
8. Network Emulation exercises based on EXATA

Subject Name & Code	**Design and Implementation Lab-1 17LNI17S**
No. of Teaching Hours – 40	**Credits : 0:0:1.5 L-T-P**
CIE Marks: 50	

Course objective:

A group of Students will conceptualize, design and implement a solution to a problem which requires skills related to more than one course in the curriculum. The will make use of relevant tools and possibly have the problem defined through industry association.

They will complete the task, document it properly and also aim for a publication in events of acceptable standards.

Subject Name & Code	Storage Area Networks
No. of Teaching Hours – 52	Credits : 4:1:0 L-T-P
CIE Marks: 50	SEE: 100

Course Outcomes:

Upon completion of this course, student should be able to:

CO1: Demonstrate a knowledge of fundamentals of storage systems and network technologies.

CO2: Analyse the metrics used for designing storage area networks.

CO3: Demonstrate the knowledge of various concepts and techniques of storage virtualization

CO4: Identify and analyze reliability, security and management issues in storage infrastructure.

CO5: Work effectively in a group for collaborative learning and demonstrate efficient oral and writing communication skills

Syllabus :

Unit-1 Storage Systems

Introduction to Information Storage and Management: Information Storage, Data Center Infrastructure, Information Lifecycle. Storage System Environment: Components of a Storage System, Disk Drive Architecture and Performance, Logical Components of the Host. Data Protection: Concept of RAID and different RAID levels **10 hours**

Unit-2 Storage Network Technologies

Direct Attached Storage and SCSI, Storage Area Networks: Fibre Channel. Network Attached Storage, IPSAN: iSCSI, FCIP. Network Attached Storage, Content Addressed Storage.

10 hours

Unit-3 Storage Virtualization

Forms of Virtualization, Storage Virtuaization Challenges, File and Block level Virtualization, Concepts in Practice. Cloud Computing: Cloud Services (SaaS, PaaS, and Iaas), Cloud concerns and implementations **10 hours**

Unit-4 Business Continuity

Business Continuity Life Cycle, Failure Analysis, Backup and Recovery: Architecture and different Backup/Recovery topologies, Local Replication technologies and their operation, Remote replication technologies and their operation. **10 hours**

Unit-5 Storage Security And Management

Storage Security framework, Storage Security domains, Security implementations in Storage Networking, Monitoring the Storage Infrastructure, Storage Management Activities, Storage Management Standards and Initiatives, Concepts in Practice. **10 hours**

References:

1. EMC Corporation, ***Information Storage and Management***, 1st edition, Wiley India.
2. Ulf Troppens, Rainer Erkens and Wolfgang Muller: ***Storage Networks Explained***, Wiley India, 2007.
3. Robert Spalding: "***Storage Networks The Complete Reference***", Tata McGraw-Hill, 2011.
4. Marc Farley: ***Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems***, Cisco Press, 2005.
5. Richard Barker and Paul Massiglia: "***Storage Area Network Essentials AComplete Guide to understanding and Implementing SANs***", Wiley India, 2006.

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Subject Name & Code	**Big Data and Analytics**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Course Outcomes:

The students will be able to:

1. Acquire and demonstrate the knowledge of different techniques in big data analytics
2. Solve statistical and mathematical problems related to large data sets
3. Use HADOOP framework and Map Reduce technique for working with different datasets in big data analytics.
4. Apply tools to analyze and compare structured, semi-structured and unstructured data.
5. Explore advances in the domain by engaging in self-study / team work and give an effective presentation with proper documentation.

Unit I : Introduction To Big Data

Introduction to Big Data Platform Challenges of Conventional Systems -Intelligent data analysis –Nature of Data -Analytic Processes and Tools -Analysis vs Reporting -Modern Data Analytic Tools -Statistical Concepts: Sampling Distributions -Re-Sampling -Statistical Inference-Prediction Error.

Unit II: Mining Data Streams

Introduction To Streams Concepts –Stream Data Model and Architecture -Stream Computing -Sampling Data in a Stream –Filtering Streams–Counting Distinct Elements in a Stream –Estimating Moments –Counting Oneness in a Window –Decaying Window -Real time Analytics

Platform(RTAP)Applications -Case Studies -Real Time Sentiment Analysis, Stock Market Predictions.

Unit III: Hadoop

History of Hadoop-The Hadoop Distributed File System –Components of Hadoop-Analyzing the Data with Hadoop-Scaling Out-Hadoop Streaming-Design of HDFS-Java interfaces to HDFS Basics-Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort –Task execution -Map Reduce Types and Formats-Map Reduce Features

Unit IV: Hadoop Environment

Setting up a Hadoop Cluster -Cluster specification -Cluster Setup and Installation –Hadoop Configuration-Security in Hadoop -Administering Hadoop –HDFS -Monitoring-Maintenance-Hadoop benchmarks-Hadoop in the cloud

Unit V :Frameworks

Applications on Big Data Using Pig and Hive –Data processing operators in Pig –Hive services –HiveQL –Querying Data in Hive -fundamentals of HBase and ZooKeeper -IBM InfoSphere BigInsights and Streams. Visualizations -Visual data analysis techniques, interaction techniques; Systems and applications

References

1. **Michael Berthold, David J. Hand**, "Intelligent Data Analysis", Springer, 2007.

2. **Tom White**" Hadoop: The Definitive Guide" Third Edition, O'reilly Media, 2012

3. **Chris Eaton, Dirk DeRoos**, Tom Deutsch, George Lapis, Paul Zikopoulos, "Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data", McGrawHill Publishing, 2012

4.**Zikopoulos**, Paul, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop an d Streaming Data, Tata McGraw Hill Publications, 2011

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Subject Name & Code	**Software Defined Radio**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Course outcomes:

Upon the completion of this course student should be able to:

1. Demonstrate the knowledge related to SDR in advanced communication systems
2. Able to explain and analyses challenges and issues in SDR
3. To analyse spectrum efficiency and soft usage of spectrum considering cognitive features
4. Apply machine learning to CR
5. Illustrate and explain issues like sampling issues ,Multirate sampling , rate related issues.

Syllabus:

Unit 1

1. Application of SDR in advanced communication systems
2. Challenges and issues regarding the implementation of SDR
3. Adaptive wireless communication systems
4. Parameter estimation for adaptation of wireless communication systems (learning environment and other factors)

Unit 2

1. SDR and cognitive radio architectures
2. Spectrum efficiency and soft spectrum usage
3. Multi-dimensional spectrum awareness
4. Applications of cognitive radio (specifically for public safety)

Unit 3

1. Cognitive features in the upcoming wireless standards (LTE, WiMAX, etc)
2. Spectrum, network, context, environment, location awareness for cognitive radio
3. Blind receiver design
4. Femto-cells and relation to cognitive radio
5. Cognitive OFDM(A)

Unit 4

1. UWB and Cognitive radio (underlay and overlay)
2. Interference awareness
3. Signal analysis, signal awareness
4. Vertical hand-off and network interoperability - network awareness, multi-tier networks

Unit 5

1. Sampling and ADC/DAC issues in CR and SDR
2. Multi-rate processing, sampling rate adjustments. Auto-rate detection and adjustments

References:

1. HüsyinArslan (Ed.), "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems," Ser. Signals and Communication Technology, xviii, 470 p., I. edition, ISBN: 978-1-4020-5541-6, Springer, August 2007
2. Joseph Mitola, III, "Cognitive Radio Architecture: The Engineering Foundations of Radio XML," John Wiley and Sons Ltd., February 2006.
3. Jeffrey H. Reed, "Software Radio: A Modern Approach to Radio Engineering," Prentice Hall PTR, 2002.
4. Walter H.W. Tuttlebee, "Software Defined Radio: Enabling Technologies," John Wiley and Sons Ltd., 2002.

Subject Name & Code	**Telecommunication management and regulation**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Telecommunications System Management: Telecom Technology Systems Evolution: Telecommunication Management network (TMN), Teletraffic Theory and Network analysis, Network planning and design. Recent Developments in Telecom Industry, Regulation & Liberalization policy.

Technomanagerial aspects of telecommunication, role of the telecommunication managers in a dynamic environment. The business of telecommunication, telecommunication as a facilitating infrastructure for economic development of the country, technical survey of the ways and means that voice, data and video traffic are moved long distances, data network, the telephone system. Issues of the monopolization and deregulation of telecom, national telecom policy, various institutions/ organizations like telecom regulatory authority etc, conveyance. Telecom service costing, economic evaluation of telecom projects, telecom project financing.

International Scenario in Telecommunication: Historical development and evolution of telecom, Patterns of Transaction in international telecom management, managing the market growth. Structure of the Telecommunications sector of developed and developing in select countries, trends in privatization, liberalization and deregulation. Role of telecommunications in socioeconomic development, new technologies and services for international telecommunications, business application of global networks. Regional prospectus on development of Telecom. Current issues and implications for the industry, Indian markets, policy issues, skill formation for ITM, problems, challenges of growth.

Telecom Dispute and Settlement: Types of disputes, agency for settlement. Telecommunication regulatory authorities, Role of ITU

Subject Name & Code	**Cyber forensics and information security**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

UNIT I NETWORK LAYER SECURITY &TRANSPORT LAYER SECURITY 9 IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec . Transport layer Security: SSL protocol, Cryptographic Computations – TLS Protocol.

UNIT II E-MAIL SECURITY & FIREWALLS 9 PGP - S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

UNIT III INTRODUCTION TO COMPUTER FORENSICS 9 Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT IV EVIDENCE COLLECTION AND FORENSICS TOOLS 9 Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT V ANALYSIS AND VALIDATION 9 Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics

TEXT BOOKS:

1. Man Young Rhee, “Internet Security: Cryptographic Principles”, “Algorithms and Protocols”, Wiley Publications, 2003.
2. Nelson, Phillips, Enfinger, Steuart, “Computer Forensics and Investigations”, Cengage Learning, India Edition, 2008.

REFERENCES:

1. John R.Vacca, “Computer Forensics”, Cengage Learning, 2005
2. Richard E.Smith, “Internet Cryptography”, 3 rd Edition Pearson Education, 2008.
3. Marjie T.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3 rd Edition, Prentice Hall, 2013.

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Subject Name & Code	**Cloud Computing and virtualization**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Course Outcomes:

1. Implement and demonstrate simple Cloud Applications
2. Apply resource allocation, scheduling algorithms.
3. Implement Map-Reduce concept.
4. Create virtual machines from available physical resources.
5. Setup a private cloud.

Unit 1

Introduction, Cloud Infrastructure Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing.

Unit 2

Cloud Computing: Application Paradigms. Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study on different areas and applications

Unit 3

Cloud Resource Virtualization. Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization.

Unit 4

Cloud Resource Management and Scheduling. Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling

Unit 5

Cloud Security, Cloud Application Development. Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2.

TEXT BOOK:

1. Dan C Marinescu: ***Cloud Computing Theory and Practice***. Elsevier(MK) 2013.

REFERENCE BOOKS:

1. RajkumarBuyya , James Broberg, Andrzej Goscinski: ***Cloud Computing Principles and Paradigms***, Willey 2014.
2. John W Rittinghouse, James F Ransome: ***Cloud Computing Implementation, Management and Security***, CRC Press 2013.

Subject Name & Code	**Underwater Communication**
No. of Teaching Hours –52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

1. Adaptive Signal Processing: Adaptive Systems, Open Loop and Closed loop Adaptations, Adaptive Linear Combiner, Theory of Adaptation with stationary Signals, Adaptive Algorithms and Structures, Applications.

2. Applications of Digital Signal Processing to Sonar: Characteristics of Sonar Signal propagation, Digital signal Processing for active sonar system and digital signal processing for passive sonar systems, Signal Processing Hardware -TMS 320 Series Signal Processors, real-time implementation considerations.

3. Orthogonal Frequency division multiplexing: Key features, characteristics and principle of operation of OFDM, Channel coding and interleaving System model, Enhancement of spectral efficiencies, Transmission/ Reception of OFTD - OFDM Simulations.

4. Acoustic Modem: Underwater Wireless Modem- Sweep spread carrier signal transmission characteristics in shallow water channel-separation of time varying multipath arrivals-Typical acoustics modems-characteristics and specifications Applications, Acoustic Releases-Real time wireless current monitoring system.

5. Underwater Sensor Network: Underwater Networking- Ocean Sampling Networks, Pollution Monitoring, Environmental Monitoring and Tactical surveillance systems, Major challenges in design of Underwater Sensor Networks, Factors that affect the UWSN- Sensor Node Architecture- GIBS, VRAP, DABSRAPT. etc.

References:

1. Digital Spectral Analysis with applications- S. Lawrence Marple Jr. Prentice Hall. Signal Processing Series, 1987.
2. Richard A. Haddad and Thomas W Parsons, "Digital Signal Processing: Theory Applications and Hardware", Computer Science Press, 1991.
3. 'Real time Deepwater Current Profiling Systems', Michael Uogel, etal, Marine Technology Symposium.
4. 'Acoustic Modems' Hydro International, June 2007, www.ece.gatech.edu.
5. 'Underwater Acoustics Sensor Network: Research Challenges: Ian F Akyildizetal, Elsevier, 3 (2005), pp 257-279.
6. 'Data Collection, Storage and Retrieval with an Underwater Sensor Network, Vasilescu, etal, Sensys' 05, Nov. 2-4, 2005, San Diego, CA.

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Subject Name & Code	**Optical and DWDM networks**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

UNIT I OPTICAL SYSTEM COMPONENTS AND NETWORK DESIGN 9 Optical System Components – Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters; Transmission System Engineering – System model, Power penalty - transmitter, receiver, Optical amplifiers, crosstalk, dispersion; Wavelength stabilization; Overall design considerations.

UNIT II OPTICAL NETWORK ARCHITECTURES 9 Introduction to Optical Networks; SONET / SDH, Metropoliton-Area Networks, Layered Architecture ; Broadcast and Select Networks – Topologies, Media-Access Control Protocols and Testbeds; Wavelength Routing Architecture.

UNIT III WAVELENGTH ROUTING NETWORKS WDM Network Elements; WDM Network Design - Cost tradeoffs, Virtual Topology Design, Routing and wavelength assignment, Statistical Dimensioning Models.

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9 Photonic Packet Switching – OTDM, Multiplexing and De-multiplexing, Synchronisation, Header Processing, Buffering, Burst Switching, Testbeds; Access Networks.

UNIT V NETWORK MANAGEMENT AND SURVIVABILITY Control and Management – Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface; network Survivability- Protection in SONET / SDH and IP Networks, Optical layer Protection, Interworking between layers.

REFERENCES:

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks : A Practical. Perspective”, Elsivier Third Edition 2010.

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

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

5. Biswanath Mukherjee, “Optical WDM Networks”, Springer, 2006

Subject Name & Code	Mobile Computing 17LNI210
No. of Teaching Hours – 52	Credits : 4:1:0 L-T-P
CIE Marks: 50	SEE: 100

Course Outcomes:

After studying this subject student will be able to:

1. Acquire and demonstrate a knowledge of mobile computing principles, architecture and applications of different Operating systems used in mobile systems
2. Analyse and compare various mobile devices and mobile computing technologies based on principles and applications
3. Apply critical thinking to the working of mobile networksand make a comparative study, selecting performance metrics.
4. Use software tools in mobile computing, demonstrate problem solving ability and draw proper inferences
5. Work in groups or as an individual to complete the assigned task and exhibit effective oral and written communication skills

Syllabus:

Unit-1 Introduction to mobile computing, Cellular systems, 1G, 2G, 3G, 4G & 5G, GSM, architecture, Hand off, network signaling, SS7 Signaling **10 Hours**

Unit-2 Challenges in mobile computing, Operating systems for mobile applications, Android, iOS, WinCE, Symbian and Palm. **10 Hours**

Unit-3 Mobile devices, PDA, CDPD, Smart phones, GPRS, VOIP, Mobile IP,Ipv6, WLL

10 Hours

Unit-4 WAP, Client software, hardware,Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs. **10 Hours**

Unit-5 Tools, WML, XML , Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME. **10 hours**

SLE component: Materials/Advanced topics from journals and papers.

Text Books:

1. **John Schiller**,"MobileCommunications",Addison-Wiley second edition, 2008.

2. **Stojmenovic and Cacute,** "Handbook of Wireless Networks and Mobile Computing", Wiley, 2009, ISBN 0471419028.

3. **Yi-Bang Lin,** "Wireless and Mobile Network Architectures", Wiley India,2012ed

Reference Books:

1. **Reza Behravanfar**, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", ISBN: 0521817331, Cambridge University Press, October 2008,

2**. Adelstein, Frank, Gupta, Sandeep KS, Richard III, Golden ,Schwiebert, Loren**, "Fundamentals of Mobile and Pervasive Computing", ISBN: 0071412379, McGraw-Hill Professional, 2009.

3. **Hansmann, Merk, Nicklous, Stober**, "Principles of Mobile Computing", Springer, second edition, 2010.

4. **Martyn Mallick**, "Mobile and Wireless Design Essentials", Wiley DreamTech, 2009.

Subject Name & Code	**Protocol Engineering** 17LNI220
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Course Outcomes:

Students will be able to

1. Explain the fundamental concepts of communication protocol, its architecture, operations and design.
2. Verify protocol testing, error testing procedures using different techniques and tools
3. Design and simulate simple protocols using formal and informal approaches.
4. Demonstrate the knowledge of developing simple protocols, their testing and writing test cases keeping abreast of industry preferences.
5. Demonstrate an ability to work individually or in a team to carry out assigned tasks, by leveraging recent open source tools, adhering to standard practices and ethics; Communicate effectively in oral and verbal methods.

Unit :1

Introduction to communication protocols, software, subsystems development methods, protocol engineering process, reference models, services and interfaces protocols at various layers

Unit :2

Protocol specifications: components of protocol, service specifications, entity specifications interface and interactions, examples(HDLC,ABP, RSVP etc)

Unit :3

SDL: Features, communication system using SDL, examples of SDL based protocol specifications, other specification languages(LOTUS, UML etc.) protocol verifiation, validation design errors, validation approaches, examples

Unit :4

Conformance testing, framework, conformance test architectures, test sequence generation methods, TTCN framework, examples

Unit :5

Protocol testing: Types, performance testing, Interoperability testing, scalability testing. Protocol synthesis, protocol implementation requirements and methods. Advanced topics and new research outcomes

References:

1. **PalappaVenkataram and Sunilkumar S Manvi**; Communication protocol engineering, PHI publishers

2. IEEE Journals/ papers

Department of Electronics and Communication Engineering, SJCE, Mysuru

Subject Name & Code	**WEB SERVICES 17LNI 230**
No. of Teaching Hours – 52	**Credits : 4:0:1 L-T-P**
CIE Marks: 50	**SEE: 100**

Course outcomes:

Students will be able to

Explain with clarity concepts of webbased services, architectures, protocols, functionalities with full range of technologies that support service oriented approaches.

Design, develop and demonstrate various JAVA based web applications using different design tools.

Design and implement registration and recovery techniques for web services from a business perspective.

Evaluate recent techniques , tools and standards for web service architecture

Demonstrate an ability to implement a group task and document it for effective communication by following standard practices and methods adhering to ethics.

Syllabus:

Unit 1:Introduction

Web Services Overview: What Are Web Services? History Web Services Technology, Other Concerns, Java and Web Services, Application Scenarios, Implementation Scenarios, Benefits of Web Services, A Word about Standards, Service-Oriented Architecture, SOA Entities, SOA Characteristics, Component-Based Service Development, Development Lifecycle, Design, Verification and Validation, Maintenance

Unit 2: Technologies

SOAP, The Case for SOAP, What Does SOAP Define? SOAP Message Structure, SOAP Message Elements, SOAP Processing Model, SOAP Encoding, WSDL, Describing a Web Service, Describing Functional Characteristics of Services of WSDL, 1.2 UDDI Discovering Web Services, Categorizing Services, Identifiers, Business Entity Relationships, UDDI's SOAP Interfaces, UDDI and SOAP/WSDL Relationships, Publishing WSDL Service Interfaces in UDDI, Internationalization and Multiple Languages, Extending a UDDI Registry, UDDI- Private UDDI Registries, ebXML, Architectural Overview of ebXML, Putting It All Together

Unit 3: Java Web Services

Java Web Service Developer, Pack JAXP, JAXP Architecture, SAX, DOM, When to Use SAX, When to Use DOM, When Not to Use Either JAXP and XML Schemes, XSLT, XSLTc, JDOM, JAXP, RI JAX-RPC, JAX-RPC Service Model, Data Types and Serialization, JAX-RPC Development, Advanced JAX-RPC, JAX-RPC Interoperability, JAX-RPC and J2EE, JAXM Messaging and MOM Messaging and Web Services Messaging in Java, JAXM Architecture, Designing with JAXM, Developing with JAXM, JAXR Registries and Repositories, JAXR Architecture, The JAXR Information Model, The JAXR, API, JAXR to UDDI Mapping, JAXR and ebXML Registry, JAXB, The Need for Binding and JAXB, When to Use JAXB, JAXB Architecture, Developing with JAXB, XML-to-Java Mapping, The JAXBAPI Validation with]AXB Customizing JAXB, When to Use Custom Declarations

Unit 4: Advanced Topics

Transaction Management Concepts, A Transaction Model for Web Services, New Transaction Specifications, JSRs for Web Service Transaction Support Security, Security Considerations for Web Services, Web Services Security Initiatives, Canonical XML, XML Digital Signatures, Apache XML Security, XML Encryption Security Assertions, Markup Language Web Services Security Assertions, XML Access Control Markup Language, XML Key Management

Specification, WS-I Specifications, Java Cryptography Extensions, Implementation Scenarios WEB 2.0

Reference books:

1. James McGovern, Sameer Tyagi, Michael E. Stevens, Sunil Mathew: Java Web Services Architecture, Morgan Kaufmann – 2003
2. Richard Monsol-Haefel: J2EE Web Services, Pearson 2003
3. Steven Graham, Dong Davis,.., Building Web Services with Java, II Edition, Pearson-2005

Department of Electronics and Communication Engineering, SJCE, Mysuru

Subject Name & Code	**Cognitive radio and networks**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Introduction to Software Radio Concepts The need for software radios, what is a software radio, characteristics and benefits of a software radio, Design principles of a software radio

Radio Frequency Implementation Issues The purpose of the RF front-end, Dynamic range: The principal Challenge of receiver design, RF receiver front-end topologies, Enhanced flexibility of the RF chain with software radios, Importance of the components of overall performance, transmitter architectures and their issues, noise and distortion in the RF chain, ADC and DAC distortion

Digital Hardware Choices Introduction, Key Hardware Elements, DSP Processors, FPGA, Tradeoffs in using DSPs FPGAs and ASICs, Power Management Issues , Combinations of DSPs , FPGAs and ASICs

INTRODUCTION TO COGNITIVE RADIOS: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio

SIGNAL PROCESING - SPECTRUM: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time

DYNAMIC SPECTRUM ACCESS AND MANAGEMENT: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

References:

1. Software Radio: A Modern Approach to Radio Engineering By Jeffrey H. Reed Pearson Education Low Price Edition
2. Dynamic Spectrum Access and Management in Cognitive Radio Networks, Ekram Hossain, Dusit Niyato, Zhu Han, Cambridge University Press.
3. Cognitive radio networks, Kwang-Cheng Chen, Ramjee Prasad, John Wiley & Sons Ltd.
4. Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Huseyin Arslan, Springer.

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Subject Name & Code	**Ubiquitous Computing**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Concept of Distributed Computing, Mobile Computing, Pervasive Computing, Wearable Computing, Modeling the Key Ubiquitous/Pervasive Computing Properties Mobile Adaptive Computing, Mobility Management and Caching

Smart Environment : CPI and CCI (Smart Devices : Application and Requirements Device Technology and Connectivity Human Computer Interaction)

Explicit HCI, Implicit HCI, User Interface and Interaction for four hand-held widely used devices, Hidden UI via basic smart devices, Hidden UI via wearable and Implanted devices, Human centered design, user models

Adaptive middleware, Context aware middleware, Mobile middleware, Service Discovery, Mobile Agents

Security and Privacy in Pervasive Networks, Experimental Comparison of Collaborative Defense Strategies for Network Security

Overview of challenges, smart devices, Smart Interaction, Smart physical environment device interaction, Smart human-device interaction, Human Intelligence versus machine intelligence, social issues.

Case Study- Wearable Computing/ Cyber Physical System

References:

1. Stefan Poslad, Ubiquitous Computing, Smart devices, environment and interaction, Wiley
2. Frank Adelstein, Sandeep Gupta, Golden Richard III, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing, Tata McGraw Hills

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Subject Name & Code	**Networking Laboratory-II**
No. of Teaching Hours – 52	**Credits : 0:0:1.5 L-T-P**
CIE Marks: 50	**SEE: 100**

Course outcomes:

Upon completion of this course, student should be able to:

1. Verify practically the importance and significance of Protocols and protocol stack
2. Apply the concepts of Mobile computing and sensor networks in simulation exercises
3. Apply and analyse various scenarios in EXATA emulator related to cellular networks,
4. Apply and test several network configuration scenarios using NS3 simulators
5. Develop and demonstrate issues related to web services.

Experiments and Exercises:

1. Exercises on Protocol design and testing
2. Exercises on simulation using EXATA making use of cellular library
3. Exercises on simulation using EXATA making use of sensor network library
4. Introduction and familiarization to NS3 based simulations
5. Development and testing of scenarios for web services applications
6. Hands on working of mobile computing operating systems
7. Exercises related to Open-flow Switches.

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Subject Name & Code	**5G Technologies**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

5G Technologies

Objectives: (Contents to be finalized)

Multi-User and Massive MIMO are cutting edge technologies for future 5G wireless networks. The large number of antennas in a Massive MIMO system significantly enhances the throughput of current wireless systems. Further, multi-user MIMO enables supporting a large number of users. Other features of Massive MIMO include simplified user scheduling due to channel hardening, leading to improved spectral efficiency and also resilience to intended/ unintended jamming, which enhances security of the link. However, the challenges in realizing this technology are immense. It requires the development of low cost RF chains for the large number of antennas, low complexity algorithms for optimal decoding of the received symbol vectors, and also efficient schemes for channel estimation, feedback and precoding for large scale MIMO systems. Further, the problem of pilot contamination arising from pilot reuse due to the extremely large number of users supported by Massive MIMO systems can also lead to a significant degradation of the quality of the channel estimate, which subsequently affects the decoding performance.

Theory behind Multi-User and Massive MIMO such as precoding, channel hardening, capacity, spatial modulation, low complexity decoding, pilot contamination etc..

MATLAB module to introduce the the practical implementation and simulation aspects of such systems, especially from the perspective of conducting research in Massive MIMO.

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Subject Name & Code	**Photonic systems and technologies**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

1. **Photonic sources:** LEDs and laser diodes, Laser physics and operation. Characteristics of laser light, Laser technology. Spectral distribution. Coherence
2. **Modulation:** Optical signal generation, Electro-optic effect, phase and intensity modulation, modulation formats, bit stream generation.
3. **Signal propagation:** Propagation of a Gaussian pulse, impact of dispersion and management, impact of losses. Medium induced distortions
4. **Amplification:** Doped fiber optical amplifiers, fiber Raman amplifiers, semiconductor optical amplifiers. Gain and rate equations, noise.
5. **Signal recovery:** Photo detectors and photonic receivers, noise sources, sensitivity, bit error rate.
6. **Nonlinear effects:** Self-phase and cross phase modulation, solitons, four wave mixing, scattering processes.
7. **Multichannel systems:** WDM systems and components, OTDM.

References:

1. Nishihara: Integrated optics
2. Govind P Agarwal: Non linear fiber optics
3. BEA Saleh: Photonics

LIST OF OPEN ELECTIVE COURSES

Students from any specialization have to register for ONE course in the even semester among these courses depending on which course is offered by the department

Course Code	Course Title	Credit pattern
17PGOL1	IOT	4:1:0
17PGOL2	Solar Energy Systems	4:1:0
17PGOL3	Machine learning	4:1:0
17PGOL4	Six Sigma and manufacturing	4:1:0
17PGOL5	Heuristics for optimization	4:1:0
17PGOL6	Organizational Behavior and Financial Management	4:1:0
17PGOL7	Deep learning	4:1:0
17PGOL8	MEMS	4:1:0
17PGOL9	Artificial Neural Networks	4:1:0

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Subject Name & Code	**Internet of Things 17PGOLI**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Course Outcomes:

1. Able to identify the basic concepts, enabling technologies, possibilities and applications of IOT from a present and a futuristic view point
2. Demonstrate the requirements and configurations for sensor technology and data acquisition in IOT
3. Able to explain and analyse the routing protocols suitable for IOT
4. Demonstrate working knowledge related to enabling technologies like WSN, Web service and cloud.
5. Demonstrate comprehensive understanding about applications, test bed scenarios related to IOT, based on group task, seminars etc.,

UNIT 1

Introduction: The definition of the Internet of Things, main assumptions and perspectives.. Platform for IoT devices: Device architectures.- Conventional and renewable power sources for resource-constrained devices.- Operating systems for resource-constrained devices.

UNIT 2

The data link layer for IoT: -Wireless communication technologies. - Wire communication technologies. MANET Networks.

UNIT 3

The network layer for IoT- LowPAN adaptation layer for devices with limited resources. - Dynamic routing protocols for wireless ad-hoc network.. Communication protocols for IoT

Service oriented protocols (COAP).-Communication protocols based on the exchange of messages (MQTT).• Service discovery protocols.

UNIT 4

The data processing for IoT - Organization of data processing for the Internet of things. - Cloud computing.-Fog computing.

UNIT 5

Applications - Smart Grid. Home Automation. Smart City. Case studies, test beds

References:

1. John Holler et all: From M2M to IOT
2. Oliver : Hersent: IOT applications and protocols. Wiley student edition
3. Intel Galileo, http://www.intel-software-academic-program.com/pages/courses#diy
4. Moduł Copernicus, http://galaxy.agh.edu.pl/~tszydlo/copernicus/
5. Jean-Philippe Vasseur and Adam Dunkels. Interconnecting Smart Objects with IP – The Next Internet, Morgan Kaufmann, 2010.
6. Zach Shelby, Carsten Bormann, 6LoWPAN: The Wireless Embedded Internet, Willey 2009

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Subject Name & Code	**Solar Energy Systems 17PGOL2**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

UNIT I

ENERGY RESOURCES AND SOLAR SPECTRUM World energy resources - Indian energy scenario - Environmental aspects of energy utilization. Renewable energy resources and their importance - Global solar resources. Solar spectrum – Electromagnetic spectrum, basic laws of radiation. Physics of the Sun - Energy balance of the Earth, energy flux, solar constant for Earth, green house effect

UNIT 2

SOLAR RADIATION AND MEASUREMENT Solar radiation on the earth surface - Extraterrestrial radiation characteristics, Terrestrial radiation, solar isolation, spectral energy distribution of solar radiation. Depletion of solar radiation - Absorption, scattering. Beam radiation, diffuse and Global radiation. Measurement of solar radiation – Pyranometer, pyrheliometer, Sunshine recorder. Solar time - Local apparent time (LAT), equation of time (E).

UNIT 3

SOLAR RADIATION GEOMETRY AND CALCULATIONS (15 hours) Solar radiation geometry - Earth-Sun angles – Solar angles. Calculation of angle of incidence - Surface facing due south, horizontal, inclined surface and vertical surface. Solar day length – Sun path diagram – Shadow determination. Estimation of Sunshine hours at different places in India. Calculation of total solar radiation on horizontal and tilted surfaces. Prediction of solar radiation availability.

UNIT 4

SOLAR THERMAL ENERGY CONVERSION Thermodynamic cycles – Carnot – Organic, reheat, regeneration and supercritical Rankine cycles - Brayton cycle – Stirling cycle – Binary cycles – Combined cycles. Solar thermal power plants - Parabolic trough system, distributed collector, hybrid solar-gas power plants, solar pond based electricpower plant, central tower receiver power plant.

UNIT 5

SOLAR ELECTRICAL ENERGY CONVERSION Solar photovoltaic energy conversion - Principles - Physics and operation of solar cells. Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants.

REFERENCES

1. Foster R., Ghassemi M., Cota A., "Solar Energy", CRC Press, 2010.

2. Duffie J.A., Beckman W.A. "Solar Engineering of Thermal Processes", 3rd ed., Wiley, 2006.

3. De Vos, A., "Thermodynamics of Solar Energy Conversion", WileyVCH, 2008.

4. Garg H.P., Prakash J., "Solar Energy Fundamentals and Applications", Tata McGraw-Hill, 2005.

5. Kalogirou S., "Solar Energy Engineering", Processes and Systems, Elsevier, 2009.

6. Petela, R., "Engineering Thermodynamics of Thermal Radiation for Solar Power", McGraw-Hill Co., 2010

Subject Name & Code	**Machine learning 17PGOL3**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

1. Introductory Topics, Linear Regression and Feature Selection ,. Linear Classification
2. Support Vector Machines and Artificial Neural Networks
3. Bayesian Learning and Decision Trees,. Evaluation Measures
4. Hypothesis Testing,. Ensemble Methods
5. Clustering. Graphical Models
6. Learning Theory and Expectation Maximization

References:

1. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2008.

2. Christopher Bishop.Pattern Recognition and Machine Learning. 2e.

Subject Name & Code	**Six Sigma Manufacturing 17PGOL4**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Course outcomes:

Upon the completion of this course student should be able to:

1. Understand systematic method for achieving quality in product development and manufacturing with fundamentals of six sigma.
2. Design for six sigma towards product development.
3. Approach towards design for x by using algorithms.
4. Apply the tools and best practices for design development, optimization and verifying capability.
5. Revealing industry insider case studies.

UNIT 1

Quality concepts: What is quality? Quality assurance and product or service life cycle, development of quality methods. Six sigma fundamentals, what is six sigma? process, process mapping, process capability and six sigma, overview of six sigma process improvement and design for six sigma.

10 Hrs

UNIT 2

Design for six sigma: What is six sigma theory? Why design for six sigma; phases of six sigma, difference between six sigma and design for six sigma (DFSS). Problems solved by DFSS, DFSS company and strategy. Design for six sigma project algorithm: Introduction, form of synergistic design team, determine customer expectations, understand functions required, evolution, generate concepts, select best concept, finalize the physical structure of selected concept, initiate design scoreboards and transfer function development, assess risk, transfer function

optimization, design for x, prototyping design, validate design, launch mass production, project risk management. **10 Hrs**

UNIT 3

Design for x: Introduction, design for manufacturing and assembly (DFMA), design for reliability (DFR), Design for manufacturability, design for serviceability, design for environmentality, design for life cycle cost (LCC).

08 Hrs

UNIT 4

Failure mode-effect analysis: Introduction, FMEA fundamentals, development of FMEA, process FMEA, quality system and control plans. Reliability prediction, introduction to descriptive and inferential statistics, measurement systems analysis, multi-vari studies, regression, Taguchi method for robust design, response surface methods, optimization methods, analytical and empirical tolerance design, reliability evaluation, statistical process control, linking design to operations. **12 Hrs**

UNIT 5

Self learning: Case studies on six sigma for technology and product development, Lean six sigma in services and manufacturing applications and case studies.

10 Hrs

Text Books:

1. Kai Yang, Basem El-Haik, ***"Design for Six Sigma: A Road Map for Product Development",*** Tata McGraw Hill, 2003.
2. C.M. Creveloing, J.L. Slutsky, D. Antis, Jr., ***"Design for Six Sigma: In Technology and Product Development",*** Pearson Education 2003, Second impression 2008.

Reference Books:

1. Peter S. Pande, Robert P. Neuman, Roland R. Cavanagh, ***"The Six Sigma Way: How GE, Motorala, and Other Companies are Honing their Performance",*** Tata McGraw Hill, 2000.

2. Sandra F. Furterer, ***"Lean Six Sigma in Services Applications and Case Studies",*** CRC Press, Taylor Francis Group 2009.
3. Peter S. Pande, Robert P. Neuman, Roland R. Cavanagh, K. ***"The Six sigma Way: Team Field Book",*** Tata McGraw Hill, 2003.
4. Joseph. A. De Fero, William Co Barnard, ***"Juran Institute's: Six Sigma Breakthrough and Beyond",*** Tata McGraw Hill, 2000

Subject Name & Code	**Heuristics for Optimization 17PGOL5**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Introduction to evolutionary computation: Biological and artificial evolution, Evolutionary computation and AI, different historical branches of EC. Genetic Algorithms: Coding, Search operators, Selection schemes, Applications.

Simulated Annealing: Theoretical Approaches, Parallelization, Applications.

Tabu Search: Neighborhood, Candidate list, Short term and Long term memory, Applications

Ant Colony Algorithms: Overview, Basic algorithm, Variants, Formalization and properties of ant colony optimization, Applications.

Multi objective evolutionary optimization: Pareto optimality, Multiobjective evolutionary algorithms.

References:

1.Baeck T, Fogel D B & Michalewicz Z -Handbook on Evolutionary Computation- IOP Press

2.Michalewicz Z-Genetic Algorithms + Data Structures = Evolution Programms- Springer-Verlag,Berlin

3.Goldberg D E-Genetic Algorithms in Search, Optimization & Machine Learning- Addisson Wesley

4.Banzhaf W,Nordin P,Keller et al.-Genetic Programming :An Introduction- Morgan Kaufmann

5.Tabu Search-Fred Glover

Subject Name & Code	**Organizational Behavior and** **Financial Management 17PGOL6**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE: 100**

Unit – 1

Introduction: Meaning-Definitions and scope of organizational behaviour-people- Organizational structure-technology and environment-OB as a Behavioral science- Foundations of Individual Behavior: Biological Characteristics-Age-Sex-Marital Status-Number of Dependents-Tenure-Ability-Intellectual Abilities- Physical Abilities-The Ability-Job fit personality-personality determinants-Personality Traits-Major Personality Attributes influencing OB-Matching personality and Jobs-learning –Theories of learning shaping-Values, attitudes, and Job satisfaction: Importance of Values-Sources of Value system-Sources and types of Attitudes-

Unit- 2

Motivation: The concept of Motivation-Early Theories of Motivation-Hierarchy of Needs theory-theory X and Theory Y-Hygiene theory-contemporary theories of motivation-ERG Theory-three needs theory-cognitive evaluation theory.

Unit-3

Foundation of group behavior: Defining and classifying groups-group process-group tasks-cohesive groups-group dynamics-leadership-nature and importance-functions-styles-communications-nature and types-effective communication-Roles of Formal and informal

communication-Conflict management-The process of conflict-types of conflict-functional and dysfunctional conflict-resolution of conflict.

Unit-4

Financial management- Meaning, Scope, and functions – Financial Planning – Financial analysis- Financial Control - Objectives-Profit Maximization and Wealth Maximization, their social implications. Sources of capital, types of capital.

Unit-5

Working Capital Management & capital structure decision : Meaning – concept- determinants of working capital, Determination of optimal investment in working capital, Capital structure theories-NI, NOI, traditional and M-M theories; EBIT -EPS Analysis

Subject Name & Code	Deep Learning 17PGOL7
No. of Teaching Hours – 52	Credits : 4:1:0 L-T-P
CIE Marks: 50	SEE Marks: 100

Syllabus

Deep Networks Regularization & optimization

Feed forward networks- Gradient based learning, hidden units, backpropagation. Regularization –parameter norm, Dataset augmentation, Noise robustness, semi-supervised learning, multitask learning, early stopping, sparse representation, bagging, ensemble, dropout, manifold learning. Optimization for training deep models- challenges in neural network optimization, adaptive learning rates, and optimization strategies. **10 hours**

Convolution networks

Convolution network, pooling, structured output, data types, efficient convolution algorithm, randomized and unsupervised features, Recurrent and recursive networks- unfold computation graphs, recurrent neural networks, encoder-decoder, deep recurrent network, recursive neural network, echo state network, optimization, and challenges. Practical methodology and its application- performance metrics, selecting hyper parameters. Some application of deep learning like computer vision, speech recognition. **10 hours**

Linear factor models

Probabilistic PCA and factor analysis, independent component analysis, slow feature analysis, sparse coding, and manifold interpretation of PCA. Auto encoders- auto encoders, regularized auto encoders, stochastic auto encoder- decoder, learning manifold with auto encoder, predictive sparse decomposition. **10 hours**

Representation learning

Greedy unsupervised pre-training, transfer learning, distribution representation, exponential gain, providing clues for underlying causes. Structured probabilistic model for deep learning – challenges of unstructured modeling, using graph to describe unstructured model, sampling from graphical models, learning about dependencies, deep learning approach towards structured probabilistic model. Monte carlo methods- sampling monte- carlo methods, importance sampling, markov chain montecarlo methods, gibbs sampling. **10 hours**

Deep generative models

Boltzmann machine, restricted Boltzmann machine, deep belief networks, Boltzmann machine for real valued data, convolutional Boltzmann machine, other Boltzmann machine, back propogation through random operations, directed generative methods, generative stochastic methods, evaluating generative methods. **10 hours**

Text Books:

1. Deep learning - Ian Goodfellow and YoshuaBengio and Aaron Courville, MIT press, Cambridge, Massachusetts, London, ,2016

Reference Books:

1. Fundamentals of Deep Learning: Nikhil Buduma, Nicholas Locascio,O'Reilly media ,2017
2. Deep Learning: Methods and Applications, Li Deng & Dong Yu, 2014.
3. Grokking Deep Learning– Andrew W trask, 2016

Subject Name & Code	**MEMS 17PGOL8**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

UNIT I

INTRODUCTION Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators –Introduction to Microfabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II

SENSORS AND ACTUATORS-I

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor –

Comb drive devices – Thermal Sensing and Actuation – Thermal expansion – Thermal couples –

Thermal resistors – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators.

UNIT III

SENSORS AND ACTUATORS-II

Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors

and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV

MICROMACHINING Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching –Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies -

Basic surface micromachining processes – Structural and Sacrificial Materials – Acceleration of

sacrificial Etch – Striction and Antistriction methods – Assembly of 3D MEMS – Foundry process.

UNIT V

POLYMER AND OPTICAL MEMS Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene –Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS –Lenses and Mirrors – Actuators for Active Optical MEMS.

TEXT BOOK:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2006.

REFERENCES:

1. Nadim Maluf, " An introduction to Micro electro mechanical system design", Artech

House, 2000.

2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2000

3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill,

New Delhi, 2002.

4. Julian w. Gardner, Vijay k. varadan, Osama O.Awadelkarim,micro sensors mems and smart devices, John Wiley & son LTD,2002

5. James J.Allen, micro electro mechanical system design, CRC Press published in 2005

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Subject Name & Code	**Artificial Neural Networks 17PGOL9**
No. of Teaching Hours – 52	**Credits : 4:1:0 L-T-P**
CIE Marks: 50	**SEE Marks: 100**

Introduction, history, structure and function of single neuron, neural net architectures, neural learning, use of neural networks

Supervised learning, single layer networks, perceptrons, linear separability, perceptron training algorithm,guarantees of success, modifications.

Multiclass networks-I, multilevel discrimination, back propagation, setting parameter values, theoretical results

Accelerating learning process, application, Madaline adaptive multilayer networks.

Prediction networks, radial basis functions, polynomial networks, regularization, unsupervised learning, winner-take-all networks

Learning vector quantizing Learning vector quantizing, counter propagation networks, adaptive resonance theorem, toplogically organized networks, distance based learning, recognition.

Associative models, Hop Field networks, brain state networks, Boltzmann machines, hetero associations

Optimization using Hopfiled networks

Optimization using Hopfiled networks, simulated annealing, random search, evolutionary computation.

Books to be finalized with CS deprtment.