GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)

Coimbatore – 641 013

Curriculum and Syllabi For

M.E. (COMPUTER SCIENCE AND ENGINEERING)

(Full Time)

2018

Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS

GOVERNMENT COLLEGE OF TECHNOLOGY

THADAGAM ROAD, COIMBATORE – 641 013

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VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a centre of excellence and eminence by imparting futuristic technical education in keeping with global standards, making our students technologically competent and ethically strong so that they can readily contribute to the rapid advancement of society and mankind.

MISSION

- To achieve academic excellence through innovative teaching and learning practices.
- To enhance employability and entrepreneurship
- To improve the research competence to address societal needs
- To inculcate a culture that supports and reinforces ethical, professional behaviours for a harmonious and prosperous society

VISION AND MISSION OF THE DEPARTMENT

VISION

To be in the frontier of Computer Science and Engineering and to produce globally competent graduates with moral values committed to build a vibrant nation.

MISSION

- To strengthen the core competence in Computer Science and Engineering through analytical learning.
- To produce successful graduates with personal and professional responsibilities and commitment to lifelong learning.
- To uplift innovative research in Computer Science and Engineering to serve the needs of Industry, Government and Society.

PROGRAMME EDUCATIONAL OBJECTIVES

The Programme Educational Objectives of M.E. Computer Science and Engineering programme are:

PEO1: Graduates will be employed in computing profession as experts in providing solutions to complex design problems by their depth of knowledge in advanced computing.

PEO2: Graduates with an aptitude in lifelong research will be either pursuing or completed doctoral programme and engaged in advanced research and development

PEO 3: Graduates will be able to apply critical, lateral thinking and use reflective learning to analyze, conceptualize and evaluate the potential solutions for conducting theoretical and practical research.

PEO4: Demonstrate Ethical and intellectual integrity in their professional practices

PROGRAMME OUTCOMES

Students of M.E. Computer Science and Engineering Programme at the time of graduation will be able to:

PO1: Exhibit higher order knowledge formation with wider and global perspective on Computer Science and Engineering.

PO2: Apply critical thinking to analyze, improve, create, evaluate and improve information for the conduct of research in Computer Science and Engineering.

PO3: Create and conceptualize optimal solutions for Computer Engineering and IT Problems by lateral thinking with awareness of public health safety, culture, society and environmental factors.

PO4: Perform exhaustive survey to familiarize with problems and rightly mix research methodologies and tools to design and conduct experiments for the development of scientific/technological knowledge.

PO5: Select, create if needed, and apply with the knowledge of limitations, the state of the art techniques and IT tools for complex engineering problems.

PO6: Recognize and use opportunities to contribute positively for collaborative-multi disciplinary scientific research to achieve common goals.

PO7: Practice engineering and management principles including economical and financial factors.

PO8: Communicate effectively and confidently.

PO9: Engage in lifelong learning to improve knowledge and competence.

PO10: Practice code of ethics in professional accomplishments and research for sustainable societal development.

PO11: Learn by observation and examination of the outcomes achieved, including mistakes, without external feedback

CURRICULUM FOR CANDIDATES ADMITTED DURING 2018-2019 AND ONWARDS

TWO YEAR M.E PROGRAMME

COMPUTER SCIENCE AND ENGINEERING

CHOICE BASED CREDIT SYSTEM-CURRICULUM

FIRST SEMESTER

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
Theory											
1	18CSFCZ1	Research Methodology and IPR	FC	50	50	100	3	3	0	0	3
2	18CSFC02	Mathematical Foundations of Computer Science	FC	50	50	100	4	3	1	0	4
3	18CSPC01	Formal Languages, Machines and Computations	PC	50	50	100	4	3	1	0	4
4	18CSPC02	High Performance Computer Architecture	PC	50	50	100	4	2	0	2	3
5	18CSPC03	Algorithms and Complexity Analysis	PC	50	50	100	3	3	0	0	3
6	18CSPEXX	Professional Elective I	PE	50	50	100	3	3	0	0	3
7	18CSACXX	Audit Course I	AC	50	50	100	2	2*	0	0	0
Practical											
8	18CSPC04	Advanced Algorithms and Elective Lab	PC	50	50	100	3	0	0	3	1.5
Total				**400**	**400**	**800**	**26**	**19**	**2**	**5**	**21.5**

SECOND SEMESTER

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
Theory											
1	18CSPC05	Advanced Database Systems	PC	50	50	100	4	2	0	2	3
2	18CSPC06	Network Science	PC	50	50	100	3	3	0	0	3
3	18CSPC07	Advances in Operating Systems	PC	50	50	100	4	2	0	2	3
4	18CSPEXX	Professional Elective II	PE	50	50	100	3	3	0	0	3
5	18CSPEXX	Professional Elective III	PE	50	50	100	3	3	0	0	3
6	18CSACXX	Audit Course II	AC	50	50	100	2	2*	0	0	0
Practical											
7	18CSEE01	Mini Project with Seminar	EEC	100	-	100	3	1	0	2	2
8	18CSPC08	Advanced Computer Networks and Electives Lab	PC	50	50	100	3	0	0	3	1.5
Total				**450**	**350**	**800**	**25**	**16**	**0**	**9**	**18.5**

THIRD SEMESTER

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
Theory											
1	18CSPEXX	Professional Elective IV	PE	50	50	100	3	3	0	0	3
2	18$OEXX	Open Elective	OE	50	50	100	3	3	0	0	3
Practical											
3	18CSEE02	Project Phase I	EEC	100	100	200	20	0	0	20	10
Total				**200**	**200**	**400**	**26**	**6**	**0**	**20**	**16**

FOURTH SEMESTER

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
Practical											
1	18CSEE03	Project Phase II	EEC	200	200	400	32	0	0	32	16
Total				**200**	**200**	**400**	**32**	**0**	**0**	**32**	**16**

TOTAL CREDITS: 72

NOTE : * - No Credit Courses.

LIST OF PROFESSIONAL ELECTIVES											
S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
LIST OF PROFESSIONAL ELECTIVES - I											
S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
1	18CSPE01	Computer Vision Engineering	PE	50	50	100	3	3	0	0	3
2	18CSPE02	Pattern Recognition	PE	50	50	100	3	3	0	0	3
3	18CSPE03	Digital Image Processing	PE	50	50	100	3	3	0	0	3
4	18CSPE04	Embedded Systems	PE	50	50	100	3	3	0	0	3
5	18CSPE05	Virtual Reality	PE	50	50	100	3	3	0	0	3
6	18CSPE06	Advanced Microcontrollers and Applications in Embedded systems	PE	50	50	100	3	3	0	0	3
7	18CSPE07	Virtualization Techniques	PE	50	50	100	3	3	0	0	3
LIST OF PROFESSIONAL ELECTIVES - II											
S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
8	18CSPE08	Soft Computing	PE	50	50	100	3	3	0	0	3
9	18CSPE09	Machine Learning	PE	50	50	100	3	3	0	0	3
10	18CSPE10	Parallel Algorithms	PE	50	50	100	3	3	0	0	3
11	18CSPE11	Fuzzy Logic and Neural Networks	PE	50	50	100	3	3	0	0	3
12	18CSPE12	Network Optimization Techniques	PE	50	50	100	3	3	0	0	3
13	18CSPE13	Theory of Modern Compilers	PE	50	50	100	3	3	0	0	3
14	18CSPE14	Distributed Network Algorithms	PE	50	50	100	3	3	0	0	3
LIST OF PROFESSIONAL ELECTIVES - III											
S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
15	18CSPE15	Internet of Things	PE	50	50	100	3	3	0	0	3

16	18CSPE16	Wireless Sensor Networks	PE	50	50	100	3	3	0	0	3
17	18CSPE17	Pervasive Computing	PE	50	50	100	3	3	0	0	3
18	18CSPE18	Software Defined Networking	PE	50	50	100	3	3	0	0	3
19	18CSPE19	Information Retrieval	PE	50	50	100	3	3	0	0	3
20	18CSPE20	Social Networks	PE	50	50	100	3	3	0	0	3

LIST OF PROFESSIONAL ELECTIVES - IV

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
21	18CSPE21	Cyber Forensics	PE	50	50	100	3	3	0	0	3
22	18CSPE22	Cloud Computing	PE	50	50	100	3	3	0	0	3
23	18CSPE23	Cryptography and Network Security	PE	50	50	100	3	3	0	0	3
24	18CSPE24	Theory and Applications of Ontology	PE	50	50	100	3	3	0	0	3
25	18CSPE25	Mining Massive Datasets	PE	50	50	100	3	3	0	0	3
26	18CSPE26	Advanced Software Engineering	PE	50	50	100	3	3	0	0	3
27	18CSPE27	Robotics process automation	PE	50	50	100	3	3	0	0	3

LIST OF OPEN ELECTIVES

SL.No	Course code	Course name	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contacts Periods	CREDITS			
								L	T	P	C
1	18SEOE01	Vastu Science For Building Construction	OE	50	50	100	3	3	0	0	3
2	18SEOE02	Planning of Smart Cities	OE	50	50	100	3	3	0	0	3
3	18SEOE03	Green Building	OE	50	50	100	3	3	0	0	3
4	18EEOE04	Environment, Health and Safety in Industries	OE	50	50	100	3	3	0	0	3
5	18EEOE05	Climate Change and Adaptation	OE	50	50	100	3	3	0	0	3
6	18EEOE06	Waste to Energy	OE	50	50	100	3	3	0	0	3
7	18GEOE07	Energy in built Environment	OE	50	50	100	3	3	0	0	3
8	18GEOE08	Earth and its environment	OE	50	50	100	3	3	0	0	3
9	18GEOE09	Natural hazards and mitigation	OE	50	50	100	3	3	0	0	3
10	18EDOE10	Business Analytics	OE	50	50	100	3	3	0	0	3
11	18EDOE11	Cost Management of Engineering Projects	OE	50	50	100	3	3	0	0	3
12	18EDOE12	Introduction to Industrial Engineering	OE	50	50	100	3	3	0	0	3
13	18MFOE13	Industrial Safety	OE	50	50	100	3	3	0	0	3
14	18MFOE14	Operations Research	OE	50	50	100	3	3	0	0	3
15	18MFOE15	Composite Materials	OE	50	50	100	3	3	0	0	3
16	18TEOE16	Global Warming Science	OE	50	50	100	3	3	0	0	3
17	18TEOE17	Introduction to Nano Electronics	OE	50	50	100	3	3	0	0	3

18	18TEOE18	Green Supply Chain Management	OE	50	50	100	3	3	0	0	3
19	18PSOE19	Distribution Automation System	OE	50	50	100	3	3	0	0	3
20	18PSOE20	Power Quality Assessment And Mitigation	OE	50	50	100	3	3	0	0	3
21	18PSOE21	Modern Automotive Systems	OE	50	50	100	3	3	0	0	3
22	18PEOE22	Virtual Instrumentation	OE	50	50	100	3	3	0	0	3
23	18PEOE23	Energy Auditing	OE	50	50	100	3	3	0	0	3
24	18PEOE24	Advanced Energy Storage Technology	OE	50	50	100	3	3	0	0	3
25	18AEOE25	Design of Digital Systems	OE	50	50	100	3	3	0	0	3
26	18AEOE26	Advanced Processors	OE	50	50	100	3	3	0	0	3
27	18AEOE27	Pattern Recognition	OE	50	50	100	3	3	0	0	3
28	18VLOE28	VLSI Design	OE	50	50	100	3	3	0	0	3
29	18VLOE29	Analog & Mixed Mode VLSI Circuits	OE	50	50	100	3	3	0	0	3
30	18VLOE30	Hardware Description Languages	OE	50	50	100	3	3	0	0	3
31	18CSOE31	Artificial Intelligence and Machine Learning	OE	50	50	100	3	3	0	0	3
32	18CSOE32	Computer Network Engineering	OE	50	50	100	3	3	0	0	3
33	18CSOE33	Big Data Analytics	OE	50	50	100	3	3	0	0	3

LIST OF AUDIT COURCES (AC)

S. No.	Course Code	Course Title	CAT	CA Marks	End Sem Marks	Total Marks	Contact Periods	Hours/Week			
								L	T	P	C
1	18CSACZ1	English for Research Paper Writing	AC	50	50	100	2	2	0	0	0
2	18CSACZ2	Disaster Management	AC	50	50	100	2	2	0	0	0
3	18CSACZ3	Value Education	AC	50	50	100	2	2	0	0	0
4	18CSACZ4	Constitution of India	AC	50	50	100	2	2	0	0	0
5	18CSACZ5	Pedagogy Studies	AC	50	50	100	2	2	0	0	0
6	18CSACZ6	Stress Management by Yoga	AC	50	50	100	2	2	0	0	0
7	18CSACZ7	Personality Development Through Life Enlightenment Skills	AC	50	50	100	2	2	0	0	0
8	18CSACZ8	Sanskrit for Technical Knowledge	AC	50	50	100	2	2	0	0	0

CURRICULUM DESIGN

S.No	Course Work Subject Area	No of Credits					Percentage
		I	II	III	IV	Total	
1.	Foundation Course	7	0	0	0	07	9.72 %
2.	Professional Cores	11.5	10.5	0	0	22	30.56 %
3.	Professional Electives	3	6	3	0	12	16.67 %
4.	Employability Enhancement Courses	0	2	10	16	28	38.88 %
5.	Open Elective Courses	0	0	3	0	03	4.17 %
Total Credits		**21.5**	**18.5**	**16**	**16**	**72**	**100%**

18CSFCZ1 RESEARCH METHODOLOGY AND IPR
(Common to All Branches)

Category : FC

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Definition and objectives of Research*
- *Quantitative methods for problem solving*
- *Data description and report writing*

UNIT I INTRODUCTION L(9)

Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code

UNIT II QUANTITATIVE METHODS FOR PROBLEM SOLVING L(9)

Statistical Modeling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

UNIT III DATA DESCRIPTION AND REPORT WRITING L(9)

Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis

Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing.

UNIT IV INTELLECTUAL PROPERTY L(9)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT V PATENT RIGHTS L(9)

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Stuart Melville and Wayne Goddard, "**Research methodology: an introduction for science & engineering students**", Juta Academic, 1996.
2. Donald H.McBurney and Theresa White, "**Research Methods**", 9th Edition, CengageLearning, 2013.
3. RanjitKumar, "**Research Methodology: A Step by Step Guide for Beginners**", 4th Edition, 2014.
4. Dr. C. R. Kotharia and GauravGarg, "**Research Methodology: Methods and Trends**", New age international publishers, Third Edition, 2014.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Develop research question ***[Usage]***
CO2: Perform exhaustive literature survey ***[Usage]***
CO3: Apply right problem solving methods ***[Usage]***
CO4: Prepare data for analysis ***[Usage]***
CO5: Write research report ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	H	H	H	H	H	M	H	H
CO2	H	H	H	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H	H	H
CO5	M	M	M	M	M	H	H	H	H	H	H

H = 3 ; M = 2 ; L = 1

18CSFC02 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Category : FC

L	T	P	C
3	1	0	4

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Random variables and discrete and continuous distributions.*
- *Queuing models.*
- *Tests of sampling.*
- *Correlation and regression analysis.*

UNIT I RANDOM VARIABLES **L(9)+T(3)**

Random variables- Binomial, Geometric, Poisson, Uniform, Exponential, Erlang and Normal distributions- Functions of a Random variable - Moments and Moment generating function.

UNIT II MARKOVIAN QUEUEING MODELS **L(9)+T(3)**

Markovian models- Birth and Death Queuing models- steady state results: Single and multiple server queuing models-queue with finite waiting rooms-Finite source- Finite source models-Little's formula.

UNIT III NON-MARKOVIAN QUEUES AND QUEUE NETWORKS **L(9)+T(3)**

M/G/1 queue- Pollazack-Khintchine formula, series queues-open and closed networks.

UNIT IV TESTING OF HYPOTHESIS **L(9)+T(3)**

Sampling distributions – Estimation of parameters- Statistical hypothesis- Tests based on Normal, t, Chi Square and F distributions for mean, variance and proportion.

UNIT V CORRELATION AND REGRESSION ANALYSIS **L(9)+T(3)**

Coefficient of correlation – rank correlation – regression lines – Multiple and Partial correlation – Partial regression - regression planes (Problems only).

LECTURE: 45 Periods TUTORIAL: 15 Periods PRACTICAL: 0 Periods TOTAL: 60 Periods

Reference Books

1. Veerarajan T, **"Probability and Random Processes (with Queueing Theory and Queueing Networks)"**, Fourth Edition ,McGraw Hill Education(India)Pvt Ltd., New Delhi, 2016.
2. Medhi J, **"Introduction to Queuing Systems and applications"**, 1st edition, New Age International(P) Ltd,New Delhi, 2015.
3. Gross D and Harris C. M, **"Fundamentals of Queuing theory"**, John Wiley and Sons, New York, 1998.
4. Gupta S.C and Kapoor V.K, **"Fundamentals of Mathematical Statistics"**, Sultan Chand & Sons, New Delhi, 2015.
5. Gupta S.P, **"Statistical Methods"**, Sultan Chand & Sons, New Delhi, 2015.
6. Veerarajan T, **"Higher Engineering Mathematics"**, Yes Dee Publishing Pvt Ltd, Chennai, 2016.
7. Kandasamy P, Thilagavathy K and Gunavathy K, **"Probability and Queueing Theory"**, S. Chand & Co, Ramnagar, New Delhi, Reprint 2013.

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1*:* Explain random variables and their distributions and also moments and moment generating functions for their mean and variance.***[Familiarity]***

CO2: Explainprobable values of queues with single and multi-server models.***[Familiarity]***

CO3. Explaintests of sampling for large and small samples.***[Familiarity]***

CO4: Explain probability distributions of discrete and continuous random variables. ***[Familiarity]***

CO5: Calculate coefficient of correlation, regression coefficients, multiple and partial correlation including regression plane.***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	M	M	M	M	M			M		M
CO4	H	M	M	M	M	M			M		M
CO5	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPC01 FORMAL LANGUAGES, MACHINES AND COMPUTATIONS

Category : PC

L	T	P	C
3	1	0	4

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Regular Languages and applications.*
- *Context Free Languages and applications.*
- *Turing Machines and applications.*
- *Computability and un-computability.*
- *Cost models and alternate models of computation*

UNIT I REGULAR LANGUAGES AND APPLICATIONS L(9)+T(3)

Regular Expressions and applications – Regular languages, properties and applications – Finite Automata, variants and applications – Pumping lemma for RL.

UNIT II CONTEXT FREE LANGUAGES L(9)+T(3)

Grammars – Context Free Languages, properties and applications – Stack machines – Context free frontier – Stack machines applications – Pumping lemma for CFL.

UNIT III TURING MACHINES L(9)+T(3)

Turing machine basics – Simple TMs – Language define by TM – Variants of TMs and their equivalence – Universal TM – Recursive, Recursively Enumerable languages and properties.

UNIT IV COMPUTABILITY AND UNCOMPUTABILITY L(9)+T(3)

Turing computable functions – Functions and languages – TM random access – Church-Turing thesis – Infinite models, finite machines – Halting problem – Reducibility – Rice's theorem – Grammars and Computability – Computable functions - Mathematical uncomputabilities.

UNIT V COST MODELS AND ALTERNATE ALGORITHMS L(9)+T(3)

Asymptotic notations, properties and functions – TM cost model – Time complexity classes – Space complexity classes – Higher complexity classes – Verification methods – NP, NP hard and NP Complete problems – Approximation algorithms, probabilistic and parallel algorithms – Interactive proof system.

Lecture: 45 Periods Tutorial: 15 Periods Practical: 0 Periods Total: 60 Periods

Reference Books

1. John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman, **"Introduction to Automata Theory, Languages and Computation"**, Third Edition, Pearson, 2013.
2. John C. Martin, **"Introduction to languages and the theory of computation"**, Third edition, McGrawHil, 2015
3. Michael Sipser, **"Introduction to Theory of Computation"**, Third Edition, Cengage learning, 2013.

4 Adam Brooks Webber, **"Formal languages: a practical introduction"**, Jim Leisy, 2008

***COURSE OUTCOMES**: Upon completion of this course, the students will be able to:*

CO1: Identify, use and apply Regular and Context Free Languages. ***[Assessment]***
CO2: Solve given problem by constructing appropriate Automata. ***[Usage]***
CO3. Construct Turing Machine for the given problem/function. ***[Usage]***
CO4: Provide solution model for computable functions. ***[Assessment]***
CO5: Identify and prove unsolvable problems. ***[Assessment]***
CO6: Classify the problems based on the cost analysis. ***[Assessment]***
CO7: Use alternate models of computation such as Approximation algorithms, probabilistic and parallel algorithms and Interactive proof system. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	M	H	M	H			M		M
CO2	H	H	H	M	H	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	M	H	M	H			M		M
CO5	H	H	M	H	M	H			M		M
CO6	H	H	M	H	M	H	L		M		M
CO7	H	H	H	M	H	M			M	L	M

H = 3 ; M = 2 ; L = 1

18CSPC02 HIGH PERFORMANCE COMPUTER ARCHITECTURE

Category : PC

L	T	P	C
2	0	2	3

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Fundamentals of Computer Organization and performance laws*
- *Concepts and issues in instruction level parallelism*
- *Multiprocessor architecture and synchronization issues in multiprocessors*
- *Memory organization and peripheral devices*
- *Multi core organization and its design issues*

UNIT I BASIC ORGANIZATION AND ARCHITECTURAL TECHNIQUES L(6) +P(6)

RISC processors - Characteristics of RISC processors, RISC vs CISC, Classification of Instruction Set Architectures - Review of performance measurements - Metrics and measures for parallel programs, Speedup performance laws, scalability analysis approaches, Amdahl's law, limitation, Benchmark, SIMD, MIMD Performance.

UNIT II INSTRUCTION LEVEL PARALLELISM L(6) +P(6)

Basic concepts of pipelining - Arithmetic pipelines , Instruction pipelines, Hazards in a pipeline: structural, data, and control hazards - Overview of hazard resolution techniques - Dynamic instruction scheduling - Branch prediction techniques - Instruction-level parallelism using software approaches - Superscalar techniques - Speculative execution - Review of modern processors - Pentium Processor and ARM Processor

UNIT III THREAD LEVEL PARALLELISM L(6) +P(6)

Centralized vs. distributed shared memory - Interconnection topologies - Multiprocessor architecture - Symmetric multiprocessors - Cache coherence problem - Synchronization - Memory consistency - Review of modern multiprocessors - Multicore Processors and their Performance.

UNIT IV MEMORY HIERACHIES AND PERIPHERAL DEVICES L(6) +P(6)

Basic concept of hierarchical memory organization - Main memories - Cache memory design and implementation - Virtual memory design and implementation - Secondary memory technology – RAID. Peripheral Devices: Bus structures and standards - Synchronous and asynchronous buses - Types and uses of storage devices - Interfacing I/O to the rest of the system - Reliability and availability - I/O system design.

UNIT V MULTICORE ARCHITECTURE L(6) +P(6)

Multithreading - SMT and CMP - Architectures - Limitations of Single Core Processors - Multicore era - Hardware Performance Issues - Software Performance Issues – Multicore Organization - Intel x86 Multicore Organization

Lecture: 30 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 60 Periods

Reference Books

1. John L. Hennessey and David A. Patterson, "**Computer Architecture – A Quantitative Approach**", Morgan Kaufmann / Elsevier, Fifth edition, 2012.
2. William Stallings, "**Computer Organization and Architecture**", Pearson Education, Ninth Edition, 2013
3. Kai Hwang, "**Advanced Computer Architecture**", Tata McGraw-Hill Education, Second Edition, 2003
4. Richard Y. Kain, "**Advanced Computer Architecture a Systems Design Approach**", Prentice Hall, Second Edition, 2011.
5. David E. Culler, Jaswinder Pal Singh, "**Parallel Computing Architecture : A Hardware/ Software Approach**" , Morgan Kaufmann / Elsevier, 2005.

COURSE OUTCOMES*: *Upon completion of this course, the students will be able to:

CO1: Compare RISC and CISC processors and analyze metrics for improving performance of processors. ***[Usage]***

CO2: Analyze structural, data and control hazards and exploit instruction level parallelism. ***[Assessment]***

CO3: Analyze design issues of distributed shared memory and explain multiprocessor Architectures. ***[Assessment]***

CO4: Explain types of memory hierarchy and issues of cache, virtual and secondary memory. ***[Familiarity]***

CO5: State the significance of RAID levels. ***[Familiarity]***

CO6: Compare SMT and CMT architectures and their performance. ***[Usage]***

CO7: List advantages of multi core processors and explain Intel x86 multi core organizations. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	M	H	M	M			M		M
CO2	H	H	M	H	M	M			M		M
CO3	H	H	M	H	M	M			M		M
CO4	H	M	M	H	M	M		L	M		M
CO5	H	M	M	M	M	M			M		M
CO6	H	H	M	H	M	M	L		M		M
CO7	H	M	M	H	M	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPC03 ALGORITHMS AND COMPLEXITY ANALYSIS

Category : PC

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Algorithm design, probabilistic analysis and amortized analysis of algorithms.*
- *Divide and Conquer, Dynamic programming and Greedy Algorithms techniques.*
- *Graph algorithms and Matrix operations.*
- *Multithreaded algorithms and Linear programming and polynomial multiplication using Fast Fourier Transforms.*
- *String matching, computational geometry, Notions of NP-Completeness and approximation algorithms.*

UNIT I INTRODUCTION L(9)

Role of Algorithms in Computing – Analyzing algorithms – Designing algorithms – Growth of functions – Divide and Conquer – Probabilistic analysis – Randomized algorithms

UNIT II DESIGN AND ANALYSIS TECHNIQUES L(9)

Dynamic programming: Rod cutting, Matrix-chain multiplication,Elements of dynamic programming, Optimal binary search trees– Greedy Algorithms: An activity-selection problem, Elements of the greedy strategy, Huffman codes – Amortized Analysis.

UNIT III GRAPH ALGORITHMS L(9)

Elementary Graph Algorithms – Minimum Spanning trees: Kruskal and Prims Algorithm – Single source shortest paths – All pairs shortest paths: Floyd-Warshall algorithm, Johnson's algorithm for sparse graphs – Maximum Flow

UNIT IV ADVANCED ALGORITHMS I L(9)

Multithreaded algorithms: Multithreaded matrix multiplication, Multithreaded merge sort – Matrix operations: Solving systems of linear equations, Inverting matrices, Symmetric positive-definite matrices and least-squares approximation – Linear programming – Polynomials and FFT.

UNIT V ADVANCED ALGORITHMS II L(9)

String matching: Naive string-matching algorithm, Rabin-Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm– Computational Geometry – NP-Completeness – Approximation algorithms

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Thomas H. Cormen, Charles E. Leiseron, Ronald L.Rivest, Clifford Stein, "**Introduction to Algorithms**", Third Edition, PHI learning Pvt. Ltd., 2011.
2. Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, "**Fundamentals of Computer Algorithms**", Galgotia Publications Pvt. Ltd., 2008.

3 Michael R. Garey, D. S. Johnson, "**Computers and Intractability: A Guide to the Theory of NP-Completeness**", W. H. Freeman, 1979.

4 Aho. A.V., Hopcroft. J.E. and Ullman .J.D., "**The Design and Analysis of Algorithms**", Addison-Wesley, 1974.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Design and analyze algorithms using divide and conquer, dynamic programming, greedy algorithms. ***[Usage]***

CO2: Perform probabilistic analysis and amortized analysis of algorithms. ***[Familiarity]***

CO3: Use minimum spanning trees, shortest path and Maximum flow algorithms in graphs to solve problems. ***[Usage]***

CO4: Solve problems using multithreaded algorithms and linear programming approach. ***[Usage]***

CO5: Solve polynomial multiplication using Fast Fourier Transforms. ***[Usage]***

CO6: Apply suitable string matching algorithms and Computational geometry algorithms. ***[Usage]***

CO7: Identify problems that are NP-Complete and generate near-optimal solutions. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	H	H	M	H	M	L		M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M			M		M
CO7	H	M	M	M	M	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPC04 ADVANCED ALGORITHMS AND ELECTIVE LAB

Category : PC

L	T	P	C
0	0	3	1.5

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Design of algorithms using Divide and Conquer, Dynamic programming approach.*
- *Design of algorithms using Greedy and Back Tracking Techniques.*
- *Implementation of Graph algorithms and Matrix operations.*
- *Implementation of String matching, computational geometry and approximation algorithms.*

LIST OF EXPERIMENTS

1. Implement an algorithm that combines k sorted lists in time O(n log k) where n is the total number of elements.
2. Implement an algorithm to solve Matrix Multiplication problem and Maximum value contiguous subsequence using dynamic programming approach.
3. Implement an algorithm based on greedy approach to solve knapsack problem and Activity Selection Problem.
4. Implement Merge Sort algorithm using Divide and Conquer approach.
5. Implement stack operations and calculate the amortized cost.
6. Implement Graph Traversal algorithms.
7. Implement algorithms to construct Minimum Spanning Trees.
8. Implement shortest path and Maximum Flow algorithms.
9. Implement String Matching Algorithms.
10. Implement Computational Geometry algorithms.

Lecture: 0 Periods Tutorial: 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES*: Upon completion of this course, the students will be able to:*

CO1*:* Design and analyze algorithms using divide and conquer, dynamic programming, greedy algorithms. ***[Usage]***

CO2: Perform probabilistic analysis and amortized analysis of algorithms. ***[Assessment]***

CO3: Implement minimum spanning tree, shortest path and Maximum flow algorithms in graphs to solve problems. ***[Usage]***

CO4: Solve problems using multithreaded algorithms and linear programming. ***[Usage]***

CO5: Usesuitable string matching algorithms and Computational geometry algorithms ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	M	H	M	M	M	M	H	M
CO2	H	H	M	H	M	H	M	M	M	H	M
CO3	H	H	H	M	M	M	M	M	M	H	M
CO4	H	H	H	M	H	M	M	M	M	H	M
CO5	H	H	H	M	H	M	M	M	M	H	M

H = 3 ; M = 2 ; L = 1

18CSPC05 ADVANCED DATABASE SYSTEMS

Category : PC

L	T	P	C
2	0	2	3

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Data base design with ER Model and Relational Model*
- *Data storage and Retrieval Techniques*
- *Query Processing and Transaction Management*
- *Parallel and distributed databases*
- *Enhanced Data models*
- *NoSQL databases*

UNIT I DATABASE DESIGN **L(6) + P(6)**

Data Models, ER Model: Constraints, ER-Diagrams, Extended ER Features, Relational Database Design: Good Relational designs, Normal Forms, Functional Dependencies, Decomposition algorithms, Modeling Temporal Data, Application Design and Development- Performance Tuning.

UNIT II STORAGE, QUERYING AND TRANSACTION MANAGEMENT **L(6) + P(6)**

Indexing and Hashing, Query Processing and Optimization, Transaction Management: Concurrency and Recovery, Advanced Transaction Processing.

UNIT III PARALLEL AND DISTRIBUTED DATABASES **L(6) + P(6)**

Database system Architecture- Parallel Databases: Parallelism, Query Optimization and design of Parallel system-Distributed Databases: Distributed Storage and Transactions, Concurrency Control, Query Processing, Cloud based databases, Directory Systems.

UNIT IV DATABASE SECURITY AND ENHANCED DATA MODELS **L(6) + P(6)**

Database Security: Issues, Access Control Mechanisms, SQL injection, Statistical Database security – Advanced Data models: Active Database, Temporal Database, Multimedia Database, Spatial and Deductive Databases, XML.

UNIT V NoSQL DATABASES **L(6) + P(6)**

Emergence-Aggregate data models- Distribution models-consistency-Key value databases-Document databases-Column family stores-Graph databases-Schema Migration- polyglot Persistence

Lecture: 30 Periods Tutorial: 0 Periods Practical: 30 Periods Total: 60 Periods

Reference Books

1. Abraham Silberschatz , Henry F. Korth and S. Sudarshan, "**DatabaseSystem Concepts**", Sixth Edition, McGraw-Hill, 2012
2. Pramod J. Sadalage and Martin Fowler, "**NoSQL Distilled- A Brief Guide to the Emerging world of Polyglot Persistence"**, Pearson Education,2013

3 R. Elmasri and S. Navethe, " **Fundamentals of Database Systems**", Seventh Edition,Pearson Education, 2015

4 Raghu Ramakrishnan and Gehrke, "**Database Management Systems**", Third Edition, McGraw Hill, 2003

5 Thomas Cannoly and Carolyn Begg, **"Database Systems, A Practical Approach to Design, Implementation and Management"** Addison- Wesley Professional, 2012

6 Tamer Ozsu M., Patrick Valdurriez, "**Principles of Distributed Database Systems**", Third Edition, Springer, 2011

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1: Design and develop a relational data model. ***[Usage]***
CO2: Understand the storage and data access mechanisms. ***[Familiarity]***
CO3: Perform Query optimization and use transaction management techniques. ***[Familiarity]***
CO4: Apply Concurrency control and Query Optimization algorithms in Parallel and Distributed data models. ***[Usage]***
CO5: Use Enhanced data models. ***[Usage]***
CO6: Explain and Use NoSQL databases. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	M	M	M	M	M			M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPC06 NETWORK SCIENCE

Category : PC

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Technological networks*
- *Fundamentals of network theory*
- *Computer algorithms for Networks*
- *Models of network information*
- *Processes on networks*

UNIT I THE EMPIRICAL STUDY OF NETWORKS L(6)

Introduction - Technological Networks: The Internet, The telephone Network, Power Grids, Transportation Networks, Delivery and distribution networks – Social Networks – Networks of Information – Biological Networks.

UNIT II FUNDAMENTALS OF NETWORK THEORY L(10)

Mathematics of Networks – Networks and their representation – Measures and metrics – The large scale structure of the networks: Components, shortest path and small world effect, degree distribution, Power laws and scale free networks, distributions of other centrality measures, Clustering coefficients, Assortative mixing.

UNIT III COMPUTER ALGORITHMS L(9)

Basic concepts of algorithms - Running time and computational complexity, Storing network data, adjacency matrix and list, trees, heaps – Fundamental network algorithms – Matrix algorithms and graph partitioning.

UNIT IV NETWORK MODELS L(10)

Random graphs – Random graphs with general degree distributions – Models of network information – Other network models – small world model, exponent random graphs.

UNIT V PROCESSES ON NETWORKS L(10)

Percolation and network resilience –Percolation, Uniform random removal of vertices, non uniform removal of vertices, percolation in real world networks, computer algorithms for percolation – Epidemics on networks – dynamical systems on networks – network search.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Mark Newman, **"Networks: An introduction",** Oxford University Press, 2010.
2. UlrikBandes, Thomas Erlebach, **"Network Analysis: Methodological foundations",** Springer, 2004.
3. David Easey, John Kleinberg, **"Networks, Crowds and markets: Reasoning about a highly connected world"**, CambridgeUniversity Press, 2010.
4. Matthew O Jackson, **"Social and Economic Networks"**, Princeton University press, 2010.
5. Albert-Laszlo Barabasi, Mark Newman, Duncan J.Watts, **"The structure and Dynamics of Networks"**, Princeton University Press, 2006.

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1: Explain the technological networks such as Internet, Distribution, Social and Biological Networks. ***[Familiarity]***

CO2: Represent the networks using appropriate data structure. ***[Assessment]***

CO3: Write algorithms for degree, degree distribution and graph partitioning. ***[Usage]***

CO4: Identify suitable model for network information. ***[Assessment]***

CO5: Write algorithms for percolation and network resilience. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	H	M	H	M	H			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	M	H	M	H			M		M
CO5	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPC07 ADVANCES IN OPERATING SYSTEMS

Category : PC

L	T	P	C
2	0	2	3

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Fundamentals of Operating Systems*
- *Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols*
- *Distributed resource management components*
- *Real time and Sensor operating systems*
- *Mobile Operating Systems*

UNIT I FUNDAMENTALS OF OPERATING SYSTEMS L(6) +P(6)

Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System.

UNIT II DISTRIBUTED OPERATING SYSTEMS L(6) +P(6)

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT III DISTRIBUTED RESOURCE MANAGEMENT L(6) +P(6)

Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distribution – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non-blocking Commit Protocol – Security and Protection.

UNIT IV REAL TIME AND SENSOR OPERATING SYSTEMS L(6) +P(6)

Basic Model of Real Time Systems – Characteristics- Applications of Real Time Systems – Real Time Task Scheduling – Handling Resource Sharing- Wireless Sensor Operating Systems – Embedded Operating Systems – Structure of the Operating System and Protocol stack – Dynamic Energy and Power management – Programming Paradigms and Application Programming Interface – Case Study: Tiny OS and nesC.

UNIT V MOBILE OPERATING SYSTEMS L(6) +P(6)

Mobile Operating Systems –Micro Kernel Design – Client Server Resource Access – Processes and Threads – Memory Management – File system. Case Study: iOS and Android- Architecture and SDK Framework – Media Layer – Services Layer – Core OS Layer – File System.

LIST OF EXPERIMENTS:

1.Handling multiple file system in Linux system
2. Implementation of Lamport's logical clocks
3. Implementation of RMI lottery application using Distributed Operating system.
4. Implementation of Ricart Agrawala and Suzuki Kazami's Algorithm.
5 .Implementation of scheduling algorithms in distributed OS
6. Implementation of two phase commit protocols.
7. implemention of an alarm clock using real time operating system
8. Minix 3 OS-adding a new system call and calling the system call handler function directly.

Lecture: 30 Periods Tutorial : 0 Periods Practical: 30 Periods Total: 60 Periods

Reference Books

1. Daniel P Bovet and Marco Cesati, "**Understanding the Linux kernel**", 3rd edition, O'Reilly, 2005.
2. MukeshSinghal and Niranjan G. Shivaratri, "**Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems**", Tata McGraw-Hill, 2001.
3. Rajib Mall, "**Real-Time Systems: Theory and Practice**", Pearson Education India, 2006
4. Holger Karl & Andreas Willig, "**Protocols And Architectures for Wireless Sensor Networks**", John Wiley, 2005.
5. Neil Smyth, "**iPhone iOS 4 Development Essentials – Xcode**", Fourth Edition, Payload media, 2011.
6. Reto Meier, "**Professional Android 4 Application Development**", Wiley, 2012.

***COURSE OUTCOMES**: Upon completion of this course, the students will be able to:*

CO1: Discuss the various synchronization, scheduling and memory management Issues. ***[Familiarity]***

CO 2: Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system. ***[Usage]***

CO 3: Discuss the various resource management techniques for distributed systems. ***[Familiarity]***

CO 4: Identify the different features of real time operating systems. ***[Assessment]***

CO 5: Explain the features of sensor operating systems. ***[Familiarity]***

CO 6: Describe the characteristics of Mobile Operating Systems. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	H	H	M	H	M			M		M
CO3	H	M	M	M	M	M			M		M
CO4	H	H	M	H	M	H			M		M
CO5	H	M	M	M	M	M			M		M
CO6	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSEE01 MINI PROJECT WITH SEMINAR

Category : EEC

L	T	P	C
1	0	2	2

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Usage of Mathematical, computational and natural sciences gained by study, experience and practice with judgment to develop effective use of matter, energy and information to the benefit of mankind.*
- *Plan, execute, manage and document a project*

COURSE OUTCOMES*: Upon completion of this course, the students will be able to:*

CO1*:* Identify research intensive feasible problems by considering societal/industrial demands. ***[Assessment]***

CO2*:* Perform exhaustive literature survey on identified problem. ***[Assessment]***

CO3*:* Use design/simulation tools to implement critical methods/algorithms of the identified problem from the literature. ***[Assessment]***

CO4*:* Perform preliminary implementation to achieve encouraging results. ***[Usage]***

CO5*:* Develop and deliver a good quality formal presentation. ***[Usage]***

CO6*:* Write clear, concise, and accurate technical document for publication. ***[Usage]***

Lecture: 15 Periods Tutorial : 0 Periods Practical: 30 Periods Total: 45 Periods

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	L	H	L	H	H	H	H	H	H
CO2	H	H	L	H	L	H	H	H	H	H	H
CO3	H	H	L	H	L	H	H	H	H	H	H
CO4	H	H	H	M	H	M	H	H	H	H	H
CO5	H	H	H	M	H	M	H	H	H	H	H
CO6	H	H	H	M	H	M	H	H	H	H	H

H = 3 ; M = 2 ; L = 1

18CSPC08 ADVANCED COMPUTER NETWORKS AND ELECTIVES LAB

Category : PC

L	T	P	C
0	0	3	1.5

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Local Area networks*
- *Routing protocols*
- *Access Control Lists and Virtual Control Lists*
- *Dynamic Host Configuration Protocols*
- *Wireless Local Area Networks such as WLAN, WiMAX and WSN.*

LIST OF EXPERIMENTS

Experiment 1: Simulating a Local Area Network
In-lab Activities : Local Area Network LAN Topologies MAC Protocols Taking turns Ethernet - Ethernet Frame Structure - Ethernet Versions - Simulating a LAN using Network Simulator 3

Experiment 2: Measuring Network Performance
In-lab Activities: Network Performance Evaluation - Performance Evaluation Metrics - Parameters Affecting the Performance of Networks - Performance Evaluation Techniques - Network Performance Evaluation using NS-3.

Experiment 3: Access Control Lists (ACL) Part1
In-lab Activities : Configuring Standard ACLs - Configuring an ACL on VTY Lines Configuring Named Standard ACLs

Experiment 4 : Access Control Lists (ACL) Part 2
In-lab Activities : Configuring Extended ACLs 1 - Configuring Extended ACLs 2 - Configuring Named Extended ACLs - Troubleshooting ACLs

Experiment 5 : Network Address Translation for IPv4 (NAT)
In-lab Activities : Investigating NAT Operation - Implementing Static and Dynamic NAT Configuring NAT Pool Overload and PAT

Experiment 6 :Virtual Local Area Networks (VLANs)
In-lab Activities : Basic VLAN Configuration - Troubleshooting a VLAN Implementation

Experiment 7 : Inter-VLAN Routing
In-lab Activities : Configuring traditional inter-VLAN routing - Configuring router-on-a-stick inter-VLAN routing - Troubleshooting Inter - VLAN Routing

Experiment 8 : Spanning Tree Protocol (STP)
In-lab Activities : Configuring STP

Experiment 9 : Dynamic Host Configuration Protocol (DHCP)
In-lab Activities : Configuring DHCP

Experiment 10 : Simulating a Wireless LANs

In-lab Activities : Wi-Fi Networks - IEEE 802.11 Standards - Hardware Requirements for Wi-Fi - How to connect to the Wi-Fi Networks? - Advantages of Wi-Fi - Limitations - MAC Protocols - Use of RTS/CTS to Exchange Data - Issues in Wi-Fi Networks - The Hidden Terminal Problem - Solution of Hidden Terminal Problem - Exposed Terminal Problem - Solution to the Exposed Terminal Problem - Simulating a Wi-Fi using Network Simulator 3

Experiment 11 : Simulating a WiMAX Network

In-lab Activities : WiMAX Network - Standards - Comparison of Wi-Fi and WiMAX - How WiMAX works? - Limitations of WiMAX - Modulation Schemes - Difference between low symbol rate and high symbol rate - WiMAX module for NS-3 - How to download and install patch for WiMAX? - Addressing Format in ns2 - The Default address format - The Hierarchical address format - Wireless (New) Trace File Format - Description of New Trace File Format - Wireless Trace File Format

Experiment 12 : Simulating a Wireless Sensor Network

In-lab Activities : Wireless Sensor Networks - Basic Characteristics of WSNs - Operating Systems for WSNs - Differences with Mobile Ad hoc Networks - Types of Wireless Sensor Networks - Routing protocols for WSNs - Clusters and Cluster heads in WSNs - The LEACH Protocol - Operation of LEACH - Discussions on LEACH - Applications of WSNs - Simulating a WSN using Network Simulator 3

Lecture: 0 Periods Tutorial : 0 Periods Practical: 45 Periods Total: 45 Periods

COURSE OUTCOMES*: *Upon completion of this course, the students will be able to:

CO1: Implementa Local Area Network and measuring its network performance in NS3 network simulator / NS2 / Packet Tracer. ***[Assessment]***

CO2*:* Implementrouting protocols in NS3 network simulator /NS2 / Packet Tracer. ***[Usage]***

CO3*:* ImplementAccess Control Lists (ACL) in Packet Tracer. ***[Usage]***

CO4: ImplementVirtual Local Area Networks (VLANs). ***[Usage]***

CO5: Implement Dynamic Host Configuration Protocol (DHCP) in Packet Tracer. ***[Usage]***

CO6: Implement Wireless LAN, WiMAX Network and Wireless Sensor Network in NS3 network simulator. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	M	H	M	H	M	M	M	H	M
CO2	H	H	H	M	H	M	M	M	M	H	M
CO3	H	H	H	M	H	M	M	M	M	H	M
CO4	H	H	H	M	H	M	M	M	M	H	M
CO5	H	H	H	M	H	M	M	M	M	H	M
CO6	H	H	H	M	H	M	M	M	M	H	M

H = 3 ; M = 2 ; L = 1.

18CSEE02 PROJECT PHASE I

Category : EEC

L	T	P	C
0	0	20	10

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Usage of Mathematical, computational and natural sciences gained by study, experience and practice with judgment to develop effective use of matter, energy and information to the benefit of mankind.*
- *Plan, execute,manage and document a project*

COURSE OUTCOMES*: Upon completion of this course, the students will be able to:*

CO1: Identify research intensive feasible problems by considering societal/industrial demands***[Assessment]***

CO2: Perform exhaustive literature survey on identified problem***[Assessment]***

CO3: Use design/simulation tools to implement critical methods/algorithms of the identified problem from the literature***[Assessment]***

CO4: Perform preliminary implementation to achieve encouraging results. ***[Usage]***

CO5: Develop and deliver a good quality formal presentation. ***[Usage]***

CO6: Write clear, concise, and accurate technical document for publication.***[Usage]***

Lecture: 0 Periods Tutorial : 0 Periods Practical: 300 Periods Total: 300 Periods

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	H	M	H	H	H	H	H	H
CO2	H	H	M	H	M	H	H	H	H	H	H
CO3	H	H	H	M	H	M	H	H	H	H	H
CO4	H	H	M	H	M	H	H	H	H	H	H
CO5	H	H	H	M	H	M	H	H	H	H	H
CO6	H	H	H	M	H	M	H	H	H	H	H

H = 3 ; M = 2 ; L = 1

18CSEE03 PROJECT PHASE II

Category : EEC

L	T	P	C
0	0	32	16

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Usage of mathematical, computational and natural sciences gained by study, experience and practice with judgment to develop effective use of matter, energy and information to the benefit of mankind.*
- *Plan, execute, manage and document a project*
- *Construct logical and physical models to demonstrate the skills at assimilating, synthesizing and critically appraising all materials relevant to the project.*

COURSE OUTCOMES*: Upon completion of this course, the students will be able to:*

CO1: Perform detailed implementation of the identified problem using advanced tools or by developing new tools. ***[Assessment]***

CO2: Exhaustive testing of the proposed methods and algorithms to validate new findings. ***[Assessment]***

CO3: Performance analysis with existing methods and algorithms to establish applicability. ***[Assessment]***

CO4: Develop and deliver a good quality formal presentation. ***[Usage]***

CO5: Write clear, concise, and accurate technical document for journal publication. ***[Usage]***

Lecture: 0 Periods Tutorial : 0 Periods Practical: 480 Periods Total: 480 Periods

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	L	H	L	H	H	H	H	H
CO2	H	H	L	H	L	H	H	H	H	H	H
CO3	H	H	L	H	L	H	H	H	H	H	H
CO4	H	H	H	L	H	L	H	H	H	H	H
CO5	H	H	H	L	H	L	H	H	H	H	H

H = 3 ; M = 2 ; L = 1

18CSPE01 COMPUTER VISION ENGINEERING

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Fundamentals of image processing techniques for computer vision.*
- *Shape and pattern analysis.*
- *Hough Transform and its applications to detect lines, circles, ellipses.*
- *Machine Learning and Deep Learning Networks.*
- *Three-dimensional image analysis and motion analysis techniques*
- *Applications of computer vision algorithms*

UNIT I LOW LEVEL VISION L(9)

Images and Imaging Operations- Image Filtering and Morphology-The Role of Thresholding - Edge detection – Corner ,Interest Point and Invariant Feature Detection – Texture Analysis.

UNIT II INTERMEDIATE LEVEL VISION L(9)

Binary Shape Analysis- Boundary Pattern Analysis- Line, Circle and Ellipse Detection-The generalized Hough Transform-Object Segmentation and Shape Models.

UNIT III MACHINE LEARNING AND DEEP LEARNING NETWORKS L(9)

Basic Classification Concepts-Machine Learning:Probabilistic Methods-Deep Learning Networks

UNIT IV 3D VISION AND MOTION L(9)

Three Dimensional World-Tackling the Perspective n-point Problem-Invariants and Perspective-Image Transformations and Camera Calibration-Motion.

UNIT V APPLICATIONS L(9)

Face Detection and Recognition: the Impact of Deep Learning- Surveillance – The Basic Geometry-Foreground-Background Separation – Particle Filters – Chamfer Matching, Tracking, and Occlusion – Combining Views from Multiple Cameras – Human Gait analysis -Application: In-Vehicle Vision System: Locating the Roadway –Location of Road Markings – Location of Road signs – Location of Vehicles-Locating Pedestrians.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1 E. R. Davies, "**Computer Vision Principles, Algorithms, Applications, Learning**", Fifth Edition, Academic Press, 2018.

2 R. Szeliski, "**Computer Vision: Algorithms and Applications**", Springer 2010.

3 Simon J. D. Prince, "**Computer Vision: Models, Learning, and Inference**", Cambridge UniversityPress, 2012

4 Mark Nixon and Alberto S. Aquado, "**Feature Extraction & Image Processing for Computer Vision**", Third Edition, Academic Press, 2012.

5 D. L. Baggio et al., "**Mastering Open CV with Practical Computer Vision Projects**", PacktPublishing, 2012.

6 Jan Erik Solem, "**Programming Computer Vision with Python: Tools and algorithms for analyzing images**", O'Reilly Media, 2012.

COURSE OUTCOMES*: *Upon completion of this course, the students will be able to:

CO1*:* Implement fundamental image processing techniques required for computer vision. ***[Familiarity]***

CO2: Perform shape analysis and apply chain codes and other region descriptors. ***[Usage]***

CO3. Apply Hough Transform for line, circle, and ellipse detections. ***[Usage]***

CO4: Implement Machine Learning Algorithms. ***[Familiarity]***

CO5: Apply 3D vision techniques and implement motion related techniques. ***[Usage]***

CO6: Develop applications using computer vision techniques. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	M	M	L	H	L		H	H	M
CO2	H	H		M	L	H	L		H	H	M
CO3	H	H		M	L	H	L		H	H	M
CO4	H	H	M	M	L	H	L		H	H	M
CO5	H	H		M	L	H	L		H	H	M
CO6	H	H	M	M	L	H	L		H	H	H

H = 3 ; M = 2 ; L = 1

18CSPE02 PATTERN RECOGNITION

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Basic concepts in pattern recognition*
- *State-of-the-art algorithms used in pattern recognition*
- *Bayes classifier and linear discriminant analysis*
- *HMM and Support Vector Machines*
- *Apply pattern recognition techniques in practical problems*

UNIT I MATHEMATICAL FOUNDATIONS OF PATTERN RECOGNITION L(9)

Introduction – Mathematical Foundations: Basics of Probability, Random Processes and Linear Algebra - Probability: independence of events, conditional and joint probability -Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors - Features, Feature Vectors, and Classifiers - Supervised versus Unsupervised Pattern Recognition.

UNIT II CLASSIFIERS BASED ON BAYES DECISION THEORY L(9)

Introduction - Minimum-error-rate classification, Classifiers, Discriminant functions, Decision surfaces, Normal density and discriminant functions, discrete features -Parameter Estimation Methods: Maximum-Likelihood estimation: Gaussian case; Maximum a Posteriori estimation; Bayesian estimation: Gaussian case - The Nearest Neighbor Rule.

UNIT III UNSUPERVISED LEARNING AND CLUSTERING L(9)

Criterion functions for clustering; Algorithms for clustering: K-Means, Hierarchical and other methods; Cluster validation; Gaussian mixture models; Expectation-Maximization method for parameter estimation; Maximum entropy estimation.

UNIT IV SEQUENTIAL PATTERN RECOGNITION L(9)

Hidden Markov Models (HMMs); Discrete HMMs; Continuous HMMs - Nonparametric techniques for density estimation: Parzen-window method; K-Nearest Neighbour method - Dimensionality reduction: Fisher discriminant analysis; Principal component analysis; Factor Analysis.

UNIT V FEATURE SELECTION AND FEATURE GENERATION L(9)

Linear discriminant functions: Gradient descent procedures; Perceptron; Support vector machines - Non-metric methods for pattern classification: Non-numeric data or nominal data; Decision trees: CART.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. S.Theodoridis and K.Koutroumbas, **"Pattern Recognition"**, 4th Ed., Academic Press, 2009
2. O.Duda, P.E.Hart and D.G.Stork, "**Pattern Classification"**, John Wiley, 2001.

3 C.M.Bishop, "**Pattern Recognition and Machine Learning**", Springer, 2006.

4 SergiosTheodoridis, AggelosPikrakis, KonstantinosKoutroumbas, DionisisCavouras, **"Introduction to Pattern Recognition: A Matlab Approach",** First Edition, Elsevier 2010.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Apply variety of mathematical techniques to pattern classification problems. ***[Usage]***
CO2: Explain and compare a variety of pattern classification, structural pattern recognition and pattern classifier combination techniques. ***[Familiarity]***
CO3: Summarize, analyze, and relate the pattern recognition problems and techniques. ***[Usage]***
CO4: Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques. ***[Assessment]***
CO5: Apply pattern recognition techniques to real-world problems such as document analysis and recognition**.** ***[Usage]***
CO6: Implement simple pattern classifiers, classifier combinations and structural pattern recognizers. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	M	H	M	H			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE03 DIGITAL IMAGE PROCESSING

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Fundamentals of digital image processing and simple operations.*
- *Image transformation and image enhancement techniques.*
- *Different kinds of restoration and image compression techniques.*
- *Segmentation methods used in image processing, image understanding and recognition.*
- *Usage of image processing in real time applications.*

UNIT I INTRODUCTION L(9)

Digital image processing systems-elements of visual perception-connectivity and relations between pixels - Arithmetic, logical, geometric operations.

UNIT II IMAGE TRANSFORMS AND ENHANCEMENT L(9)

Image Transforms: 2D orthogonal and unitary transforms-properties and examples. 2D DFT, FFT, DCT, Hadamard transform, Haar Transform, Slant transform, KL Transform- properties and examples. Image Enhancement: Point processing-filtering in spatial and frequency domain, Nonlinear filtering-Color image processing fundamentals.

UNIT III IMAGE RESTORATION AND COMPRESSION L(9)

Image Restoration: Image observation and degradation model-circulant and block circulant matrices and its application in degradation model-Algebraic approach to restoration-Inverse by Wiener filtering, Generalized inverse- SVD and iterative methods, blind deconvolution, image reconstruction from projections. Image compression: redundancy and compression models - Loss less compression: variable-length, Huffman, Arithmetic coding, bit-plane coding, Lossless predictive coding. Lossy compression: Transform based coding (DCT), JPEG standard, sub band coding.

UNIT IV IMAGE SEGMENTATION, UNDERSTANDING AND RECOGNITION L(9)

Image segmentation: Edge detection, line detection, curve detection. Edge linking and boundary extraction-boundary representation-region representation and segmentation; morphology: dilation, erosion, opening and closing. Image understanding and recognition: Matching by templates, classifiers-statistical and neural network based model.

UNIT V APPLICATIONS L(9)

Applications: Automatic visual system in part inspection-forensic and security system- scientific and medical investigation- entertainment: multimedia.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1 Rafael C. Gonzalez and Richard E. Woods, "**Digital Image Processing**", Third Edition, Pearson Education, 2012.

2 Anil K. Jain, "**Fundamental of Digital Image Processing**", Prentice Hall, 2015.

3 B.Chanda, D.Duttamajumder, "**Digital Image Processing and Analysis**", Second Edition, PHI, 2011.

4 Annadurai S, Shanmugalakshmi R, "**Fundamentals of Digital Image Processing**", Pearson Education Pvt. Ltd., 2007.

5 Milan Sonka, Vaclav Hlavac and Roger Boyle, "**Image Processing, Analysis and Machine Vision**", Fourth Edition, Cengage Learning, 2015.

6 S. Sridhar, "**Digital Image Processing**", OXFORD University press, 2011.

7 S. Jayaraman, S.Esakkirajan, T.Veerakumar, "**Digital Image Processing**", Tata McGraw Hill Education Pvt. Ltd., 2011.

COURSE OUTCOMES: ***Upon completion of this course, the students will be able to:***

CO1: Process digital images using fundamental steps of image processing and simple arithmetic, logical and geometric operations. ***[Usage]***

CO2: Analyze and apply image transforms like FFT, DCT, Hadamard, Haar, Slant, KL transforms for images. ***[Usage]***

CO3: Enhance the quality of images using frequency and spatial domain techniques. ***[Assessment]***

CO4: Identify the degradation modeling and restoring the image using different methods like algebraic approaches and projections. ***[Assessment]***

CO5: Apply Lossy and lossless image compression techniques for digital images. ***[Usage]***

CO6: Perform edge detection and segmentation. ***[Assessment]***

CO7: Recognize image using matching by templates, statistical and neuralnetwork models. ***[Usage]***

CO8: Apply suitable image processing techniques for various real time applications like medical and network security applications. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	M			M		M
CO2	H	H	H	M	H	M			M		M
CO3	H	H	M	H	M	H			M		M
CO4	H	H	M	H	M	H			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	M	H	M	H			M		M
CO7	H	H	H	M	H	M			M		M
CO8	H	H	H	M	H	M			M	L	M

H = 3 ; M = 2 ; L = 1

18CSPE04 EMBEDDED SYSTEMS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Architecture and Instruction set of microcontrollers.*
- *Addressing modes and Interrupt mechanisms of microcontrollers*
- *Peripheral functions, Timers and data Convertors and their interfacing*
- *RTOS, Multiple process environment and develop applications*
- *Development Tools and Hardware Software Co-Design*

UNIT I MICROCONTROLLER ARCHITECTURE, CLOCK AND OPERATING MODES **L(9)**

New generation embedded systems: low power operations, high performance, battery operated embedded systems; Introduction to RL78 microcontrollers; Architecture of RL78 microcontrollers, General purpose registers; Memory space; Flash mirror facility; Boot clusters; Special function registers; Pipeline execution. RL78 clock circuitry and operating modes; Operating modes; Reset management; Power-on-reset; Voltage detection circuit; Applying voltage detection circuits.

UNIT II INSTRUCTION SET AND FAIL-SAFEFEATURES **L(9)**

Instruction set; Addressing modes; Types of instructions; Types of interrupts; Interrupt sources and configurations, Interrupt priority; Interrupt servicing; Key interrupt functions; Introduction to fail- safe standard IEC60730; Usage of CRC in memory; Detection of abnormal CPU operations.

UNIT III PERIPHERALS: I/O PORTS, COMMUNICATION FUNCTIONS, TIMERS, DATA CONVERTERS **L(9)**

RL78 peripheral functions; I/O Ports; Port architecture; Port operations; Port controlling registers; Serial ports of RL78, Functions of 3-wire serial I/O; Functions of UART channels; Functions of simplified IIC channels; Functions of LIN communications, Timer array units; PWM output generation; One-shot pulse outputs; Multiple PWM outputs; Interval timers; Real time counters; Watchdog timers; Analog to digital converter overview; A/D conversion operations; A/D conversion modes; Flash memory configurations; Flash memory programming.

UNIT IV INTRODUCTION TO ARM CORTEX M3 MICROCONTROLLERS **L(9)**

Introduction to STM32F1xx family, Overview of Cortex-M3 architecture, Bus configurations and Memory structure, Reset and Clock circuitry, General purpose and alternate function I/Os, Interrupts and events, DMA controller, Data converters, Timers, Watchdog timers, Flexible static memory controller, SDIO, communication facilities like SPI, IIC, CAN, Ethernet, USB.

UNIT V RTOS, DEVELOPMENT TOOLS AND HARDWARE SOFTWARE CO-DESIGN **L(9)**

Understanding Code development environment for microcontrollers, Debugging tools, Embedded System Design Methodologies, RTOS, Hardware Software Codesign**.**

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1 Alexander G. Dean and James M. conard, " **Creating Fast, Responsive and Energy-efficient Embedded Systems using the Renesas RL 78 Microcontroller"**, Micrium Press, 2011

2 Joseph Yiu, "**The Definitive Guide to the ARM Cortex-M3**", Elsevir Inc., Second Edition, 2010

3 Frank Vahid, Tony D. Givargis, "***Embedded system Design: A Unified Hardware/Software Introduction***", John Wily & Sons Inc.2002

4 Peter Marwedel, "***Embedded System Design***", Science Publishers, 2007.

5 Tammy Noergaard "**Embedded Systems Architecture:** ***A Comprehensive Guide for Engineers and Programmers***", ElsevierPvt.Ltd.Publications, 2005

COURSE OUTCOMES: ***Upon completion of this course, the students will be able to:***

CO1: Describe architectural features of RENESAS RL78 microcontroller***. [Familiarity]***

CO2: Design and implement software systems to provide an interface to RL 78 based hardware Systems.***[Assessment]***

CO3: Describe the multiple process operating environment and system call interfaces to monitor and control processes.***[Familiarity]***

CO4: Develop interface peripherals for serial communication, timer applications and Data convertors.***[Usage]***

CO5: Describe architectural features of ARM Cortex M3 Microcontroller. ***[Familiarity]***

CO6: Design and implement software systems to provide an interface to ARM Cortex M3 based hardware systems.***[Assessment]***

CO7: Explain the RTOS design issues and hardware software co-design methodologies. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	H	M	H	M	H			M		M
CO3	H	M	M	M	M	M			M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	M	M	M	M	M			M		M
CO6	H	H	M	H	M	H			M		M
CO7	H	M	M	M	M	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE05 VIRTUAL REALITY

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Geometric modeling*
- *Virtual environment.*
- *Virtual Hardwares and Softwares*
- *Virtual Reality applications*

UNIT I INTRODUCTION TO VIRTUAL REALITY L(9)

Virtual Reality & Virtual Environment : Introduction – Computer graphics – Real time computer graphics –Flight Simulation – Virtual environments –requirement – benefits of virtual reality- Historical development of VR : Introduction – Scientific Landmark -3D Computer Graphics :Introduction – The Virtual world space – positioning the virtual observer – the perspective projection – human vision – stereo perspective projection – 3D clipping – Colour theory – Simple 3D modeling.– Illumination models – Reflection models – Shading algorithms- Radiosity – Hidden Surface Removal – Realism-Stereographic image.

UNIT II GEOMETRIC MODELLING L(9)

Geometric Modeling: Introduction – From 2D to 3D – 3D space curves – 3D boundary representation - Geometrical Transformations: Introduction – Frames of reference – Modeling transformations – Instances –Picking – Flying – Scaling the VE – Collision detection - A Generic VR system: Introduction – The virtual environment – the Computer environment – VR Technology – Model of interaction – VR Systems

UNIT III VIRTUAL ENVIRONMENT L(9)

Animating the Virtual Environment: Introduction – The dynamics of numbers – Linear and Non-linear interpolation - The animation of objects – linear and nonlinear translation - shape & object inbetweening – free from deformation – particle system- Physical Simulation : Introduction – Objects falling in a gravitational field – Rotating wheels – Elastic collisions – projectiles – simple pendulum – springs – Flight dynamics of an aircraft.

UNIT IV VR HARDWARES AND SOFTWARES L(9)

Human factors : Introduction – the eye - the ear- the somatic senses - VR Hardware : Introduction – sensor hardware – Head-coupled displays –Acoustic hardware – Integrated VR systems-VR Software: Introduction –Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML.

UNIT V VR APPLICATION L(9)

Virtual Reality Applications: Introduction – Engineering – Entertainment – Science – Training – The Future: Introduction – Virtual environments – modes of interaction.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. John Vince, "**Virtual Reality Systems** ", Pearson Education Asia, 2007.
2. Gregory C. Burdea & Philippe Coiffet "**Virtual Reality Technology**", Second Edition, John Wiley & Sons, 2006.
3. Adams, "**Visualizations of Virtual Reality**", Tata McGraw Hill, 2000.
4. William R. Sherman, Alan B. Craig, "**Understanding Virtual Reality: Interface, Application, and Design**", Morgan Kaufmann, 2008.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Explain the basic concepts of virtual environments. ***[Familiarity]***

CO2: Apply geometric modeling and implement 3D interaction techniques. ***[Usage]***

CO3: Develop immersive virtual reality applications. ***[Usage]***

CO4: Identify required virtual hardware and software for modeling virtual world**. *[Usage]***

CO5: Explore different Virtual Reality applications. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	M	M	M	M	M			M		M
CO5	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE06 ADVANCED MICROCONTROLLERS AND APPLICATIONS IN EMBEDDED SYSTEMS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *RL78 Microcontroller Architecture, Clock and Operating Modes*
- *Instruction set and fail-safe features of RL78*
- *RL78 peripherals: I/O ports, communication functions, timers, data converters*
- *Introduction to arm cortex m3 microcontrollers*
- *Hands-on exposure and applications on RL78*

UNIT I RL78 MICROCONTROLLER ARCHITECTURE,CLOCK AND OPERATING MODES L(9)

New generation embedded systems: low power operations, high performance, battery operated embedded systems, Introduction to RL78 microcontrollers, General purpose registers, Memory space, Flash mirror facility,Boot clusters, Special function registers, Pipeline execution.RL78 clock circuitry and operating modes:Operating modes,Reset management,Power-on-reset,Voltage detection circuit,Applying voltage detection circuits.

UNIT II INSTRUCTION SETAND FAIL-SAFE FEATURES OF RL78 L(9)

Instruction set, Addressing modes, Types of Instructions, Types of interrupts, Interrupt sources and configurations, Interrupt priority, Interrupt servicing, Key interrupt functions, Introduction to fail-safe standard IEC60730,Usage of CRC in memory, Detection of abnormal CPU operation

UNIT III RL78 PERIPHERALS: I/O PORTS, COMMUNICATION FUNCTIONS, TIMERS, DATA CONVERTERS L(9)

RL78 Peripheral functions: I/O ports, port architecture, port operations, port controlling registers, serial ports of RL78,Functions of 3-wire serial I/O,Functions of UART channels, Functions of simplified IIC channels, Functions of LIN communications ,Timer array units, PWM output generation, One-shot pulse outputs, Multiple PWM outputs, Interval timers, Real time counters, Watchdog timers, Analog to Digital Converter overview, A/D conversion operations, A/D conversion modes, Flash memory configurations, Flash memory programming.

UNIT IV INTRODUCTION TO ARM CORTEX M3 MICROCONTROLLERS L(9)

Introduction to STM32F1xx family, Overview of Cortex-M3 architecture, Bus configurations and Memory structure, Reset and Clock circuitry, General purpose and alternate function I/Os, Interrupts and events, DMA controller, Data converters, Timers, Watchdog timers, Flexible static memory controller, SDIO, communication facilities like SPI, IIC, CAN, Ethernet, USB.

UNIT V HANDS-ON EXPOSURE AND APPLICATIONS ON THE ABOVE MICROCONTROLLERS **L(9)**

Understanding code development environment for above microcontrollers, Debugging tools, Study of salient features of the microcontrollers.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Alexander G. Dean and James M. Concord, "**Creating Fast, Responsive and Energy-Efficient Embedded Systems using the Renesas RL78 Microcontroller**", Micrim Press 2012.
2. Joseph Yiu, "**The definitive guide to the ARM CORTEX-M3**", Elsevier, Second Edition, 2010
3. Michael Barr, Anthony Massa, "**Programming Embedded Systems with C and GNU Development Tools**", 2nd Edition, O'Reilly, 2009.
4. Tammy Noergaard, "**Embedded Systems Architecture: A Comprehensive Guide for engineers & Programmers**", Elsevier, Second Edition, Newnes, 2013.
5. Joseph Yiu, "**The Definitive Guide To ARM Cortex – Mo And Cortex – MD – Processors"** Elsevier, Second Edition, Newnes, 2015.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Explain RL78 Microcontroller Architecture, Clock and Operating Modes. ***[Familiarity]***

CO2: Explain Instruction set and fail-safe features of RL78. ***[Familiarity]***

CO3: Describe RL78 peripherals: I/O ports, communication functions, timers, data converters. ***[Familiarity]***

CO4: Describe arm cortex m3 microcontrollers. ***[Familiarity]***

CO5: Develop applications using RL78. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	M	M	M	M	M			M		M
CO4	H	H	M	H	M	H			M		M
CO5	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE07 VIRTUALIZATION TECHNIQUES

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Basics of virtualization*
- *Types of virtualization*
- *Concepts of virtualization and virtual machines*
- *Practical virtualization solutions and enterprise solutions*
- *Creation of virtual private network*

UNIT I OVERVIEW OF VIRTUALIZATION L(9)

Basics of Virtualization – Types of Virtualization Techniques – Merits and demerits of Virtualization – Full Vs. Para-virtualization – Virtual Machine Monitor/Hypervisor - Virtual Machine Basics – Taxonomy of Virtual machines – Process Vs System Virtual Machines – Emulation: Interpretation and Binary Translation - HLL Virtual Machines.

UNIT II SERVER AND NETWORK VIRTUALIZATION L(9)

Server Virtualization: Virtual Hardware Overview - Server Consolidation – Partitioning Techniques - Uses of Virtual server Consolidation – Server Virtualization Platforms, Network Virtualization: Design of Scalable Enterprise Networks – Layer2 Virtualization – VLAN - VFI - Layer 3 Virtualization – VRF - Virtual Firewall Contexts - Network Device Virtualization - Data- Path Virtualization - Routing Protocols.

UNIT III STORAGE AND APPLICATION VIRTUALIZATION L(9)

Hardware Devices – SAN backup and recovery techniques – RAID – Classical Storage Model – SNIA Shared Storage Model – Virtual Storage: File System Level and Block Level, Application Virtualization: Concepts - Application Management Issues - Redesign Application Management – Application Migration.

UNIT IV APPLYING VIRTUALIZATION L(9)

Practical Virtualization Solutions: Comparison of Virtualization Technologies: Guest OS/ Host OS – Hypervisor – Emulation – Kernel Level – Shared Kernel, Enterprise Solutions: VMWare Server – VMWareESXi – Citrix Xen Server – Microsoft Virtual PC – Microsoft Hyper-V – Virtual Box.

UNIT V APPLYING SERVER, DESKTOP AND NETWORK VIRTUALIZATION L(9)

Configuring Servers with Virtualization – Adjusting and Tuning Virtual servers – VM Backup – VM Migration, Desktop Virtualization: Terminal services – Hosted Desktop – Web-based Solutions – Localized Virtual Desktops, Network and Storage Virtualization: Virtual Private Networks – Virtual LAN – SAN and VSAN – NAS.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. James E. Smith, Ravi Nair**," Virtual Machines: Versatile Platforms for Systems and Processes"**, Elsevier/Morgan Kaufmann, 2005.
2. David Marshall, Wade A. Reynolds, **"Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center"**,Auerbach Publications, 2006.
3. Kumar Reddy, Victor Moreno, **"Network virtualization",** Cisco Press, July, 2006.
4. Danielle Ruest, Nelson Ruest, **"Virtualization: A Beginner's Guide",** TMH, 2009.
5. Kenneth Hess, Amy Newman: "**Practical Virtualization Solutions: Virtualization from the Trenches"**,Prentice Hall 2010.
6. Chris Wolf, Erick M. Halter, "**Virtualization: From the Desktop to the Enterprise**", A Press, 2005.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Deploy legacy OSs on virtual machines. **[*Usage*]**
CO2: Explain the intricacies of server, storage, network, desktop and application virtualizations. **[*Familiarity]***
CO3: Design new models for virtualization. **[*Usage*]**
CO4: Design and develop cloud applications on virtual machine platforms. **[*Usage]***
CO5: Configuring server, Desktop and Network virtualization. **[*Assessment*]**
CO6: Deploy virtual private network in cloud environment. **[*Usage*]**

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	M	H	M	H			M		M
CO6	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE08 SOFT COMPUTING

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Classifier of Neutral network*
- *Fuzzy sets and rules*
- *Neuro Fuzzy modelling techniques*
- *Genetic algorithms*
- *Integration of hybrid systems.*

UNIT I NEURAL NETWORKS L(9)

Supervised Learning Neural Networks-Perceptrons-Adaline-Back propagation-Multilayer perceptrons-Radial Basis Function Networks- Unsupervised Learning and Other Neural Networks-Competitive Learning Networks-Kohonen Self-Organizing Networks-Learning Vector Quantization-Hebbian Learning.

UNIT II FUZZY LOGIC SYSTEM L(9)

Fuzzy Sets-Basic Definition and Terminology- Set-theoretic operations-Member Function-Fuzzy Rules and FuzzyReasoning-Extension principle and Fuzzy Relations- Fuzzy If-Then Rules-Fuzzy Reasoning- Fuzzy Inference Systems-Mamdani Fuzzy Models-Sugeno Fuzzy Models-Defuzzification.

UNIT III NEURO FUZZY MODELING L(9)

Adaptive Neuro-Fuzzy Inference Systems-Architecture-Hybrid Learning Algorithm-learning Methods that Cross-fertilize ANFIS and RBFN-Coactive Neuro-Fuzzy Modeling-Framework-Neuron Functions for Adaptive Networks-Neuro Fuzzy Spectrum

UNIT IV GENETIC ALGORITHMS L(9)

Traditional optimization and search methods-Simple Genetic Algorithm-Reproduction-Crossover-Mutation-Schemata-Schema Theorem-Two and K-arm Bandit Problem-Improvements in basic Techniques-Selection Schemes-Scaling Mechanisms-Ranking Procedures

UNIT V HYBRID SYSTEMS L(9)

Integration of neural networks, fuzzy logic and genetic algorithms

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1 Jang J.S.R., Sun C.T. and Mizutani E, "**Neuro - Fuzzy and Soft Computing** ", Pearson Education, 2009.

2 Timothy J.Ross, "**Fuzzy Logic with Engineering Applications**", John Wiley and sons Pvt.Ltd. 2010.

3 Zimmermann.H.J, "**Fuzzy Set Theory and its Applications**", Fourth Edition, Kluwer Academic Publishers, 2013.

4 James J. Buckley and EsfandiarEslami, "**Advances in Soft Computing-An Introduction to Fuzzy Logic and Fuzzy Sets**", Springer International Edition, 2011.

5 Davis E. Goldberg, "**Genetic Algorithms: Search, Optimization and Machine Learning**" Addison Wesley, N.Y., 1989.

6 S.Rajasekaran and G.A.V.Pai, "**Neural Networks, Fuzzy Logic and Genetic Algorithms**", PHI, 2003.

7 Elaine Rich, Kevin Knight, "**Artificial Intelligence**", Third Edition, Tata McGraw Hill, 2011.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Analyze various neural network architectures. [***Assessment*]**

CO2: Analyze the ideas of Neural networks, fuzzy logic and use of heuristics. [***Assessment***]

CO3: Explain Fuzzy sets and rules. [***Familiarity]***

CO4: Analyze and gain insight onto Neuro Fuzzy modeling and control. [***Assessment*]**

CO5: Analyze the genetic algorithms and their applications. [***Assessment]***

CO6: Implement soft computing techniques and their applications. [***Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	M	H	M	H			M		M
CO2	H	H	M	H	M	H			M		M
CO3	H	M	M	M	M	M			M		M
CO4	H	H	M	H	M	H			M		M
CO5	H	H	M	H	M	H			M		M
CO6	H	H	H	M	H	M			M	L	M

H = 3 ; M = 2 ; L = 1

18CSPE09 MACHINE LEARNING
(Common to AE and CSE)

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *The characteristics of machine learning that make it useful to real-world problems and the basic underlying concepts, Characteristics of supervised machine learning algorithms.*
- *Unsupervised algorithms for clustering, Instance-based learning and Principal Component Analysis.*
- *The inference and learning algorithms for the hidden Markov model and Bayesian networks and few machine learning tools.*
- *Reinforcement learning algorithms.*
- *Various advanced machine learning algorithms in a range of real-world applications.*

UNIT I INTRODUCTION L(9)

Introduction- Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning: Classification and Regression Trees, Support vector machines - Model Selection and feature selection – Decision trees-Ensemble methods :Bagging - Boosting - Real-world applications.

UNIT II UNSUPERVISED LEARNING L(9)

Unsupervised learning : Clustering, Instance-based learning- K-nearest Neighbor, Locally weighted regression, Radial Basis Function - EM- Mixtures of Gaussians-The Curse of Dimensionality-Dimensionality Reduction -Factor analysis -Principal Component Analysis - Probabilistic PCA-Independent components analysis.

UNIT III PROBABILISTIC GRAPHICAL MODELS L(9)

Graphical Models -Undirected graphical models-Markov Random Fields -Directed Graphical Models -Bayesian Networks -Conditional independence properties -Inference –Learning-Generalization -Hidden Markov Models – Machine learning tools – R,Scikit Learn, Octave, BigML , WEKA.

UNIT IV REINFORCEMENT LEARNING L(9)

Reinforcement Learning – Introduction -Elements of Reinforcement Learning – Learning Task – Q-learning – k-armed Bandit Elements – Model-Based learning – Value Iteration – Policy iteration – Temporal Difference Learning - Exploration Strategies – non-deterministic rewards and actions

UNIT V ADVANCED MACHINE LEARNING L(9)

Introduction to learning theory - Modeling structured outputs: multi-label classification, introduction to Conditional Random Fields (CRFs)- Spectral clustering- Semi-supervised learning - Recommendation systems - Active Learning - Learning from streaming data, online-learning - Deep learning.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Tom Mitchell, **"Machine Learning"**, McGraw-Hill, 1997
2. Christopher Bishop, "**Pattern Recognition and Machine Learning",** Springer, 2006
3. Richard Sutton and Andrew Barto, **Reinforcement Learning: An introduction",** MIT Press,1998
4. Kevin P. Murphy, **"Machine Learning: A Probabilistic Perspective"**, MIT Press, 2012
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, **"The Elements of Statistical Learning"**, Second Edition ,Springer, 2011
6. EthemAlpaydin, **"Introduction to Machine Learning"**, Third Edition, MIT Press, 2014.
7. http://DeepLearning.net.
8. http://active-learning.net.

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1: Explain and discuss the basic concepts, fundamental issues and challenges of machine learning algorithms and the paradigms of supervised learning. ***[*Familiarity*]***

CO2: Explain and discuss the basic concepts of un-supervised machine learning. ***[*Familiarity*]***

CO3: Design and implement some basic machine learning algorithms using Machine learning tools. ***[Usage]***

CO4: Explain and discuss the basic concepts and architecture of reinforcement learning algorithms. ***[*Familiarity*]***

CO5: Design and implement various advanced machine learning algorithms in a range of real-world applications. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	M	M	M	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	M	M	M	M	M			M		M
CO5	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE10 PARALLEL ALGORITHMS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Parallel Computing Architecture*
- *Fundamentals of parallel algorithms*
- *Analysis of Parallel algorithm*
- *Applications of parallel algorithms*
- *Parallelization of Fast Fourier transforms, linear equations and partial differential equations*

UNIT I PARALLEL COMPUTING ARCHITECTURE L(9)

Introduction to parallel computers: Parallel Computing, Shared memory multiprocessors, Distributed Memory Multiprocessors, SIMD, Systolic processor, Cluster, Grid Computing, Multicore systems, SM, Communication between parallel processors – Shared memory multi processors: Cache coherence and Memory Consistency – Interconnection Networks: Classification and Interconnection.

UNIT II FUNDAMENTALS OF PARALLEL ALGORITHMS L(9)

Concurrency platforms: Cilk++, OpenMP, CUDA – Adhoc techniques for parallel algorithms: Independent loop scheduling, dependent loops, loop spreading, loop unrolling, problem partitioning, Divide and Conquer strategies, pipelining – Non serial Parallel algorithms.

UNIT III ALGORITHM ANALYSIS L(9)

Z-Transform analysis: Definition, DFA, Software and Hardware implementations of zTransform and various designs – Dependence Graph analysis: DFA, Deriving dependence graph of an algorithm, Scheduling function, Node projection operation, Nonlinear projection operation, Software and hardware implementations – Computational Geometry analysis.

UNIT IV APPLICATIONS L(9)

Pattern matching: Expressing the algorithm as RIA, Obtaining algorithm dependence graph, Data scheduling, DAG node projection – Motion estimation for video compression – Multiplication over GF (2m) – Polynomial division over GF(2).

UNIT V CASE STUDY L(9)

The Fast Fourier transforms: Decimation-in-time FFT, pipeline Radix 2Decimation-in-time FFTprocessor, Decimation-in-frequency FFT, pipeline Radix 2Decimation-in-frequency FFTprocessor– Solving systems of Linear equations – Solving partial differential equations.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1 Fayez Gebali, "**Algorithms and Parallel Computing**", Wiley publications, 2011.

2 A.Grama, A.Gupta, G.Karypis and V.Kumar, "**Introduction to Parallel Computing**", Second Edition, Addison-Wesley, 2003.

3 Barry Wilkinson and Michael Allen, "**Parallel programming: techniques and applications using networked workstations and parallel computers**", Pearson Education, 2003.

4 Joseph JaJa, "**An introduction to Parallel Algorithms**", Addison-wesley publications, 1992.

5 Selim G. Akl, "**Design and analysis of parallel algorithms**", Prentice Hall, 1989.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Explain the architecture of Parallel Computing Systems. ***[Familiarity]***

CO2: Explain shared memory multiprocessors and Interconnection networks. ***[Familiarity]***

CO3: Use adhoctechniques for parallel and non-serial parallel algorithms. ***[Usage]***

CO4: Perform parallel algorithm analysis. ***[Assessment]***

CO5: Write parallel algorithms for applications such as pattern matching, video compression etc. ***[Usage]***

CO6: Solve Systems of Linear equations, FFT, partial differential equationsusing Parallelization. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	M	H	M	H			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE11 FUZZY LOGIC AND NEURAL NETWORKS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Basics of fuzzy sets and fuzzy logic.*
- *Fuzzyfication and de-fuzzyfication methods.*
- *Neural network learning rules and training algorithms.*
- *Different neural network architectures and applications.*
- *Applications of neural networks and fuzzy logic.*

UNIT I INTRODUCTION L(9)

Properties and operations on Classical and Fuzzy sets-Crisp and Fuzzy Relations-Cardinality, Properties and operations, Composition, Tolerance and Equivalence relations,-Simple Problems. Membership functions: Features of membership functions-Standard forms and Boundaries-Fuzzyfication, membership value assignments, Fuzzy to Crisp Conversions, Lambda Cuts for fuzzy sets and relations, Defuzzzyfication methods**.**

UNIT II ARCHITECTURE L(9)

Typical Architecture, Common Activation Functions, McCulloch-Pitts Neuron, Learning Rules, Simple Neural Nets For Pattern Classification: Architecture, Biases and Thresholds, Linear Separability, Hebb Net-Perceptron-Adaline.

UNIT III TRAINING ALGORITHM L(9)

Training Algorithm for Pattern Association-Hebb rule and Delta Rule, Heteroassociative, Auto associative and Iterative Auto Associative Net, Bidirectional Associative Memory- Storage and Retrieval Algorithms-Neural Network based on Competition: Fixed weight Competitive Nets-Kohonen Self-Organizing Maps-Linear vector Quantization.

UNIT IV ADAPTIVE RESONANCE NEURAL NETWORKS L(9)

Adaptive Resonance Neural networks:ART1 and ART2-Basic operation and Algorithm, BackPropagation Neural Net- Boltzman Machine Learning-Neocognitron-Architecture, Algorithms.

UNIT V ADAPTIVE RESONANCE NEURAL NETWORKS L(9)

Adaptive Resonance Neural networks: Pattern Recognition-Image Compression-Communication-Control systems. Application of Fuzzy Logic: Fuzzy Clustering-Fuzzy pattern Recognition-Fuzzy Image Processing-Fuzzy Databases-Fuzzy Information retrieval.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1 Laurene Fausett, "**Fundamentals of Neural Networks"**, Pearson Education India, 2008.

2 Timothy J.Ross, "**Fuzzy Logic with Engineering Applications**", John Wiley and sons Pvt.Ltd. 2010.

3 J.A.Freeman and B.M.Skapura, "**Neural Networks, Algorithms applications and Programming Techniques**",Pearson, 2002.

4 Klir G.J. and Folger.T, "**Fuzzy sets,Uncertainty and Information**",Prentice Hall, 1991.

5 Zimmermann.H.J, "**Fuzzy Set Theory and its Applications**", Fourth Edition, Kluwer Academic Publishers, Dordrecht, Germany, 2013.

6 Zurada J.M. "**Introduction to Artificial Neural Systems**",Jaico Publishing House,1994.

7 James J. Buckley and Esfandiar Eslami, "**Advances in Soft Computing-An Introduction to Fuzzy Logic and Fuzzy Sets**", Springer International Edition, New Delhi,2011.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Perform simple arithmetic, logical and geometric operations on classical and fuzzy sets. **[*Usage*]**

CO2: Use fuzzification and defuzzification methods. **[*Familiarity]***

CO3: Apply activation functions suitable for different neural networks and Solve linearly separable problems. **[*Usage]***

CO4: Apply training algorithm suitable for pattern classification, pattern association, pattern matching, image compression and storage and retrieval. **[*Usage]***

CO5: Discuss the features, operations and applications of Adaptive resonance neural networks, Boltzman Machine, Neocognitron and backpropagation networks.**[*Familiarity]***

CO6: Apply neural network and fuzzy logic techniques for real time applications. **[*Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	M			M		M
CO2	H	M	M	M	M	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	M	M	M	M	M			M		M
CO6	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE12 NETWORK OPTIMIZATION TECHNIQUES

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Network Flow Algorithms*
- *Max-Flow and Min-Cost algorithms*
- *Simplex, dual ascent methods and auction algorithms*
- *Nonlinear network optimization*
- *Convex separable and Integer constraints network problems*

UNIT I NETWORK FLOW MODELS L(9)

Introduction - Graphs and Flows - Network Flow Models - Network Flow Algorithms - Problem Formulation and Applications - Shortest Path Algorithm - Label Setting (Dijkstra) Methods - Label Correcting Methods - Comparison of Label Setting and Label Correcting - Single Origin/Single Destination Methods - Auction Algorithms - Multiple Origin/Multiple Destination Methods.

UNIT II MAX-FLOW AND MIN-COST FLOW PROBLEM L(9)

The Max -Flow and Min-Cut Problems - The Ford-Fulkerson Algorithm - Price-Based Augmenting Path Algorithms - Transformations and Equivalences - Duality.

UNIT III SIMPLEX, DUAL ASCENT METHODS AND AUCTION ALGORITHMS L(9)

Main Ideas in Simplex Methods - The Basic Simplex Algorithm - Extension to Problems with Upper and Lower Bounds - Dual Ascent - Primal-Dual Method - Relaxation Method - Implementation Issues -Auction Algorithm for the Assignment Problem - Extensions of the Auction Algorithm - Preflow-Push Algorithm for Max-Flow –ε-Relaxation Method - Auction/ Sequential Shortest Path Algorithm.

UNIT IV NONLINEAR NETWORKOPTIMIZATION L(9)

Convex and Separable Problems - Problems with Side Constraints - Multicommodity Flow Problems -Integer Constraints - Networks with Gains - Optimality Conditions - Duality- Algorithms and Approximations.

UNIT V CONVEX SEPARABLE AND INTEGER CONSTRAINTS NETWORK PROBLEMS L(9)

Convex Functions of a Single Variable - Optimality Conditions - Dual Function Differentiability - Algorithms for Differentiable Dual Problems - Auction Algorithms - Monotropic Programming- Integer -Constrained Problems - Branch-and-Bound - Lagrangian Relaxation - Local Search Methods - Rollout Algorithms.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1 Dimitri P. Bertsekas "**Network optimization: Continuous & Discrete Models**", Athena Scientific, Belmont, Massachusetts, 1998.

2 Magnanti.T.L., Orlin.J.B., "**Network Flows: Theory, Algorithm and Applications**", Prentice Hall,1993

3 Cook.W.J.,Cunningham.W.H., Pulleyblank.W.R., and Schrijver.A," **Combinatorial Optimization**", John Wiley&Sons,1998.

4 R. Tyrrell Rockafellar, "**Network Flows and MonotropicOptimization",**Wiley, 1984.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Use the right network flow algorithm. ***[Assessment]***
CO2: Assess the performance of label correcting and setting methods. ***[Assessment]***
CO3: Optimize Max flow and min cost flow problems. ***[Assessment]***
CO4: Use Simplex Methods, Dual Ascent and Auction Algorithms for Min-Cost flow problem. ***[Usage]***
CO5: Perform Non-Linear Network Optimization. ***[Usage]***
CO6: Solve Convex separable and Integer constraints network problems. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	M	H	M	H			M		M
CO2	H	H	M	H	M	H			M		M
CO3	H	H	M	H	M	H			M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE13 THEORY OF MODERN COMPILERS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Intermediate Representations*
- *Control and Data flow analysis*
- *Early and loop Optimization*
- *Procedure optimization and scheduling*
- *Interprocedural analysis and memory hierarchy optimization*

UNIT I INTERMEDIATE REPRESENTATIONS L(9)

Introduction to compiler technologies - Review of compiler Structure -Intermediate Representations - Run Time Support: Data representations and Instructions, Register Usage, The local stack frame, Run time Stack, Parameter Passing, Procedure Prologues, Epilogues, Call and returns, Code sharing and position independent code-Producing Code Generators Automatically.

UNIT II FLOW ANALYSIS L(9)

Control Flow Analysis -Data Flow Analysis: Iterative data flow analysis, Lattices of flow functions, Control tree based data flow analysis, Structural analysis, Interval analysis - Dependence Analysis and Dependence Graph-Alias Analysis.

UNIT III EARLY OPTIMIZATIONS AND LOOP OPTIMIZATIONS L(9)

Introduction to optimization, Importance of Individual optimizations, Order and repetition of optimizations - Early Optimization: Constant folding, Scalar replacement of aggregates, Algebraic simplifications and Reassociation, Value Numbering, Copy and Constant Propagation-Redundancy Elimination-Loop Optimizations

UNIT IV PROCEDURE OPTIMIZATION AND SCHEDULING L(9)

Procedure Optimizations-Register Allocation - Code Scheduling –Control-Flow and Low- Level Optimizations: Unreachable code elimination, Straightening, If and Loop simplification, Loop inversion, Unswitching, Branch Optimizations, Tail merging, Conditional moves, deadcode elimination, Branch prediction.

UNIT V INTERPROCEDURAL ANALYSIS AND MEMORY HIERARCHY OPTIMIZATION L(9)

Interprocedural Analysis and Optimizations: Control flow, Dataflow and Alias analysis, Constant Propagation, Optimization and Register allocation – Optimization for the Memory Hierarchy: Impact of data and Instruction caches and Optimizations

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. A V Aho, Monical Lam, R Sethi, J D Ullman ,**"Compilers: Principles, Techniques, and Tools"**, Second Edition ,2008
2. Steven Muchnick.,**"Advanced Compiler Design and Implementation"**, MorganKaufmann Publishers, Elsevier,2008.

3 Randy Allen & KenKennedy**, "Optimizing Compilers for Modern Architectures"**, Morgan Kaufmann, Elsevier, 2002.

4 Andrew W. Appel, Jens Palsberg, **"Modern Compiler Implementation in Java"**, Second Edition, Cambridge University Press, 2002

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1: Explain the phases of compilers. ***[Familiarity]***
CO2: Generate Intermediate representations. ***[Usage]***
CO3: Perform control and data flow analysis. ***[Usage]***
CO4: Eliminate redundancy from IR and Target Code. ***[Usage]***
CO5: Optimize loops, Procedures and Memory Hierarchy. ***[Usage]***
CO6: Generate target code. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	H	H	M	H	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE14 DISTRIBUTED NETWORK ALGORITHMS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *The principles and practice in the area of Distributed Systems.*
- *Vertex coloring, leader Election, Maximal independent set, dominating set, locality lower bounds distributed network algorithm.*
- *Distributed routing algorithms*
- *Distributed Fault-tolerance, consensus and Leader Election*
- *The various real-world distributed network algorithms applications.*

UNIT I INTRODUCTION L(9)

Distributed Computing – Framework -Fundamental issues in distributed computing: communication, limited knowledge, failures, timing, and synchrony ad algorithmic and programming difficulties. Distributed computing models: shared memory versus message passing, synchronous versus asynchronous, CONGEST versus LOCAL; Complexity measures - time and message complexity. Topology & routing - Basic algorithms: Broadcast, Convergecast, Upcast, Downcast. Tree Algorithms: Spanning Tree, Minimum Spanning Tree.Distributed Shortest Paths Algorithms : Bellman-Ford Algorithm

UNIT II DISTRIBUTED NETWORK ALGORITHMS -I L(9)

Symmetry breaking: Randomization -Vertex coloring – Leader Election – Distributed sorting – shared Memory –Shared Objects –Maximal Independent set – Dominating Set –Locality Lower bounds – Social Networks.

UNIT III DISTRIBUTED NETWORK ALGORITHMS -II L(9)

Routing: Array –mesh –Hot-potato Routing –Shortest path routing – compact routing –other routing schemes – Routing Strikes Back-Distributed approximation algorithms - Synchronization – Hard problems –stabilization: Self-Stabilization –Advanced stabilization– Labeling Schemes -All-to-all Communication.

UNIT IV DISTRIBUTED NETWORK ALGORITHMS -III L(9)

Asynchronous systems : synchronizers –logical time –global snapshots – Fault-tolerance: Fundamental algorithms under failure and adversarial models – consensus and Leader Election. Multi-core computing -Byzantine Agreement -Authenticated Agreement - Distributed Storage.

UNIT V REAL-WORLD DISTRIBUTED NETWORKS L(9)

Peer-to-peer and dynamic networks: Models and Algorithmic issues– Wireless and Sensor networks: Models and Algorithmic issues – Distributed processing of Large –scale data: Models and Algorithmic issues in systems such as MapReduce Algorithms and Pregel – Overlay Design- datacenter networks – Virtual networks – Software-defined networks.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. DavidPeleg, "**Distributed Computing: A Locality Sensitive Approach**", SIAM, Philadelphia., 2000.
2. K. Erciyes, "**Distributed Graph Algorithms for Computer Networks**" Springer-Verlag London, 2013.
3. Stefan Schmid and parathasarathimandal, "**Lecture notes for GIAN course on Distributed network Algorithms**", 2016. https://www.net.t-labs.tu-berlin.de/~stefan/NetAlg13.pd
4. RogerWattenhofer," **Distributed ComputingNotes**" http://www. dcg.ethz.ch/lectures/podc/
5. Nancy Lynch," **Distributed Algorithms**", Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 1996.
6. Gerard Tel," **Introduction to Distributed Algorithms**", second edition. Cambridge University Press, 2000.
7. Robert SedgewickandKevin Wayne,**"Algorithms",** fourth edition, Pearson Education ,2011.
8. T. H. Cormen, C. E. Leiserson, R. Rivest, and C. Stein. **Introduction to Algorithms**. MIT Press, 2009
9. Research Papers published in IEEE, ACM, Elsevier publishers, etc.

COURSE OUTCOMES: Upon Completion of the course, the students will be able to:

CO1: Explain the basic concepts, framework and model of Distributed Computing. ***[Familiarity]***

CO2: Analyse the vertex coloring, leader Election , Maximal independent set , dominating set, locality lower bounds distributed network algorithm. ***[Usage]***

CO3: Analyse the basic concepts of routing, routing strikes back, distributed approximation algorithms, Synchronization and Self-Stabilization. ***[Usage]***

CO4: Explain the Fault-tolerance, consensus and Leader Election. Multi-core computing – Byzantine Agreement distributed network algorithms. ***[Familiarity]***

CO5: Explain the basic concepts, model and Algorithmic issues of real-world distributed networks. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			H		M
CO2	H	H	H	M	H	L			M		M
CO3	H	H	H	L	H	L			L		L
CO4	H	M	M	L	M	M			L		L
CO5	H	M	M	M	L	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE15 INTERNET OF THINGS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Fundamental characteristics of IoT and its applications*
- *Standardization efforts for IoT*
- *Data link and network layer functionality of IoT*
- *Communication between things and data discovery among IoT devices*
- *Security issues concerning IoT*

UNIT I INTRODUCTION TO INTERENT OF THINGS L(9)

Definition and Characteristics – Physical Design of IoT – Things in IoT – Logical Design of IoT- IoT Functional blocks, communication model and enabling technologies. Applications of domain specific IoT systems such as smart environment, smart energy, smart agriculture and smart health, IoT levels.IoTVs M2M, SDN and NVF for IoT.

UNIT II IoT STANDARDIZATION AND INTEROPERABILITY L(9)

Defining a common architecture, iCore functional architecture, M2M service level standardizations, OGC sensor web for IoT, Data Interoperability, Semantics Interoperability, Organizational Interoperability and Eternal Interoperability, IoT testing methodologies, Semantics as an interoperability enabler.

UNIT III DATA LINK AND THE NETWORK LAYER L(9)

The data link layer for IoT - EEE 802.15.4 and the Internet of things – Low Power Link Layer Security for IoT: Implementation and Performance Analysis, RFIDIoT: RFID as the data link layer for the internet of things. The network layer for IoT - Routing protocols in Internet of Things - An Improved AOMDV Routing Protocol for Internet of Things

UNIT IV COMMUNICATION AND SERVICE DISCOVERY L(9)

Communication protocols for IoT - Service oriented protocols (COAP) - Communication protocols based on the exchange of messages (MQTT) - Analysis on IoT communication protocol. Service discovery protocols - The data processing for IoT - Lightweight service discovery protocols for constrained environment - Organization of data processing for the Internet of Things.

UNIT V SECURITY AND FUTURE RESEARCH L(9)

Security in the Internet of Things – A review. Big data in IoT, platforms for Big data in IoT - Cloud computing – issues of incorporating cloud in IoT - Fog computing.Case study – Smarter Classrooms.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. ArshdeepBahga, Vijay Madisetti, **"Internet of Things A Hands on Approach"**, 2014.
2. OvidivVermesan, Peter Friess, **"Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems"**, River publications, 2013.
3. Charalampos doucas, **"Building the Internet of Things with Arduino"**, Create Space, 2002
4. Dieter Uckelmann, **"Architecting the Internet of Things"**, Springer 2011.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Define things and understand the functional building blocks of IoT. ***[Familiarity]***
CO2: Explain domain specific applications of IoT and levels of IoT.***[Familiarity]***
CO3: Analyze the need for standardization and explain the functional architecture of IoT. ***[Assessment]***
CO4: Use semantic, data and organizational interoperability to resolve heterogeneity issues. ***[Usage]***
CO5: List protocols for data link layer in IoT and their functionalities and compare their performance.***[Assessment]***
CO6: List protocols for network layer in IoT and their functionalities and compare their performance.***[Assessment]***
CO7: Use COAP in the application layer for device to device interaction. ***[Usage]***
CO8: Exploit data processing in IoT through light weight service discovery protocol. ***[Assessment]***
CO9: Develop security principles for IoT. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	M	M	M	M	M			M		L
CO3	H	H	M	H	M	H			L		L
CO4	H	H	M	L	H	L			L		M
CO5	H	H	M	L	M	L			L		M
CO6	H	H	M	M	M	M			M		M
CO7	H	H	H	M	H	L			M		L
CO8	H	H	M	L	L	L	L		L	L	M
CO9	H	M	M	L	M	L	M		M	M	M

H = 3 ; M = 2 ; L = 1

18CSPE16 WIRELESS SENSOR NETWORKS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Wireless Sensor Networks*
- *Architecture of Wireless Sensor Networks*
- *Networking of Sensors*
- *Establishment of Infrastructure for WSN*
- *Sensor Network platforms and tools*

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS L(9)

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks-Enabling Technologies for Wireless Sensor Networks

UNIT II ARCHITECTURES L(9)

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

UNIT III NETWORKING OF SENSORS L(9)

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing

UNIT IV INFRASTRUCTURE ESTABLISHMENT L(9)

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS L(9)

Operating Systems for Wireless Sensor Networks, Sensor Node Hardware-Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Holger Karl & Andreas Willig, "**Protocols And Architectures for Wireless Sensor Networks"**, John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, **"Wireless Sensor Networks- An Information Processing Approach",** Elsevier, 2007.
3. Kazem Sohraby, Daniel ivlinoli, & Taieb Znati, **"Wireless Sensor Networks-Technology, Protocols, And Applications",** John Wiley, 2007.
4. Anna Hac, **"Wireless Sensor Network Designs",** John Wiley, 2003.
5. Bhaskar Krishnamachari, **"Networking Wireless Sensors",** Cambridge Press, 2005.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Explain the characteristics, requirements and applications of Wireless Sensor Networks. ***[Familiarity]***

CO2: Explain Architecture of Wireless Sensor Networks. ***[Familiarity]***

CO3: Illustrate MAC and routing protocols of WSN. ***[Usage]***

CO4: Establish Infrastructure for WSN. ***[Usage]***

CO5: Use Sensor Network platforms and tools. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	H	M	M			L		L
CO2	H	M	H	H	M	H			M		L
CO3	H	H	H	M	M	M			M		L
CO4	H	H	M	M	M	M			L		L
CO5	M	H	H	H	M	M			L		L

H = 3 ; M = 2 ; L = 1

18CSPE17 PERVASIVE COMPUTING

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Vision of Ubiquitous computing and smart devices.*
- *Human computer interaction.*
- *Intelligent systems and their interactions with artificial world.*
- *Managing communications among smart devices in the ubiquitous world.*
- *Cognitive networks and its future research.*

UNIT I SMART DEVICES AND SERVICES L(9)

Vision of ubiquitous computing, Modeling the Key Ubiquitous Computing Properties, Ubiquitous System Environment Interaction, Architectural Design for UbiCom Systems: Smart DEI Model, Smart Devices and Services, Service Architecture Models, Service Provision Life-Cycle, Virtual Machines and Operating Systems, Smart Mobiles, Cards and Device Networks, Smart Mobile Devices, Users, Resources and Code, Operating Systems for Mobile Computers and Communicator Devices, Smart Card Devices, Device Networks.

UNIT II HUMAN–COMPUTER INTERACTION L(9)

User Interfaces and Interaction for Four Widely Used Devices, Hidden UI Via Basic Smart Devices, Hidden UI Via Wearable and Implanted Devices, Human-Centered Design (HCD), User Models, Tagging, Sensing and Controlling - Sensors and Sensor Networks, Micro Actuation and Sensing: MEMS, Embedded Systems and Real-Time Systems, Control Systems (for Physical World Tasks), Robots, Context-Aware Systems – Mobility, Spatial and Temporal Awareness.

UNIT III INTELLIGENT SYSTEMS L(9)

Introduction, IS Architectures, Semantic KB IS, Soft Computing IS Models, IS System Operations, Intelligent System Interaction - Interaction Multiplicity, Interaction Design, Generic Intelligent Interaction Applications, Autonomous Systems - Basic Autonomous Intra-Acting Systems, Reflective and Self-Aware Systems, Autonomic Computing, Complex Systems, Artificial Life.

UNIT IV UBIQUITOUS COMMUNICATION L(9)

Audio Networks, Data Networks, Wireless Data Networks, Universal and Transparent Audio, Video and Alphanumeric Data Network Access, Ubiquitous Networks, Management of Smart Devices, Managing Smart Devices in Virtual Environments, Managing Smart Devices in Human User-Centered Environments, Managing Smart Devices in Physical Environments, Ubiquitous System: Challenges and Outlook, Smart Physical Environment Device Interaction, Human Intelligence Versus Machine Intelligence

UNIT V COGNITIVE NETWORKS L(9)

Introduction to Biologically Inspired Networking, The road map to Cognitive networks, Vision of Cognitive networks, Cognitive network design, The Role of Autonomic Networking in Cognitive Networks – Future research in cognitive networks, Adaptive Networks and Self-Managing Networks –design issues and research challenges.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Stefan Poslad, **"Ubiquitous Computing: Smart Devices, Environments and Interactions"**, Wiley, 2009.
2. Qusay Mahmoud, **"Cognitive Networks: Towards Self-Aware Networks"**, Wiley 2007.
3. Mohammad S .Obaidat et al, **"Pervasive Computing and Networking"**, John Wiley, 2007.
4. Frank AdelsteinSandeep K. S. Gupta Golden G. Richard III Loren Schwiebert **"Fundamentals of Mobile and Pervasive Computing",** McGraw-Hill, 2005.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Explain architectural design and service models for UbiCom Systems. ***[Familiarity]***

CO2: Analyze interactions between UbiCom devices, devices and people (HCI), devices and the physical world. ***[Assessment]***

CO3: Explain intelligent system architectures, autonomous intra systems and self aware systems. ***[Familiarity]***

CO4: Use smart devices in virtual environment, establish communications and manage ubiquitous networks. ***[Usage]***

CO5: Explain design issues and research challenges in cognitive networks. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		L
CO2	H	H	M	H	M	H			M		L
CO3	H	M	M	L	M	M			L		M
CO4	H	H	H	L	H	L			L		L
CO5	H	M	M	L	M	L			M		L

H = 3 ; M = 2 ; L = 1

18CSPE18 SOFTWARE DEFINED NETWORKING

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *The basics of SDN, the difference between control and data plane, functions performed by each plane, infrastructure that supports the control plane and the data plane and challenges of separation.*
- *The basics of Network Virtualization, in-depth architectures and deployment models for SDN-based network virtualization and SDN controllers.*
- *The controlplane, data plane, Testing and verification and security of SDN.*
- *SDN Programming concepts using the pythonandNetwork Functions Virtualization (NFV)*
- *Basic architectural principles, fundamental mechanisms and technical challenges arising from SDNs as well as the potential issues in applying SDNs to data centers, security and other applications and contexts.*

UNIT I INTRODUCTION L(9)

History and Evolution of Software Defined Networking (SDN): Separation of Control Plane and Data Plane, IETF Forces, Active Networking. Control and Data Plane Separation - Concepts, Advantages and Disadvantages, OpenFlow protocol Fundamentals - OpenFlow - Enabling Innovation in Campus Networks.

UNIT II NETWORK VIRTUALIZATION AND CONTROL PLANE L(9)

Network Virtualization: Concepts, Architectural approaches,Applications, Existing NetworkVirtualization Framework (VMWare ,VirtualBox and others), Mininetand the Mininet Python API based examples.Control Plane: Overview, Existing SDN Controllers includingFloodlight ,ODL, ONOS, Ryu, POX and OpenDaylight.

UNIT III DATA PLANE AND LANGUAGE DESIGN L(9)

Customization of Control Plane: Switching and FirewallImplementation using SDN Concepts.Data Plane: Software-based and Hardware-based; Programmable NetworkHardware. Language Design - Testing and Verification - Security - Challenges - Opportunities.

UNIT IV PROGRAMMING SDNs L(9)

Programming SDNs: Motivation for Programming SDNs - Northbound Application Programming Interface,Current Languages and Tools - Frenetic -Procera, Composition of SDNs - Pyretic, Event-Driven SDN.Network Functions Virtualization (NFV) and Software DefinedNetworks: Concepts, Implementation and Applications.

UNIT V SDN APPLICATIONS THROUGH USE CASES L(9)

Data Center Networks: Packet, Optical and Wireless Architectures, Network Topologies.
Use Cases of SDNs: Data Centers and cloud, Internet Exchange Points, BackboneNetworks, Home Networks, Traffic Engineering.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Thomas D. Nadeau, Ken Gray, **"SDN: Software Defined Networks, An Authoritative Review of NetworkProgrammability Technologies"**, O'Reilly Media, August 2013.
2. PaulGoransson and Chuck Black, **"Software Defined Networks: A Comprehensive Approach"**, Morgan Kaufmann, June 2014.
3. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015.
4. OpenFlow standards, http://www.openflow.org, 2015.
5. Online Reading Lists, including: http://www.nec-labs.com/~lume/sdn-reading-list.html, 2015.
6. VivekTiwari, **"SDN and OpenFlow for Beginners"**, ASIN, 2013.

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1: Explain and discuss the basic concepts and architecture of SDN. ***[Familiarity]***
CO2: Compare and contrast conventional networking approaches and SDN. ***[Assessment]***
CO3: Analyze and apply implementation of SDN through Open Flow Switches. ***[Usage]***
CO4: Apply the SDN programming concepts using Python. ***[Usage]***
CO5: Implement, troubleshoot and debug SDNs through hands on illustrations. ***[Usage]***
CO6: Critically evaluate the pros and cons of applying SDN in WAN and data centers ***[Assessment]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	H	M	H	M	H			M		L
CO3	H	H	H	M	H	M			L		L
CO4	H	H	H	M	H	M			L		L
CO5	H	H	H	M	H	M			M		L
CO6	H	H	M	H	M	H			M		M

H = 3 ; M = 2 ; L = 1

18CSPE19 INFORMATION RETRIEVAL

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Fundamentals of Information Retrieval systems*
- *Static and Dynamic inverted indices*
- *Various language modelling and retrieval methods*
- *Usage of Queueing Theory and Scheduling*
- *Different kinds of Information Retrieval systems.*

UNIT I INTRODUCTION **L(9)**

Information Retrieval systems-Working with electronic text-Test Collections-Open source IR systems- Basic Techniques: Inverted indices, Retrieval and Ranking, Evaluation- Tokens and Terms.

UNIT II INDEXING **L(9)**

Static inverted indices-Query Processing-Index Compression- Dynamic inverted indices.

UNIT III RETRIEVAL AND RANKING **L(9)**

Probabilistic Retrieval-Language Modeling and Related Methods-Categorization and Filtering-Fusion and Meta learning.

UNIT IV EVALUATION **L(9)**

Measuring Effectiveness: Traditional Effectiveness Measures- The Text Retrieval Conference (TREC)- Using Statistics in Evaluation- Minimizing Adjudication Effort- Nontraditional Effectiveness Measures- Measuring Efficiency: Efficiency Criteria- Queueing Theory-Query Scheduling-Caching.

UNIT V APPLICATIONS **L(9)**

Parallel Information Retrieval: Parallel Query Processing, MAP Reduce - Web Search: Structure, Queries and Users, Ranking, Evaluation, Web Crawlers- XML Retrieval.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze,**"Introduction to Information Retrieval"**,Cambridge University Press, 2008.
2. Stefan Buttcher, Charles L. A. Clarke, V. Cormack,**"Information Retrieval Implementing and Evaluating Search Engines"**, MIT press,2010.
3. Robert Korfhage,**"Information Storage & Retrieval"**, John Wiley & Sons,2006.
4. D. Grossman and O. Frieder, **"Information Retrieval: Algorithms and Heuristics"**, Second Edition, Springer Publishers, 2004.
5. Gerald Kowalski, **"Information Retrieval Architecture and Algorithms"**, Springer Science & Business Media, 2010.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Explain the working of information retrieval system. ***[Familiarity]***

CO2: Differentiate between static and dynamic inverted indices. ***[Familiarity]***

CO3: Apply models like Bookstein's Two –Poisson, Approximating the Two-Poisson Model for Probabilistic Information Retrieval. ***[Usage]***

CO4: Compare Traditional and nontraditional effectiveness measures for text retrieval. ***[Familiarity]***

CO5: Develop parallel and XML information retrieval systems for efficient retrieval. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	M	M	M	M	M			M		L
CO3	H	H	H	M	H	M	L		L		M
CO4	H	M	M	M	M	L	L		L		L
CO5	H	H	H	M	H	L			L		L

H = 3 ; M = 2 ; L = 1

18CSPE20 SOCIAL NETWORKS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES**: **Upon completion of this course, the students will be familiar with,

- *Structure and properties of Social Networks*
- *Community discovery across Social Networks*
- *Privacy preserving mechanisms in Social Networks and predict the efficiency of links*
- *Building Social Network infrastructures*
- *Visualize Social Networks and explain applications of Social Networks*

UNIT I INTRODUCTION L(9)

Properties of social networks – static and dynamic properties - Random walks on graphs – Algorithms for Hitting and Commute Times - Algorithms for Computing Personalized Pagerank and Simrank - Algorithms for Computing Harmonic Functions - Applications in computer vision, text analysis, combating webspam and collaborative filtering.

UNIT II DISCOVERING COMMUNITIES L(9)

Communities in Context - Core methods – community discovery in dynamic, heterogeneous and directed networks- Classification of nodes - local classifiers – classifiers for large scale social networks. Social influence analysis – Similarity and influence maximization.

UNIT III PRIVACY AND LINK PREDICTION L(9)

Privacy breaches in social networks - k-anonymity - l-diversity and *t*-closeness - Privacy preserving mechanisms - social networks and affiliation networks. Link Prediction - Feature Set Construction - Classification Models - Bayesian Probabilistic Models - Link Prediction by Local Probabilistic Models, Network Evolution based Probabilistic Model and Hierarchical Probabilistic Model - Probabilistic Relational Models - Relational Bayesian Network and Relational Markov Network.

UNIT IV SOCIAL NETWORK INFRASTRUCTURES L(9)

Decentralized Online Social Networks - Multi-Relational Characterization of Dynamic Social Network Communities- Accessibility Testing of Social Websites - Understanding and Predicting Human Behavior for Social Communities - Associating Human-Centered Concepts with Social Networks Using Fuzzy Sets.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS L(9)

Visualization of Social Networks - Novel Visualizations and Interactions for Social Networks Exploration - Applications of Social Network Analysis - Online Advertising in Social Networks - Social Bookmarking on a Company's Intranet: A Study of Technology Adoption and Diffusion.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Charu C. Aggarwal, **"Social Network Data Analytics"**, Springer 2011.
2. BorkoFurht, **"Handbook of Social Network Technologies and Applications"**, Springer 2010
3. Stanley Wasserman, Katherine Faust. "**Social network analysis: methods and applications"**, Cambridge University Press, 2007
4. David Easley and Jon Kleinberg. "**Networks, Crowds, and Markets: Reasoning About a Highly Connected World"**, Cambridge University Press, 2010

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Compare static and Dynamic properties of Social Networks.***[Usage]***

CO2: Explain random walks in graphs and develop algorithms to perform random walks. ***[Familiarity]***

CO3: Develop methods to discover communities in large scale online Social Networks. ***[Assessment]***

CO4: Use Similarity and influence maximization techniques to analyze online Social Networks. ***[Usage]***

CO5: Use k-anonymity, l-diversity and *t*-closeness techniques to detect privacy threats in Social Networks ***[Usage]***

CO6: Explain link selection and use Bayesian Probabilistic Models to estimate the efficiency of the links in graphs. ***[Familiarity]***

CO7: Explain decentralized large scale online Social Networks. ***[Familiarity]***

CO8: Use fuzzy sets to understand human behavior in Social Network communities ***[Assessment]***

CO9: Visualize Social Networks using social network analysis tools and study applications of Social Networks. ***[Assessment]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	L	M	M			M		M
CO2	H	H	M	H	M	H	L		M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	M	L	M	H	H			M		M
CO7	H	M	M	M	L	H			M		M
CO8	H	H	L	H	L	H	L		M		M
CO9	H	M	M	H	L	H	L		M		M

H = 3 ; M = 2 ; L = 1

18CSPE21 CYBER FORENSICS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

***COURSE OBJECTIVES*: Upon completion of this course, the students will be familiar with,**

- *Cyber forensics technology*
- *Cyber Crime Laws*
- *Basics of Digital forensics*
- *Basics of mobile phone forensics*
- *Methods of investigation using digital forensic techniques.*

UNIT I INTRODUCTION L(9)

Introduction to Cyber forensics: Information Security Investigations, Corporate Cyber Forensics, Scientific method in forensic analysis, investigating large scale Data breach cases. Types of Computer Forensics Technology, Types of Military Computer Forensic Technology, Types of Law Enforcement: Computer Forensic Technology, Types of Business Computer Forensic Technology, Specialized Forensics Techniques.

UNIT II CYBER CRIME AND CYBER LAWS L(9)

Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation,Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

UNIT III DIGITAL FORENSICS L(9)

Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics.

UNIT IV MOBILE PHONE FORENSICS L(9)

Crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems- Android forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques.

UNIT V CYBER CRIME INVESTIGATION L(9)

Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, Email Recovery, Hands on Case Studies: Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. John R. Vacca, Computer Forensics**: "Computer Crime Scene Investigation"**, 2nd Edition, Charles River Media, 2009.
2. Bernadette H Schell, Clemens Martin, **"Cybercrime"**, ABC – CLIO Inc, 2009.
3. Iosif I. Androulidakis, **"Mobile phone security and forensics: A practical approach"**, Springer publications, 2012.
4. Andrew Hoog, **"Android Forensics: Investigation, Analysis and Mobile Security for Google Android"**, Elsevier publications, 2011.
5. Angus M.Marshall, **"Digital forensics: Digital evidence in criminal investigation"**, John – Wiley and Sons, 2008.
6. Nelson Phillips and EnfingerSteuart, **"Computer Forensics and Investigations"**, Cengage Learning, 2009

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Describe the various Cyber forensics technologies.***[Familiarity]***
CO2: Understand Cyber Laws. ***[Familiarity]***
CO3: Analyze the different Cyber Crime & Cyber Laws. ***[Assessment]***
CO4: Analyze the Digital Forensics Technology and Practices. ***[Assessment]***
CO5: Analyze the Mobile Forensics Technology and Practices. ***[Assessment]***
CO6: Investigate Cyber Crime. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M	L	M
CO2	H	M	M	L	M	M			M	M	M
CO3	H	H	H	L	H	L			M	M	M
CO4	H	H	H	L	H	L			M	M	L
CO5	H	H	H	M	H	L			M	M	L
CO6	H	H	L	M	M	M	M	M	M	L	L

H = 3 ; M = 2 ; L = 1

18CSPE22 CLOUD COMPUTING

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Basic underlying concepts, Characteristics, issues and challenges of cloud computing.*
- *Cloud computing architecture and virtualization.*
- *Cloud application program and the ANEKA platform.*
- *Security issues of cloud computing.*
- *Real-world cloud applications.*

UNIT I INTRODUCTION TO CLOUD COMPUTING L(9)

Overview of Computing Paradigm:Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing - Introduction to Cloud Computing - Cloud issues and challenges- Cloud Computing (NIST Model) - History of Cloud Computing, - Cloud service providers Properties, Characteristics & Disadvantages - Pros and Cons of Cloud Computing, Benefits of Cloud Computing - Role of Open Standards .

UNIT II CLOUD COMPUTING ARCHITECTURE AND VIRTUALIZATION L(9)

Cloud computing stack - Comparison with traditional computing architecture (client/server), Services provided at various levels - Role of Networks in Cloud computing, protocols used, Role of Web services- Service Models (XaaS)- Infrastructure as a Service(IaaS) -Platform as a Service(PaaS) - Cloud Platform and Management – Software as a Service(SaaS)- Web services - Web 2.0 - Deployment Models -Public cloud -Private cloud -Hybrid cloud -Community cloud - Virtualization concepts - Introduction to virtualization - Types of Virtualization- Introduction to Various Hypervisors - High Availability (HA)/Disaster Recovery (DR) using Virtualization, Moving VMs

UNIT III CLOUD APPLICATION PROGRAMMING AND THE ANEKA PLATFORM L(9)

Aneka - Framework overview - anatomy of the Aneka container - Building Aneka clouds - Cloud programming and management - Programming applications with threads - Multithreading with Aneka - Programming applications with Aneka threads - Task computing - Task-based application models - Aneka task-based programming - Data-Intensive Computing - Aneka MapReduce programming

UNIT IV CLOUD SECURITY L(9)

Infrastructure Security - Network level security, Host level security, Application level security - Data security and Storage - Data privacy and security Issues, Jurisdictional issues raised by Data location - Identity & Access Management -Access Control -Trust, Reputation, Risk , Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations.- Cloud Reliability and fault-tolerance -privacy - policy and compliance -Cloud federation, interoperability and standards.

UNIT V CLOUD APPLICATIONS AND CASE STUDY **L(9)**

Scientific applications : Healthcare – Biology – Geoscience - Business and consumer applications: CRM and ERP – Productivity - Social networking - Media applications - Multiplayer online gaming - Case Study on Open Source & Commercial Clouds – Eucalyptus - Microsoft Azure - Amazon EC2 - Google AppEngine

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Barrie Sosinsky, "**Cloud Computing Bible**" , Wiley-India, 2010
2. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "**Distributed and cloud computing from Parallel Processing to the Internet of Things**", Morgan Kaufmann, 2012.
3. RajkumarBuyya, Christian Vecchiolaand S. ThamaraiSelvi ," **Mastering Cloud Computing Foundations andApplications Programming**", Morgan Kaufmann, 2013
4. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, **" Cloud Computing: Principles and Paradigms**", Wiley,2011
5. Nikos Antonopoulos, Lee Gillam ," **Cloud Computing: Principles, Systems and Applications**" Springer, 2012
6. Ronald L. Krutz, Russell Dean Vines," **Cloud Security: A Comprehensive Guide to Secure Cloud Computing**", Wiley-India, 2010.
7. John W. Rittinghouse, James F. Ransome**"Cloud Computing: Implementation, Management, and Security"** CRC Press, 2016**.**

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1: Explain and discuss basic concepts, fundamental issues and challenges of Cloud Computing and paradigms of computing. ***[Familiarity]***

CO2: Explain the basic architecture of cloud computing and virtualization techniques. ***[Familiarity]***

CO3: Design and implement basic cloud application using Aneka framework. ***[Usage]***

CO4: Explain the core issues of cloud computing such as security, privacy, and interoperability. ***[Familiarity]***

CO5: Provide cloud computing solutions and recommendations and for applications. [**Usage**]

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	H	M	M	H	H			M		L
CO2	H	M	M	H	H	H			L		L
CO3	H	M	M	H	M	M			L		M
CO4	H	H	H	H	M	M			M		L
CO5	H	H	M	M	H	M	M		L	L	L

H = 3 ; M = 2 ; L = 1

18CSPE23 CRYPTOGRAPHY AND NETWORK SECURITY

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *The mathematics of the cryptographic algorithms*
- *The working of different existing public-key cryptographic algorithms*
- *The Authentication algorithms, Digital Signature and Certificates.*
- *The network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite and network layer security protocols, Transport layer security protocols and Web security protocols.*
- *Software attacks, security and the wireless network security threats.*

UNIT I INTRODUCTION L(9)

Classical Cryptography -Types of attack: Chosen Message Attack (CMA) – Chosen Plaintext Attack (CPA) – Chosen Cipher text Attack (CCA)- Shannon's Theory -One Time Passwords (OTP) - Pseudo random bit generators - stream ciphers and RC4 -Block ciphers -Modes of operation - DES and its variants – AES - Linear and differential cryptanalysis.

UNIT II PUBLIC-KEY CRYPTOGRAPHY L(9)

Introduction to Public-key Cryptography - Number Theory: Euclidean Algorithm - Chinese Remainder Theorem - RSA Cryptosystem -Implementing RSA- Attacks On RSA - Rabin Cryptosystem - Factoring Algorithms - ElGamal Cryptosystem and Discrete Logs - Finite Field and Elliptic Curve Systems - Key Distribution and Key Agreement : Blom's Scheme - Diffie-Hellman Key Predistribution – Kerberos - Diffie-Hellman Key Agreement scheme.

UNIT III AUTHENTICATION ALGORITHMS, DIGITAL SIGNATURE AND CERTIFICATES L(9)

Authentication: Requirements - Functions - Message authentication codes - Hashing: Functions - Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure Hash Algorithm - Digital signature schemes - Digital Signature Standard - X.509 Certificate

UNIT IV NETWORK SECURITY AND WEB SECURITY PROTOCOLS L(9)

Network Security, Security services, attacks, Security Issues in TCP/IP suite- Sniffing, spoofing, buffer overflow, ARP poisoning, ICMP Exploits, IP address spoofing, IP Fragment attack, routing exploits, UDP exploits, TCP exploits - Network Security Protocols:IP Security - AH and ESP - SSL/TLS - SSH. Web Security Protocols: HTTPS - DNS Security - Electronic Mail Security (PGP, S/MIME).

UNIT V SOFTWARE ATTACKS AND SECURITY L(9)

Intruders - Viruses - Worms - Trojan horses - Distributed Denial-Of-Service (DDoS) - Honey nets and Honey pots. Security Systems: Firewalls – IDS - Wireless Security:Issues and threats in Wireless networks. Wireless LAN Security: WEP – WPA.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Douglas R. Stinson. "**Cryptography: Theory and Practice**", Third edition, Chapman & Hall/CRC, 2010.
2. W. Stallings, "**Cryptography and Network Security: Principles and Practice**", 6/E, Prentice Hall, 2014.
3. AtulKahate, "**Cryptography and Network Security**", Tata McGraw-Hill, 2003.
4. Bruce Schneier," **Applied Cryptography**", Second Edition, John Wiley & Sons, 1996.
5. WenboMao," **Modern Cryptography: Theory and Practice**", First Edition, Pearson Education, 2004.

***COURSE OUTCOMES**: Upon completion of this course, the students will be able to:*

CO1: Explain the basic concepts, attack and mode of operation of Cryptography and build a new unbreakable cryptosystem with DES, AES. ***[Usage]***

CO2: Design and implement some public –key cryptographic algorithms with the existing communication protocols. ***[Usage]***

CO3: Explain the basic concepts of authentication algorithms, Digital Signature and Certificates. ***[Familiarity]***

CO4: Explain the basic concepts and architecture used in Network security and web security protocols. ***[Familiarity]***

CO5: Design a security solution for a given system or real-world applications. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	M			M	M	M
CO2	H	H	H	M	H	M			M	M	M
CO3	H	M	M	M	M	M			L	M	L
CO4	H	M	M	M	M	M			L	M	L
CO5	H	H	H	M	H	M	H	H	M	M	L

H = 3 ; M = 2 ; L = 1

18CSPE24 THEORY AND APPLICATIONS OF ONTOLOGY

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Usage of semi structured data and Description Logics.*
- *Modelling Languages.*
- *Usage of OWL and various Semantic web Software Tools.*
- *Application of ontology for different application areas*

UNIT I INTRODUCTION **L(9)**

Knowledge Representation - Logic and Inference: Monotonic and Non Monotonic Rules - Syntax and Semantics- Rule Markup in XML- Ontology: Definition-Features-Development Issues-Describing Semantics-Ontology Languages- XML - RDF: Features, Data Model

UNIT II ONTOLOGY LANGUAGES **L(9)**

RDF/XML-RDFS- Overview-Species-Encoding OWL Ontology-Defining Basic OWL lite Classes and Properties-Describing OWL Lite Property Characteristics

UNIT III OWL **L(9)**

Deriving OWL Lite Classes – Describing Individuals- OWL DL: Restrictions-Complex Classes/ Expressions –OWL Full - OWL Dialect Selection

UNIT IV TECHNOLOGIES **L(9)**

Methods for ontology Development – Ontology Sources : Meta Data , Upper Ontologies – Semantic Web Software Tools : Metadata and Ontology Editors

UNIT V APPLICATIONS **L(9)**

Case Study: Horizontal Information Products at Elsevier , Data Integration at Audi - e-learning – web services- Business Ontologies -Ontologies in Biology- Medical Ontologies- Language Processing- Ubiquitous Computing Applications - Ontology Engineering

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Lee W. Lacy, **"Owl: Representing Information Using the Web Ontology Language"**, Trafford Publishing, 2005.
2. Poli, Roberto, Healy, Michael, Kameas, Achilles, **"Theory and Applications of Ontology: Computer Applications"**, Springer, 2010
3. K.K. Breitman, M.A. Casanova and W. Truszkowski, **"Semantic Web: Concepts, Technologiesand Applications"**, Springer, 2007
4. DraganGasevic · DraganDjuricVladanDevedzic, **"Model Driven Architecture and Ontology Development"**, Springer Berlin Heidelberg, 2006.
5. Grigoris Antoniou and Frank van Harmelen, **"A Semantic Web Primer"**, MIT Press, USA, 2012

6 Dean Allemang and Jim Hendler, **"Semantic Web for the Working Ontologist – Effective modeling in RDFS and OWL"**, Second Edition, Morgan Kaufman, 2011.

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1: Explain Knowledge representation using logic and inference. ***[Familiarity]***
CO2: Use semantic Languages such as RDF, RDFS and OWL. ***[Usage]***
CO3: Define OWL Lite Classes and describe OWL Lite Property Characteristics. ***[Usage]***
CO4: Write their own ontologies in OWL**. *[Usage]***
CO6: Use Semantic web software tools. ***[Usage]***
CO7: Understand the application areas of ontologies. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	H	H	M	H	M			M		M
CO3	H	H	H	M	H	M			M		M
CO4	H	H	H	M	H	M			M	L	M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M			M		M
CO7	H	M	M	M	M	M			M		M

H = 3 ; M = 2 ; L = 1

18CSPE25 MINING MASSIVE DATASETS

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Managing immense amounts of data quickly using MapReduce.*
- *Examining data for similar items.*
- *Efficient mining of data streams.*
- *Analyzing large-scale data derived from social-networks.*
- *Online advertising and Recommender systems*

UNITI INTRODUCTION L(9)

Introduction to Data Mining - Statistical limits on data mining - Introduction to Distributed File Systems- MapReduce - Algorithms using MapReduce - Communication cost model - Complexity Theory for MapReduce.

UNIT II SIMILARITY SEARCH L(9)

Similarity Search- Applications of nearest-neighbour search - Shingling of Documents – Similarity - preserving summaries of sets - Locality - Sensitivity hashing for documents - Distance measures - Theory of locality-Sensitive functions - Applications - Methods for high degrees of similarity.

UNIT III MINING DATA STREAMS AND LINK ANALYSIS L(9)

Mining Data streams - Stream data model - Sampling data in a Stream - Filtering streams - Counting distinct elements in a stream- Estimating moments - Link analysis – Pagerank - Efficient computation of Pagerank - Topic-sensitive page rank - Link spam - Hubs and Authorities.

UNIT IV MINING SOCIAL NETWORKS L(9)

Social networks as graphs - Clustering of social-network graphs - Direct discovery of communities - Partitioning of graphs - Finding overlapping communities - Simrank - Counting triangles - Neighborhood properties of graphs.

UNIT V ONLINE ADVERTISING AND RECOMMENDATION SYSTEMS L(9)

Advertising on Web: Issues- Online Algorithms- Matching Problems - Adwords Problem - Implementation – Recommendation Systems: Model – Content based Recommendation- Collaborative Filtering-Dimensionality Reduction.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Jure Leskovec, AnandRajaraman, Jeffrey D. Ullman, **"Mining of massive Datasets"**, Cambridge University Press, 2014.
2. Jimmy Lin, Chris Dyer, **"Data-Intensive Text Processing with MapReduce"**, Cambridge University Press, 2013.

3 James Abello, Panos M. Pardalos, Mauricio G. C. Resende (editors), **"Handbook of Massive Data Sets"**, Kluwer Academic Publishers, 2002.

4 Lei Tang, Huan Liu, **"Community Detection and Mining in Social Media"**, Morgan & Claypool Publishers, 2010.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Use MapReduce to handle large amount of data. ***[Usage]***

CO2: Analyze similarity problem as finding sets with large intersection and also to test the degree of similarity among data. ***[Assessment]***

CO3: Summarize data streams, filter it and efficiently store it for future use. ***[Familiarity]***

CO4: Identify communities, similarity among nodes of a graph, measure the connectedness of community, and measure the neighborhood size of nodes in a graph. ***[Familiarity]***

CO5: Use algorithms to address issues like matching problems and adwords problem. ***[Usage]***

CO6: Implement Recommendation system. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	M	L		M		L
CO2	H	H	M	H	M	M			M		L
CO3	H	M	M	M	M	M			M		L
CO4	H	M	M	M	M	M			M		L
CO5	H	H	H	M	H	M			M		L
CO6	H	H	H	M	H	M	L		M		M

H = 3 ; M = 2 ; L = 1

18CSPE26 ADVANCED SOFTWARE ENGINEERING

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Software Process models.*
- *Software Requirement Analysis and modeling.*
- *Software Design and Estimation techniques*
- *Aspects related to Software Quality, Testing and Maintenance.*
- *Scrum Development Process.*

UNIT I INTRODUCTION AND REQUIREMENTS MODELING L(9)

Software Engineering- Process models-Agile development- Software engineering Knowledge-core Principles-Principles that guide each framework Activity - Requirements Engineering- Developing use cases-Building the requirements model-Negotiating, validating Requirements-Requirements Analysis-Requirements Modeling.

UNIT II SOFTWARE DESIGN AND ESTIMATION L(9)

Design Process - Design Concepts – Design Model - Architectural Design - Component level design – User interface design - pattern based design – Web App design – Case Study

Software Project Estimation – Process and Project Metrics- Empirical Estimation model – Specialized Estimation Technique for Agile Development - Project Scheduling - Risk Management

UNIT III SOFTWARE QUALITY AND TESTING L(9)

Software Quality- Software - Quality Dilemma- Achieving Software Quality- Testing: Strategic Approach to software Testing- Strategic IssuesTesting: Strategies for Conventional Software, Object oriented software, Web Apps-Validating Testing- System Testing- Art of Debugging. -

UNIT IV SOFTWARE MAINTENANCE AND IMPROVEMENT L(9)

Software Maintenance-Software Supportability- Reengineering- Business Process Reengineering-Software Reengineering- Reverse Engineering-Restructuring- Forward Engineering.

Software Process improvement: Process – CMMI – The people CMM – SPI return on investment – SPI Trends.

UNIT V INTRODUCTION TO SCRUM DEVELOPMENT PROCESS L(9)

Basics of Scrum – Running a Scum project – Steps for transition to scrum – Metrics for scrum –Case Study.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Roger Pressman.S“**Software Engineering: A Practitioner’s Approach**”Eighth Edition, McGraw Hill, 2010
2. Ian Sommerville“**Software Engineering**”Nineth Edition, Pearson Education Asia, 2011
3. Shari Lawrence Pfleeger, Joanne M. Atlee, “**Software Engineering: Theory andPractice**”, Fourth Edition, Pearson Education, 2011.
4. Alistair Cockburn, "**Agile Software Development**", First Edition, Pearson Education, 2001.

COURSE OUTCOMES**: **Upon completion of this course, the students will be able to:

CO1: Apply different process models for different projects levels. ***[Assessment]***
CO2: Perform requirement gathering and model the requirements. ***[Usage]***
CO3: Perform architectural design, component level design, UI design and Web design for a given project. ***[Assessment]***
CO4: Identify risks and construct RMMM plan for a software project. ***[Assessment]***
CO5: Apply effort and schedule estimation models. ***[Assessment]***
CO6: Verify and validate the software applications using different types of testing and maintain the quality of software. ***[Usage]***
CO7: Application of Scrum Development Process to develop software. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	H	M	M	H		M		M
CO2	H	H	H	H	M	L	H		M		M
CO3	H	H	H	H	M		H		M		M
CO4	H	H	H	H	M		H		M		M
CO5	H	H	H	H	M		H		M		M
CO6	H	H	H	H	H		H		M		M
CO7	H	H	H	H	H		H		M	L	M

H = 3 ; M = 2 ; L = 1

18CSPE27 ROBOTICS PROCESS AUTOMATION

Category : PE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *The types and generation of Robots.*
- *Automation and control of Robots and Robotics programming languages.*
- *Manipulators, Sensors, Actuators and Grippers for Robotic applications.*
- *Path planning mechanisms for Robots*
- *Futuristic applications of Robotics and Automation*

UNIT I INTRODUCTION L(9)

Origin of Robotics – Types and generation of robots – Degree of freedom – Asimov's law of Robotics- Dynamic stabilization of Robots. Power Sources and Sensors – hydraulic, pneumatic and electric drives – Path determination – Micro machines in robots – Machine vision – Ranging – laser – acoustics- magnetic, fiber optic and tactile sensors.

UNIT II ROBOT COMPONENTS AND AUTOMATION L(9)

The Robot Technology – Automation and Robotics – Robot Autonomy – Work Volume- Precision of movements – End effectors – Sensors. Robot Programming – Methods – Interlocks textual languages. Characteristics of robot level languages and task level languages.

UNIT III MANIPULATORS, ACTUATORS AND GRIPPERS L(9)

Construction of manipulators – Manipulator dynamics and force control – Electronic and pneumatic manipulator control circuits – End effectors – U various types of grippers – Design considerations – Robot cell design – Selection of a robot.

UNIT IV KINEMATICS AND PATH PLANNING L(9)

Solutions of inverse kinematic problems – Multiple solution jacobian work envelop – Hill climbing techniques – Multiple Robots – Machine interface – Robots in manufacturing and non manufacturing applications

UNIT V ADVANCED ROBATICS L(9)

Advanced Robotics – Robotics in Space – Special features of space Robots- Long term technical developments- Advanced robotics in under water operations. Future applications of robotics technology**.**

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Ghosh, "**Control in Robotics and Automation: Senor Based Integration**", Allied Publishers, 1998.
2. Klafer R.D, Chimielewski T.A, Negin M, "**Robotic Engineering- An Integrated Approach**", Prentice Hall, 1994.
3. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "**Industrial Robotics Technology**", McGraw Hill, 1996.
4. Deb S.R, "**Robotics Technology and Flexible Automation**", John Wiley, 1992.

COURSE OUTCOMES: **Upon completion of this course, the students will be able to:**

CO1*:* State the working principle of a Robot. ***[Familiarity]***

CO2: Explain the basic components of a Robot. [***Familiarity***]

CO3. Compare dynamics and force control mechanisms of Robots. [***Usage***]

CO4: Write and use trajectory planning algorithms for Robotic applications. ***[Usage]***

CO5: Explain usage of Robots in space and under water applications. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	H	H	H	M		H		M
CO2	H	H	H	H	H	H	M		H		M
CO3	H	H	H	H	L	H	M		H		M
CO4	H	H	H	H	L		M		H		M
CO5	H	H	H	H	L	M	M		H		M

H = 3 ; M = 2 ; L = 1

18SEOE01 VASTU SCIENCE FOR BUILDING CONSTRUCTION
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

To impart basic knowledge of vastu science and its impact on human well being.

UNIT I - INTRODUCTION (9)

Traditional definition - Meaning of Vastu and Vaastu -its classification -Relationship to earth - concept of existence and manifestation – planatory influence on earth.

UNIT II - SPACE THEORY IN VASTU (9)

Features of good building site -good building shapes -macro, micro, enclosed and material spaces - relationship between built space, living organism and universe -impact of built space on human psyche. Flow of energy within built space and outside -
zoning of functional areas -fitting of components in the building -significance of water bodies and energy -The cube as the basic structure.

UNIT III - COSMOGRAM & SETTLEMENT CONCEPTS (9)

: Orientation of building, site, layout and settlement -positive and negative energies - importance of cardinal and ordinal directions -The celestial grid or-mandala and its type.The Vaastu Purusha Mandala and its significance in creation of patterns, and lay-outs, extension of this to aural and visual fields -Types of Lay-Outs

UNIT IV - INTERFACE OF TIME, VIBRATION AND RHYTHM (9)

Theory of vibration and energy transfer – equation of time and space – manifestation in living organism – human beings – measurement of the energy– Kirlian energy of various forms- documentation of objects – filaments and streamers.

UNIT V - MEASUREMENTS & MATERIALS (9)

Units of measurement -Mana shastra -Ayadi techniques -Tala system and Hasta system of measures -Musical measurements compared to space measurements -resultant ambience in built space.Use of wood, stone, metal, brick and time- making technology, corbelling technology,jointing technology -foundations for heavy and light structures -Landscaping in and around buildings -Aesthetic in Indian Architecture.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Dr.Prasanna Kumar Acharya-Manasara -Ox ford1 University Press1927 -(English version)
2. K.S.Subramanya Sastri -Maya Matam -Thanjavur Maharaja Sarjoji saraswathil Mahal Library -Thanjavur-1966.
3. Stella Kramresh -The Hindu Temple Vol.1 & II Motital Banarsidass Publishers Pvt. Ltd., Delhi -1994.
4. Bruno Dagens -Mayamatam, Vol.1 & IIIGNCA and Motilal Bamarsidars, .Publishers Pvt. Ltd-s Delhi -1994.
5. George Birdsall -Feng Shui: The Key Concepts -January 2011

COURSE OUTCOMES: The students are able to

CO1: Obtain exposure on various concepts of vastu
CO2: Understand the theories in Vastu.
CO3: familiarize with the Cosmogram and settlement concepts of vastu
CO4: Understand the role of vasthu in energy flow manifestation in living beings.
CO5: Plan a structure considering various vastu techniques.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1
CO1	H										
CO2	H										
CO3	H										
CO4	H								M		
CO5	M				M						

L-Low, M-Moderate(Medium), H-High

18SEOE02 PLANNING OF SMART CITIES
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: Nil

COURSE OBJECTIVE:

To have an exposure on development of smart cities considering various fields related and their challenges.

UNIT I SMART CITIES DEVELOPMENT POTENTIALS AND CHALLENGES (9)

Perspectives of Smart Cities: Introduction and Overview - Implementation Challenges - Methodological issues - Spatial distribution of start up cities – Re imagining post industrial cities - Implementation Challenges for Establishing Smart Urban Information and Knowledge Management System

UNIT II ROLE OF ICT, REMOTE SENSING, AND GEOGRAPHICAL INFORMATION SYSTEM (9)

Optimising Green Spaces for Sustainable Urban Planning - 3D City Models for Extracting Urban Environmental Quality Indicators - Assessing the Rainwater Harvesting Potential - The Strategic Role of Green Spaces - Monitoring Urban Expansion

UNIT III ENVIRONMENT, ENERGY, DISASTER MANAGEMENT AND SUSTAINABLE DEVELOPMENT (9)

Alternatives for Energy Stressed Cities - Social Acceptability of Energy-Efficient Lighting - Energy Management - Urban Dynamics and Resource Consumption - Issues and Challenges of Sustainable Tourism - Green Buildings: Eco-friendly Technique for Modern Cities

UNIT IV MULTIFARIOUS MANAGEMENT FOR SMART CITIES (9)

An Assessment of Domestic Water Use Practices - An Issue of Governance in Urban Water Supply - Assessment of Water Consumption at Urban Household Level - Water Sustainability - Socio-economic Determinants and Reproductive Healthcare System - Problems and Development of Slums.

UNIT V INTELLIGENT TRANSPORT SYSTEM (9)

Introduction to Intelligent Transportation Systems (ITS)- The Range of ITS Applications - Network Optimization-Sensing Traffic using Virtual Detectors- In-Vehicle Routing, and Personal route information-The Smart Car-Commercial Routing and Delivery-Electronic Toll Collection-The Smart Card-Dynamic Assignment- Traffic Enforcement. Urban Mobility and Economic Development

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Poonam Sharma, Swati Rajput, "Sustainable Smart Cities in India_ Challenges and Future Perspectives Springer 2017 Co.(P) Ltd. 2013
2. Ivan Nunes Da Silva, Rogerio Andrade Flauzino-Smart Cities Technologies-ExLi4EvA (2016)
3. Stan McClellan, Jesus A. Jimenez, George Koutitas (eds.)-Smart Cities_ Applications, Technologies, Standards, and Driving Factors-Springer International Publishing (2018)
4. Stan Geertman, Joseph Ferreira, Jr., Robert Goodspeed, John Stillwell, "Planning Support Systems and Smart Cities" , Springer, 2015

COURSE OUTCOME:

CO1: Identify the potential and challenges in smart city development.

CO2: Apply the different tools for sustainable urban planning.

CO3: Understand the concepts of environment, energy and disaster management.

CO4: Identify the proper methods for water and waste water management.

CO5: Familiarize with the intelligent transport systems.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1											
CO2											
CO3									M	M	
CO4						M					
CO5	L	H				L					

L-Low, M-Moderate(Medium), H-High

18SEOE03 GREEN BUILDING
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

- To introduce the different concepts of sustainable design and green building techniques and how they may be synthesized to best fit a specific construction project.

UNIT I INTRODUCTION (9)

Life Cycle impacts of materials and products – sustainable design concepts – strategies of Design for the Environment -The sun-earth relationship and the energy balance on the earth's surface, climate, wind – Solar radiation and solar temperature – Sun shading and solar radiation on surfaces – Energy impact on the shape and orientation of buildings – Thermal properties of building materials.

UNIT II ENERGY EFFICIENT BUILDINGS (9)

Passive cooling and day lighting – Active solar and photovoltaic- Building energy analysis methods- Building energy simulation- Building energy efficiency standards- Lighting system design- Lighting economics and aesthetics- Impacts of lighting efficiency – Energy audit and energy targeting- Technological options for energy management.

UNIT III INDOOR ENVIRONMENTAL QUALITY MANAGEMENT (9)

Psychrometry- Comfort conditions- Thermal comfort- Ventilation and air quality-Air conditioning requirement- Visual perception- Illumination requirement- Auditory requirement- Energy management options- -Air conditioning systems- Energy conservation in pumps- Fans and blowers- Refrigerating machines- Heat rejection equipment- Energy efficient motors- Insulation.

UNIT IV GREEN BUILDING CONCEPTS (9)

Green building concept- Green building rating tools- Leeds and IGBC codes. – Material selection Embodied energy- Operating energy- Façade systems- Ventilation systems- Transportation- Water treatment systems- Water efficiency- Building economics

UNIT V GREEN BUILDING DESIGN CASE STUDY (9)

Students to work through a controlled process of analysis and design to produce drawings and models of their own personal green building project. Topics include building form, orientation and site considerations; conservation measures; energy modeling; heating system and fuel choices; renewable energy systems; material choices; and construction budget-Case Study on green construction and design.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Kibert, C. "Sustainable Construction: Green Building Design and Delivery", John Wiley & Sons, 2005
2. Edward G Pita, "An Energy Approach- Air-conditioning Principles and Systems", Pearson Education, 2003.
3. Colin Porteous, "The New Eco-Architecture", Spon Press, 2002.
4. Energy Conservation Building Codes: www.bee-india.nic.in
5. Lever More G J, "Building Energy Management Systems", E and FN Spon, London, 2000.
6. Ganesan T P, "Energy Conservation in Buildings", ISTE Professional Center, Chennai, 1999.
7. John Littler and Randall Thomas, "Design with Energy: The Conservation and Use of Energy in Buildings", Cambridge University Press, 1984.

COURSE OUTCOMES: The students are able to

CO1: Describe the concepts of sustainable design

CO2: Familiarize with green building techniques including energy efficiency management.

CO3: Understand the indoor environmental quality management in green building.

CO4: Perform the green building rating using various tools.

CO5: Create drawings and models of their own personal green building project.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO 1	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**
CO1	L										
CO2					M	M					
CO3						M					
CO4						M					
CO5	M								L	M	M

L-Low, M-Moderate(Medium), H-High

18EEOE04 ENVIRONMENT, HEALTH AND SAFETY IN INDUSTRIES

(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES: ***On completion of this course the students are able to:***

1. Get knowledge about occupational health hazard and safety measures at work place
2. Learn about accident prevention and safety management
3. Learn about general safety measures in industries

UNIT I OCCUPATIONAL HEALTH AND HAZARDS (8)

Occupation, Health and Hazards - Safety Health and Management: Occupational Health Hazards - Ergonomics - Importance of Industrial Safety Radiation and Industrial Hazards : Types and effects - Vibration - Industrial Hygiene - Different air pollutants in industries and their effects Electrical, fire and Other Hazards - General causes, Machine Guards and its types, Automation.

UNIT II SAFETY A WORKPLACE (10)

Safety at Workplace - Safe use of Machines and Tools: Safety in use of different types of unit operations - Ergonomics of Machine guarding - working in different workplaces - Operation, Inspection and maintenance Plant Design and Housekeeping, Industrial lighting, Vibration and Noise.

UNIT III ACCIDENT PREVENTION (9)

Accident Prevention Techniques - Principles of accident prevention - Definitions, Theories, Principles - Hazard identification and analysis, Event tree analysis, Hazop studies, Job safety analysis - Theories and Principles of Accident causation - First Aid : Body structure and functions - Fracture and Dislocation, Injuries to various body parts.

UNIT IV SAFETY MANAGEMENT (9)

Safety Management System and Law - Legislative measures in Industrial Safety: Various acts involved in Detail- Occupational safety, Health and Environment Management : Bureau of Indian Standards on Health and Safety, 14489, 15001 - OSHA, Process safety management (PSM) and its principles - EPA standards- Safety Management : Organisational & Safety Committee - its structure and functions.

UNIT V GENERAL SAFETY MEASURES (9)

Plant Layout for Safety -design and location, distance between hazardous units, lighting, colour coding, pilot plant studies, Housekeeping - Accidents Related with Maintenance of Machines - Work Permit System : Significance of Documentation Directing Safety : Definition, Process, Principles and Techniques Leadership : Role, function and attribution of a leader Case studies - involving implementation of health and safety measures in Industries.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. R.K. Jain and Sunil S. Rao, Industrial safety, Health and Environment Management, Khanna publishers, New Delhi (2006).
2. Frank P. Lees - Loss of Prevention in Process Industries, Vol 1 and 2, Butterworth - Heinamann Ltd., London (1991)
3. Industrial Safety - National Council of India
4. Factories Act with Amendments 1987, Govt. of India Publications DGFASLI, Mumbai

COURSE OUTCOMES: At the end of the course student will be able to:

CO1 : Gain the knowledge about occupational health hazard and safety measures at work place

CO2 : be Able to learn about accident prevention and safety management

CO3 : Understand occupational health hazards and general safety measures in industries

CO4 : Got to know various laws, standards and legislations.

CO5 : Able to learn about safety and proper management of industries

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	L	M		H			L		H	H	L
CO2	H	H	M	H			L		M	H	H
CO3	H	H		M			L		L	M	M
CO4							L		L	L	L
CO5							L		L	L	L

L-Low, M-Moderate(Medium), H-High

18EEOE05 CLIMATE CHANGE AND ADAPTATION

(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES: On completion of this course the students are able to:

1. Able get knowledge about Climate system and its changes and causes
2. Able to learn about impacts, adaptation and mitigation of climate change
3. Able to learn about clean technology and clean energy

UNIT I EARTH'S CLIMATE SYSTEM (9)

Introduction-Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies - Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

UNIT II OBSERVED CHANGES AND ITS CAUSES (9)

Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – climate change modeling.

UNIT III IMPACTS OF CLIMATE CHANGE (9)

Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT IV CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES (9)

Adaptation Strategy/Options in various sectors – Water – Agriculture –- Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

UNIT V CLEAN TECHNOLOGY AND ENERGY (9)

Clean Development Mechanism – Carbon Trading - examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Jan C. van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.
2. IPCC fourth assessment report - The AR4 synthesis report, 2007
3. IPCC fourth assessment report –Working Group I Report, " The physical Science Basis", 2007
4. IPCC fourth assessment report - Working Group II Report, " Impacts, Adaptation and Vulnerability", 2007
5. IPCC fourth assessment report – Working Group III Report" Mitigation of Climate change", 2007
6. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 'Climate Change and Water'. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.
7. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

COURSE OUTCOMES: At the end of the course the student will be able:

CO1: To understand the climatic system and the factors influencing the climatic changes
CO2: To assess the uncertainty and impact of climatic changes
CO3: To develop strategies for adaptation and mitigation of climatic changes
CO4: To identify clean technologies for sustainable growth
CO5: To identify clean technologies for sustainable growth

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M			M			H		L	M	M
CO2	M			M			M		L	L	M
CO3	M			M			H		L	M	M
CO4	M	M	M	M	M	M	L	M	M	L	M
CO5	M			M			M		L	L	L

L-Low, M-Moderate(Medium), H3-High

18EEOE06 WASTE TO ENERGY

(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES*: *On completion of this course the students are able to:

Able to get knowledge about the utilization of waste and its purpose.

UNIT I INTRODUCTION (9)

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forestresidue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT II BIOMASS PYROLYSIS (9)

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III BIOMASS GASIFICATION (9)

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers –Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT IV BIOMASS COMBUSTION (9)

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs,Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT V BIOGAS (9)

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technologyand status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

COURSE OUTCOMES: At the end of the course the student will be able :

CO1: Understand solid waste management techniques

CO2: Know what is biomass

CO3 : Study Methods and factors considered for biomass gasification

CO4 : Know equipmentmeant for biomass combustion

CO5 : Understand about biogas and its development in India

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M			M			H		L	L	L
CO2	M			M			H		L	L	L
CO3	M			M			H		L	L	L
CO4	M		M	M			H		L	L	L
CO5	M			M			H		L	L	L

L-Low, M-Moderate(Medium), H-High

18GEOE07 ENERGY IN BUILT ENVIRONMENT
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES: On completion of this course students are able to:

1. About energy use and its management
2. Understand constructional requirements of buildings
3. Know relationship of energy and environment

UNIT I INTRODUCTION (9)

Indoor activities and environmental control - Internal and external factors on energy use - Characteristics of energy use and its management -Macro aspect of energy use in dwellings and its implications - Thermal comfort - Ventilation and air quality - Air-conditioning requirement -Visual perception - Illumination requirement - Auditory requirement

UNIT II LIGHTING REQUIREMENTS IN BUILDING (9)

The sun-earth relationship - Climate, wind, solar radiation and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings – Lighting and daylighting: Characteristics and estimation, methods of day-lighting – Architectural considerations for day-lighting

UNIT III ENERGY REQUIREMENTS IN BUILDING (9)

Steady and unsteady heat transfer through wall and glazed window - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer - Thermal gain andnet heat gain - End-use energy requirements - Status of energy use in buildings - Estimation of energy use in a building

UNIT IV ENERGY AUDIT (9)

Energy audit and energy targeting - Technological options for energy management - Natural andforced ventilation – Indoor environment and air quality - Airflow and air pressure on buildings -Flow due to stack effect

UNIT V COOLING IN BUILT ENVIRONMENT (9)

Passive building architecture – Radiative cooling - Solar cooling techniques - Solar desiccant dehumidification for ventilation - Natural and active cooling with adaptive comfort – Evaporativecooling – Zero energy building concept.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. J. Krieder and A. Rabl (2000), Heating and Cooling of Buildings: Design for Efficiency,McGraw-Hill.
2. S. M. Guinnes and Reynolds (1989), Mechanical and Electrical Equipment for Buildings,Wiley.
3. A. Shaw (1991), Energy Design for Architects, AEE Energy Books.
4. ASHRAE (2001), Handbook of Fundamentals, ASHRAE, Atlanta, GA.
5. Reference Manuals of DOE-2 (1990), Orlando Lawrence-Berkeley Laboratory,University of California, and Blast, University of Illinois, USA.

COURSE OUTCOMES: At the end of the course the student will be able :

CO1: Understand energy and its usage

CO2: To know lighting to be given to a building

CO3 : To study energy requirements in a building

CO4 : Understand energy audit

CO5 : To study architectural specifications of a building.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M			M			M		L	L	L
CO2	M			M			M		L	L	L
CO3	M			M			M		L	L	L
CO4	M			M		M	M		L	L	L
CO5	M			M			M		L	L	L

L-Low, M-Moderate(Medium), H-High

18GEOE08 EARTH AND ITS ENVIRONMENT
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE

To know about the planet earth, the geosystems and the resources like ground water and air and to learn about the Environmental Assessment and sustainability.

UNIT I EVOLUTION OF EARTH (9)

Evolution of earth as habitable planet - Evolution of continents - oceans and landforms - evolution of life through geological times - Exploring the earth's interior - thermal and chemical structure - origin of gravitational and magnetic fields.

UNIT II GEOSYSTEMS (9)

Plate tectonics - working and shaping the earth - Internal Geosystems – earthquakes – volcanoes - climatic excursions through time - Basic Geological processes - igneous, sedimentation - metamorphic processes.

UNIT III GROUND WATER GEOLOGY (9)

Geology of groundwater occurrence - recharge process - Groundwater movement - Groundwater discharge and catchment hydrology - Groundwater as a resource - Natural groundwater quality and contamination - Modeling and managing groundwater systems.

UNIT IV ENVIRONMENTAL ASSESMENT AND SUSTAINABILITY (9)

Engineering and sustainable development - population and urbanization - toxic chemicals and finite resources - water scarcity and conflict - Environmental risk - risk assessment and characterization - hazard assessment - exposure assessment.

UNIT V AIR AND SOLIDWASTE (9)

Air resources engineering - introduction to atmospheric composition – behaviour - atmospheric photochemistry - Solid waste management – characterization - management concepts.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. John Grotzinger and Thomas H. Jordan, Understanding Earth, Sixth Edition, W. H. Freeman, 2010.
2. Younger, P. L., Groundwater in the Environment: An introduction, Blackwell Publishing, 2007.
3. Mihelcic, J. R., Zimmerman, J. B., Environmental Engineering: Fundamentals, Sustainability and Design, Wiley, NJ, 2010.

COURSE OUTCOMES: At the end of the course, students will be able to

CO1: Know about evolution of earth and the structure of the earth.

CO2: Understand the internal Geosystems like earthquakes and volcanoes and the various geological processes.

CO3: Understand the geological process of occurrence and movement of groundwater and the modeling systems.

CO4: Assess the Environmental risks and the sustainability developments.

CO5: Learn about the photochemistry of atmosphere and the solid waste management concepts.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	L			M	M			H	H		
CO2	H		H	H		H					
CO3	M						H			M	
CO4		M			L		H	H	H		H
CO5	M	M		L				H			

L-Low, M-Moderate(Medium), H-High

18GEOE09 NATURAL HAZARDS AND MITIGATION
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE

To get idea about the various natural hazards like Earthquakes, slope stability, floods, droughts and Tsunami and the mitigation measures.

UNIT I EARTHQUAKES (9)

Definitions and basic concepts - different kinds of hazards – causes - Geologic Hazards – Earthquakes - causes of earthquakes – effects - plate tectonics - seismic waves - measures of size of earthquakes - earthquake resistant design concepts.

UNIT II SLOPE STABILITY (9)

Slope stability and landslides - causes of landslides - principles of stability analysis - remedial and corrective measures for slope stabilization.

UNIT III FLOODS (9)

Climatic Hazards – Floods - causes of flooding - regional flood frequency analysis - flood control measures - flood routing - flood forecasting - warning systems.

UNIT IV DROUGHTS (9)

Droughts – causes - types of droughts - effects of drought - hazard assessment - decision making - Use of GIS in natural hazard assessment – mitigation - management.

UNIT V TSUNAMI (9)

Tsunami – causes – effects – undersea earthquakes – landslides – volcanic eruptions – impact of sea meteorite – remedial measures – precautions – case studies.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Donald Hyndman and David Hyndman, Natural Hazards and Disasters, Brooks/Cole Cengage Learning, 2008.
2. Edward Bryant, Natural Hazards, Cambridge University Press, 2005.
3. J Michael Duncan and Stephan G Wright, Soil Strength and Slope Stability, John Wiley & Sons, Inc, 2005.
4. Amr S Elnashai and Luigi Di Sarno, Fundamentals of Earthquake Engineering, John Wiley & Sons, Inc, 2008.

COURSE OUTCOMES: At the end of the course, students will be able to

CO1: Understand the basic concepts of earthquakes and the design concepts of earthquake resistant buildings.

CO2: Acquire knowledge about the causes and remedial measures of slope stabilization.

CO3: Gain knowledge about the causes and control measures of flood.

CO4: Understand the types, causes and mitigation of droughts.

CO5: Know the causes, effects and precautionary measures of Tsunami.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	H			H		M		H	M
CO2	H			H	H		L		M	H	M
CO3	H		H				M			H	M
CO4	H		M		L					H	M
CO5	H				L		M			H	M

L-Low, M-Moderate(Medium), H-High

18EDOE10 BUSINESS ANALYTICS
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISTES :Nil

COURSE OBJECTIVE:

- Understand the role of business analytics within an organization.
- Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

UNIT I BUSINESS ANALYTICS AND PROCESS (9)

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT II REGRESSION ANALYSIS (9)

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT III STRUCTURE OF BUSINESS ANALYTICS (9)

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT IV FORECASTING TECHNIQUES (9)

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT V DECISION ANALYSIS AND RECENT TRENDS IN BUSINESS ANALYTICS (9)

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making. Recent Trends: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey **"Business analytics Principles, Concepts, and Applications"**, Pearson FT Press.
2. **PurbaHalady Rao,2013"Business Analytics: An application focus", PHI Learning Pvt. Ltd..**
3. **R.N.Prasad, Seema Acharya,2011"Fundamentals of Business Analytics ", Persons Education.**
4. James Evans**"Business Analytics"**, Persons Education.

COURSE OUTCOMES: On completion of this course, students will be able to

CO1: Students will demonstrate knowledge of data analytics.

CO2: Students will demonstrate the ability of think critically in making decisions based on dataand deep analytics.

CO3: Students will demonstrate the ability to use technical skills in predicative and prescriptivemodeling to support business decision-making.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	L	L	L	L	M	L	-	L	M	-	L
CO2	-	H	L	L	L	L	-	-	L	-	-
CO3	L	L	-	-	L	-	L	M	L	-	L

L-Low, M-Moderate (Medium), H-High

18EDOE11 COST MANAGEMENT OF ENGINEERING PROJECTS
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISTES : Nil

COURSE OBJECTIVE :

- To be familiar with cost management and project planning.
- To acquire knowledge of decision making, price strategies and total quality management tools.

UNIT I INTRODUCTION TO COST MANAGEMENT (9)

Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II PROJECT PLANNING ACTIVITIES (9)

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process.

UNIT III COST ANALYSIS (9)

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis.

UNIT IV PRICING STRATEGIES AND BUDGETORY CONTROL (9)

Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing, Costing of service sector, Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V TQM AND OPERATIONS REASEARCH TOOLS (9)

Total Quality Management and Theory of constraints, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. **Cost Accounting a Managerial Emphasis**, *Prentice Hall of India, New Delhi.*
2. Charles T. Horngren and George Foster, Advanced **Management Accounting.**
3. Robert S Kaplan Anthony A. Alkinson, **Management & Cost Accounting.**
4. Ashish K. Bhattacharya, **Principles & Practices of Cost Accounting** *A. H. Wheeler publisher.*
5. N.D. Vohra, **Quantitative Techniques in Management**, *Tata McGraw Hill Book Co. Ltd.*

COURSE OUTCOMES: ***On completion of this course, students will be able to***

CO1: Understanding methods concepts of cost management.

CO2: Developing the skills for project planning.

CO3: Evaluating the cost behavior and profit.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	-	-	L	L	L	L	M	L	L	-	L
CO2	-	L	L	M	L	L	M	L	L	-	L
CO3	L	-	L	-	-	-	H	-	L	L	L

L-Low, M-Moderate (Medium), H-High

18EDOE12 INTRODUCTION TO INDUSTRIAL ENGINEERING
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISTES : Nil

COURSE OBJECTIVE :

- The objective of this course is to provide foundation in Industrial Engineering in order to enable the
  students to make significant contributions for improvements in different organisations.

UNIT I INTRODUCTION (9)

Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production Management Vs Industrial Engineering – Operations Management – Production System – Input Output Model –Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures.

UNIT II PLANT LOCATION AND LAYOUT (9)

Factors affecting Plant location – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.

UNIT III WORK SYSTEM DESIGN (9)

Need – Objectives – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Work Measurement techniques.

UNIT IV STATISTICAL QUALITY CONTROL (9)

Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Sampling Inspection – Sampling Plans – Sampling Plans.

UNIT V PRODUCTION PLANNING AND CONTROL (9)

Forecasting – Qualitative and Quantitative forecasting techniques – Types of production – Process planning – Economic Batch Quantity – Tool control – Loading – Scheduling and control of production – Dispatching–Progress control.

Contact Periods:

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. O.P.Khanna, 2010**, Industrial Engineering and Management,** Dhanpat Rai Publications**.**
2. Ravi Shankar, 2009**, Industrial Engineering and Management,** Galgotia Publications & Private Limited.

3. Mart and Telsang, 2006**, Industrial Engineering and Production Management,** S. Chand and Company.
4. M.I. Khan, 2004**, Industrial Engineering and Production Management,** New Age International.

COURSE OUTCOMES: On completion of this course, students will be able to

CO1: Understanding the functioning of various kinds of Industries.

CO2: Developing the knowledge in plant location layout and work system design.

CO3: Evaluating the cost optimization in industries.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	-	-	-	-	L	L	L	L	L	L	M
CO2	L	L	L	L	L	L	-	-	L	H	M
CO3	L	L	-	-	-	-	H	-	-	L	-

L-Low, M-Moderate (Medium), H-High

18MFOE13 INDUSTRIAL SAFETY
(Common to All Branches)

Category: OE

PREREQUISTES : Nil

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To be familiar with industrial safety equipments and techniques.
- To acquire practical knowledge of maintenance techniques available in industry.

UNIT I INDUSTRIAL SAFETY (9)

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING (9)

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III WEAR AND CORROSION (9)

.Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV FAULT TRACING (9)

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE (9)

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Higgins & Morrow **"Maintenance Engineering Handbook",** Da Information Services, 2008

2. H.P.Garg **"Maintenance Engineering"**, S. Chand and Company, 2010.

3. Audels **"Pump-hydraulic Compressors",** Mcgrew Hill Publication, 1943.

4. Winterkorn, Hans **"Foundation Engineering Handbook"**, Chapman & Hall London, 1975.

COURSE OUTCOMES : On completion of this course, students will be able to

CO1: Understand types of industrial safety equipments and techniques available.

CO2: Acquire practical knowledge of maintenance techniques available in industry.

CO3: Acquire knowledge on fault tracing techniques in industrial safety.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**
CO 1	M	L	L	L	-	L	L	-	M	M	L
CO 2	M	H	M	L	L	L	L	-	L	H	M
CO 3	H	H	H	L	-	L	M	-	M	L	-

L – Low, M – Moderate (Medium), H – High

18MFOE14 OPERATIONS RESEARCH
(Common to All Branches)

Category: OE

PREREQUISTES : Nil

L	T	P	C
3	0	0	3

COURSE OBJECTIVE :

- To familiarize students with the basic concepts, models and statements of the operations research theory.

UNIT I INTRODUCTION (9)

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT II LINEAR PROGRAMMING PROBLEM (9)

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

UNIT III NON LINEAR PROGRAMMING PROBLEM (9)

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV SEQUENCING AND INVENTORY MODEL (9)

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V GAME THEORY (9)

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. H.A. Taha **"Operations Research, An Introduction"**, PHI, 2008
2. H.M. Wagner **"Principles of Operations Research"**, PHI, Delhi, 1982.
3. J.C. Pant **"Introduction to Optimisation: Operations Research"**, Jain Brothers, Delhi, 2008
4. Hitler Libermann **"Operations Research"**, McGraw Hill Pub. 2009
5. Pannerselvam **"Operations Research"**, Prentice Hall of India 2010
6. Harvey M Wagner **"Principles of Operations Research"** Prentice Hall of India 2010

COURSE OUTCOMES : On completion of this course, students will be able to

CO1: Apply basic theoretical principles in optimization and formulate the optimization models.

CO2: Develop mathematical skills to analyse and solve integer programming, network models arising from a wide range of industrial applications.

CO3: Implement optimization techniques in engineering problems.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO 1	H	H	H	L	H	L	M	-	-	L	L
CO 2	H	H	H	L	-	L	L	-	-	L	-
CO 3	L	M	H	L	L	L	-	-	-	L	M

L – Low, M – Moderate (Medium), H – High

18MFOE15 COMPOSITE MATERIALS
(Common to All Branches)

Category: OE

PREREQUISTES : Nil

L	*T*	*P*	*C*
3	*0*	*0*	*3*

COURSE OBJECTIVES :

- To be familiar with composite materials and their advantages, applications.
- To acquire knowledge of reinforcement, manufacturing and strength analysis of composites.

UNIT I INTRODUCTION (9)

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II REINFORCEMENT (9)

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT III MANUFACTURING OF METAL MATRIX COMPOSITES (9)

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT IV MANUFACTURING OF POLYMER MATRIX COMPOSITE (9)

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT V STRENGTH ANALYSIS OF COMPOSITES (9)

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. **Lubin**, George, **"Hand Book of Composite Materials",** Springer, 1982.
2. K.K.Chawla, "**Composite Materials"**, Springer, 2011
3. Deborah D.L. Chung**, "Composite Materials Science and Applications"** , Springer, 2010.
4. Danial Gay, Suong V. Hoa, and Stephen W.Tasi, "**Composite Materials Design and Applications"**, CRC Press, 2002.
5. R.W.Cahn, "**Material Science and Technology – Vol 13– Composites",** VCH, West Germany, 1996.
6. WD Callister, Jr., Adapted by R. Balasubramaniam, "**Materials Science and Engineering, An introduction"**, John Wiley & Sons, NY, Indian edition, 2007.

COURSE OUTCOMES: On completion of this course, students will be able to

CO1: Understand the nature of composite materials and composite reinforcements.

CO2: Develop the skills for manufacturing of composites.

CO3: Evaluate the strength of composite materials.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	L	L	M	L	L	-	-	L	-	L
CO2	L	M	H	L	L	L	-	-	L	L	L
CO3	M	L	H	M	L	L	-	-	L	L	L

L – Low, M – Moderate (Medium), H – High

18TEOE16 GLOBAL WARMING SCIENCE
(Common to All Branches)

Category : OE

PREREQUISITES : Nil

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students to learn about the material consequences of climate change, sea level change due to increase in the emission of greenhouse gases and to examine the science behind mitigation and adaptation proposals.

UNIT I INTRODUCTION (9)

Terminology relating to atmospheric particles – Aerosols-types, characteristics, measurements – Particle mass spectrometry. Anthropogenic-sources, effects on humans.

UNIT II CLIMATE MODELS (9)

General climate modeling- Atmospheric general circulation model, Oceanic general circulation model, Sea ice model, Land model concept, Paleo-climate, Weather prediction by Numerical process. Impacts of climate change, Climate Sensitivity, Forcings and feedbacks.

UNIT III EARTH CARBON CYCLE AND FORECAST (9)

Carbon cycle-process, importance, advantages. Carbon on Earth, Global carbon reservoirs, Interactions between human activities and Carbon cycle. Geologic time scales, Fossil fuels and energy, Perturbed Carbon cycle.

UNIT IV GREEN HOUSE GASES

Blackbody Radiation, Layer model, Earth's atmospheric composition and Green house gases effects on weather and climate. Radiative equilibrium. Earth's energy balance.

UNIT V GEO ENGINEERING (9)

Solar mitigation, Strategies – Carbon dioxide removal, solar radiation management, Recent observed trends in global warming for sea level rise, drought, glacier extent.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Archer, David. **GlobalWarming: Understanding the Forecast**, Wiley, 2011
2. Budyko, **Climate Changes, American Geophysical Society**, Washington, D.C.,244 pp.
3. Bodansky, **May we engineer the climate?**Clim. Change 33, 309-321.
4. Dickinson, **Climate Engineering-A review of aerosol approaches to changing the global energy** balance, Clim. Change 33, 279-290.
5. Climate Change 2007-**The Physical Science Basis: Working Group I Contribution to the Fourth Assessment Report of the IPCC**. Cambridge University Press, 2007.

COURSE OUTCOMES : On completion of this course, the students will be able to:

CO1: Understand the current warming in relation to climate changes throughout the Earth.

CO2: Assess the best predictions of current climate models.

CO3: Able to know about current issues, including impact from society, environment, economy as well as ecology related to greenhouse gases.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	L	L	L	L	M	H	M	L	M	L
CO2	L	L	L	L	L	M	H	M	L	M	L
CO3	L	L	L	L	L	H	M	M	L	L	L

L – Low, M – Moderate (Medium), H – High

18TEOE17 INTRODUCTION TO NANO ELECTRONICS
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

- To make the students to provide strong, essential, important methods and foundations of quantum mechanics and apply quantum mechanics on engineering fields.

UNIT I INTRODUCTION (9)

Particles and Waves, Operators in quantum mechanics, The Postulates of Quantum Mechanics, The Schrodinger Equation Values and Wave Packet Solutions, Ehrenfest's Theorem.

UNIT II ELECTRONIC STRUCTURE AND MOTION (9)

Atoms- The Hydrogen Atom, Many-Electron Atoms, Many-Electron Atoms. Pseudo potentials, Nuclear Structure, Molecules, Crystals. Translational motion – Penetration through barriers – Particle in a box. Two Terminal Quantum Dot Devices, Two Terminal Quantum Wire Devices.

UNIT III SCATTERING THEORY (9)

The formulation of scattering events- scattering cross section, stationary scattering state. Partial wave stationary scattering events, Multi-channel scattering, Solution for Schrodinger Equation- radial and wave equation, Greens' function.

UNIT IV CLASSICAL STATISTICS (9)

Probabilities and microscopic behaviors, Kinetic theory and transport processes in gases, Magnetic properties of materials, The partition function.

UNIT V QUANTUM STATISTICS (9)

Statistical mechanics- Basic Concepts, Statistical models applied to metals and semiconductors. The thermal properties of solids- The electrical properties of materials. Black body radiation, Low temperatures and degenerate systems.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Peter L. Hagelstein, Stephen D. Senturia, and Terry P. Orlando, **Introductory Applilied Quantum Statistical Mechanics**, Wiley (2004).
2. A. F. J. Levi, **Applied Quantum Mechanics** (2^{nd} Edition), Cambridge (2006).
3. Walter A Harrison, **Applied Quantum Mechanics**, Stanfor University (2008).
4. Richard Liboff, **Introductory Quantum Mechanics**, 4^{th} edition, Addison Wesley (2003).
5. P.W. Atkins and R.S. Friedman, **Molecular Quantum Mechanics** Oxford University Press, 3^{rd} edition 1997.

COURSE OUTCOMES: On completion of this course, students will be able to:

CO1: The student should be familiar with certain nanoelectronic systems and building blocks such as: low-dimensional semiconductors, hetero structures.

CO2: The student should be able to set up and solve the Scfrödinger equation for different types of potentials in one dimension as well as in 2 or 3 dimensions for specific cases.

CO3: Potentially be able to join a research group in nanoscience / nanotechnology as a student researcher.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M	M	L	M	L	M	L	L	L	L	L
CO2	M	M	L	M	L	M	L	L	L	L	L
CO3	M	M	L	M	L	H	L	L	L	L	L

L – Low, M – Moderate (Medium), H – High

18TEOE18 GREEN SUPPLY CHAIN MANAGEMENT
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES : Nil

COURSE OBJECTIVES:

- To make the students to learn and focus on the fundamental strategies, tools and techniques required to analyze and design environmentally sustainable supply chain systems.

UNIT I INTRODUCTION (9)

Logistics – aim, activities, importance, progress, current trends. Integrating logistics with an organization.

UNIT II ESSENTIALS OF SUPPLY CHAIN MANAGEMENT (9)

Basic concepts of supply chain management, Supply chain operations – Planning and sourcing, Making and delivering. Supply chain coordination and use of Technology. Developing supply chain systems.

UNIT III PLANNING THE SUPPLY CHAIN (9)

Types of decisions – strategic, tactical, operational. Logistics strategies, implementing the strategy. Planning resources – types, capacity, schedule, controlling material flow, measuring and improving performance.

UNIT IV ACTIVITIES IN THE SUPPLY CHAIN (9)

Procurement – cycle, types of purchase. Inventory management – EOQ, uncertain demand and safety stock, stock control. Material handling – purpose of warehouse and ownership, layout, packaging. Transport – mode, ownership, routing vehicles.

UNIT V SUPPLY CHAIN MANAGEMENT STRATEGIES (9)

Five key configuration components, Four criteria of a good supply chain strategies, Next generation strategies- New roles for end to end supply chain management. Evolution of supply chain organization.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Rogers,Dale., and Ronald Tibben-Lembke.”**An Examination of Reverse Logistics Practices.”** Journal of Business Logistics 22, no. 2 (2001): 129-48.
2. Guide, V., Kumar Neeraj, et al. “**cellular Telephone Reuse: The ReCellular Inc. Case.”** Managing Closed-Loop Supply Chains. Case: Part 6, (2005): 151-156.
3. Mark, K. “**Whirlpool Corrporation: Reverse Logistics.”** Richard Ivey School of Business. Case: 9B11D001, August 8, 2011.
4. Porter, Michael E., and Mark R. Kramer. “**Strategy and Society: The Link between Competitive Advantage and Corporate Social Responsibility.”** Harvard Business Revies 84, no. 12 (2006): 78-92.
5. Shoshnah Cohen, Josep Roussel, “**Strategic Supply Chain Management”,** the five disciplines for top performance, McGraw-Hill, (2005.)

COURSE OUTCOMES: On completion of this course, students will be able to:

CO1: Evaluate complex qualitative and quantitative data to support strategic and operational decisions.

CO2: Develop self-leadership strategies to enhance personal and professional effectiveness.

CO3: The importance of the design and redesign of a supply chain as key components of an organization's strategic plan.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	L	L	L	L	H	L	M	L	L	L
CO2	M	L	L	L	L	H	L	M	L	L	L
CO3	M	L	L	L	L	H	L	M	L	L	L

L – Low, M – Moderate (Medium), H – High

18PSOE19 DISTRIBUTION AUTOMATION SYSTEM
(Common to all Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

To study about the distributed automation and economic evaluation schemes of power network

UNIT I INTRODUCTION (9)

Introduction to Distribution Automation (DA) - Control system interfaces- Control and data requirements- Centralized (vs) decentralized control- DA system-DA hardware-DAS software.

UNIT II DISTRIBUTION AUTOMATION FUNCTIONS (9)

DA capabilities - Automation system computer facilities- Management processes- Information management- System reliability management- System efficiency management- Voltage management- Load management.

UNIT III COMMUNICATION SYSTEMS (9)

Communication requirements – reliability - Cost effectiveness- Data requirements - Two way capability- Communication during outages and faults - Ease of operation and maintenance- Conforming to the architecture of flow. Distribution line carrier- Ripple control-Zero crossing technique- Telephone, cableTV, radio, AM broadcast, FM SCA,VHF radio, microwave satellite, fiber optics-Hybrid communication systems used in field tests.

UNIT IV ECONOMIC EVALUATION METHODS (9)

Development and evaluation of alternate plans- select study area – Select study period- Project load growth-Develop alternatives- Calculate operating and maintenance costs- Evaluate alternatives.

UNIT V ECONOMIC COMPARISON (9)

Economic comparison of alternate plans-Classification of expenses - capital expenditures- Comparison of revenue requirements of alternative plans-Book life and continuing plant analysis- Year by year revenue requirement analysis, Short term analysis- End of study adjustment-Break even analysis, sensitivity analysis - Computational aids.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. IEEE Tutorial course “Distribution Automation”, IEEE Working Group on Distribution Automation, IEEE Power Engineering Society. Power Engineering Education Committee, IEEE Power Engineering Society. Transmission and Distribution Committee, Institute of Electrical and Electronics Engineers, 1988
2. Maurizio Di Paolo Emilio, “Data Acquisition Systems: From Fundamentals to Applied Design”, Springer Science & Business Media, 21-Mar-2013
3. Taub, “Principles Of Communication Systems”, Tata McGraw-Hill Education, 07-Sep-2008
4. M.K. Khedkar, G.M. Dhole, “A Textbook of Electric Power Distribution Automation”, Laxmi Publications, Ltd., 2010.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Analyse the requirements of distributed automation
CO2: Know the functions of distributed automation
CO3: Perform detailed analysis of communication systems for distributed automation.
CO4: Study the economic evaluation method
CO5: Understand the comparison of alternate plans

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	M	M	L	M	L	L	L	L	L
CO2	H	H	L	L	L	L	L	L	L	L	L
CO3	M	L	M	L	L	L	L	L	L	L	L
CO4	M	M	M	L	L	L	L	L	L	L	L
CO5	M	M	M	L	L	L	M	M	L	L	L

L – Low, M – Moderate (Medium), H- High

18PSOE20 POWER QUALITY ASSESSMENT AND MITIGATION
(Common to all Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREUISITES: Nil

COURSE OBJECTIVE:

To identify, analyze and create solutions for the power quality problems in power system networks.

UNIT I INTRODUCTION (09)

Importance of power quality - Terms and definitions as per IEEE std.1159 for transients, short and long duration voltage variations, interruptions, short and long voltage fluctuations, imbalance, flickers - Symptoms of poor power quality- Definitions and terminology of grounding- Purpose of groundings- Good grounding practices - problems due to poor grounding.

UNIT II FLICKERS AND TRANSIENT VOLTAGES (09)

RMS voltage variations in power system, complex power, voltage regulation and per unit system - Basic power flow and voltage drop - Devices for voltage regulation and impact of reactive power management - Causes and effects of voltage flicker - Short term and long term flickers -Methods to reduce flickers- Transient over voltages, impulsive transients, switching transients - Effect of surge impedance and line termination - control of transient voltages.

UNIT III VOLTAGE INTERRUPTIONS (09)

Definitions -Voltage sags versus interruptions - Economic impact, Major causes and consequences -characteristics, assessment, Influence of fault location and fault level on voltage sag - Areas of vulnerability, Assessment of equipment sensitivity, Voltage sag limits for computer equipment- CBEMA, ITIC, SEMI F 42curves, Report of voltage sag analysis, Voltage sag indices, Mitigation measures for voltage sag- DSTATCOM, UPQC,UPS, DVR, SMEs, CVT, utility solutions and end user solutions.

UNIT IV WAVEFORM DISTORTION (09)

Definition of harmonics, inter-harmonics, sub-harmonics- Causes and effects - Voltage versus current distortion, Fourier analysis, Harmonic indices, A.C. quantities under non-sinusoidal conditions, Triplet harmonics, characteristic and non characteristic harmonics- Series and Parallel resonances- Consequence - Principles for controlling and Reducing harmonic currents in loads, K-rated transformer -Computer tools for harmonic analysis- Locating sources of harmonics, Harmonic filtering- Passive and active filters - Modifying the system frequency response- IEEE Harmonic standard 519-1992.

UNIT V ANALYSIS AND CONVENTIONAL MITIGATION METHODS (09)

Analysis of power outages, Analysis of unbalance condition: Symmetrical components inphasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers - Analysis of distortion: On–line extraction of fundamental sequence components from measured

samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. M. H. J. Bollen, **"Understanding Power Quality Problems, Voltage Sag and Interruptions",** IEEE Press, series on Power Engineering, 2000.
2. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso and Wayne Beaty H., **"Electrical Power SystemQuality"**, Second Edition, McGraw Hill Publication Co., 2008.
3. G.T.Heydt, **"Electric Power Quality",** Stars in a Circle Publications, 1994(2nd edition).
4. Enrique Acha, Manuel Madrigal**, "Power System Harmonics: Computer Modeling and Analysis**", John Wiley and Sons, 2001.
5. Arrillaga J. and Watson N**."Power System Harmonics"**2nd edition on; John Willey&sons, 2003
6. IEEE Std. 519-1992/ IEEE Std. 1159 IEEE recommended practices and requirements for harmonics control in electrical power system.

COURSE OUTCOMES:

CO1: Acquire knowledge about the power quality issues and standards like IEEE,IEC on voltage, Frequency and harmonics.
CO2: Recognize the practical issues in the power system
CO3: Analyze the impact of power electronic devices and techniques in power system
CO4: Develop trouble shooting skills and innovative remedies for various power quality problems in power system

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	M	-	-	-	-	-	-	L
CO2	H	H	H	H	L	L	-	L	L	-	L
CO3	H	H	H	H	M	M	-	-	L	L	-
CO4	H	H	H	M	H	M	M	L	L	L	L

L – Low, M – Moderate (Medium), H- High

18PSOE21 MODERN AUTOMOTIVE SYSTEMS
(Common to all Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

To expose the students with theory and applications of Automotive Electrical and Electronic Systems.

UNIT-I INTRODUCTION TO MODERN AUTOMOTIVE ELECTRONICS (08)

Introduction to modern automotive systems and need for electronics in automobiles- Role of electronics and microcontrollers- Sensors and actuators- Possibilities and challenges in automotive industry- Enabling technologies and industry trends.

UNIT-II SENSORS AND ACTUATORS (09)

Introduction- basic sensor arrangement- Types of sensors- Oxygen sensor, engine crankshaft angular position sensor – Engine cooling water temperature sensor- Engine oil pressure sensor- Fuel metering- vehicle speed sensor and detonation sensor- Pressure Sensor- Linear and angle sensors- Flow sensor- Temperature and humidity sensors- Gas sensor- Speed and Acceleration sensors- Knock sensor- Torque sensor- Yaw rate sensor- Tyre Pressure sensor- Actuators - Stepper motors – Relays.

UNIT-III POWER TRAIN CONTROL SYSTEMS IN AUTOMOBILE (09)

Electronic Transmission Control - Digital engine control system: Open loop and close loop control systems- Engine cooling and warm up control- Acceleration- Detonation and idle speed control - Exhaust emission control engineering- Onboard diagnostics- Future automotive power train systems.

UNIT-IV SAFETY, COMFORT AND CONVENIENCE SYSTEMS (10)

Cruise Control- Anti-lock Braking Control- Traction and Stability control- Airbag control system- Suspension control- Steering control- HVAC Control.

UNIT-V ELECTRONIC CONTROL UNITS (ECU) (09)

Need for ECUs- Advances in ECUs for automotives - Design complexities of ECUs- V-Model for Automotive ECU‘s- Architecture of an advanced microcontroller (XC166 Family, 32-bit Tricore) used in the design of automobile ECUs- On chip peripherals, protocol interfaces, analog and digital interfaces.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. M. H. J. Bollen, **"Understanding Power Quality Problems, Voltage Sag and Interruptions",** IEEE Press, series on Power Engineering, 2000.
2. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso and Wayne Beaty H., **"Electrical Power SystemQuality"**, Second Edition, McGraw Hill Publication Co., 2008.
3. G.T.Heydt, **"Electric Power Quality",** Stars in a Circle Publications, 1994(2nd edition).
4. Enrique Acha, Manuel Madrigal**, "Power System Harmonics: Computer Modeling and Analysis**", John Wiley and Sons, 2001.
5. Arrillaga J. and Watson N**."Power System Harmonics"** 2nd edition on; John Willey & sons, 2003
6. IEEE Std. 519-1992/ IEEE Std. 1159 IEEE recommended practices and requirements for harmonics control in electrical power system.

COURSE OUTCOMES:

CO1: Acquire knowledge about the power quality issues and standards like IEEE,IEC on voltage, Frequency and harmonics.
CO2: Recognize the practical issues in the power system
CO3: Analyze the impact of power electronic devices and techniques in power system
CO4: Develop trouble shooting skills and innovative remedies for various power quality problems in power system.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	M	-	-	-	-	-	-	L
CO2	H	H	H	H	L	L	-	L	L	-	L
CO3	H	H	H	H	M	M	-	-	L	L	-
CO4	H	H	H	M	H	M	M	L	L	L	L

L – Low, M – Moderate (Medium), H- High

18PEOE22 VIRTUAL INSTRUMENTATION **Category:OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

To comprehend the Virtual instrument action programming concepts towards measurements and control.

UNIT-I INTRODUCTION (07)

Introduction - advantages - Block diagram and architecture of a virtual instrument - Conventional Instruments versus Traditional Instruments - Data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT-II GRAPHICAL PROGRAMMING AND LabVIEW (09)

Concepts of graphical programming - LabVIEW software - Concept of VIs and sub VI - Display types - Digital - Analog - Chart and Graphs. Loops - structures - Arrays – Clusters- Local and global variables – String - Timers and dialog controls.

UNIT-III MANAGING FILES & DESIGN PATTERNS (11)

High-level and low-level file I/O functions available in LabVIEW – Implementing File I/O functions to read and write data to files – Binary Files – TDMS – sequential programming – State machine programming – Communication between parallel loops –Race conditions – Notifiers & Queues – Producer Consumer design patterns

UNIT-IV PC BASED DATA ACQUISITION (09)

Introduction to data acquisition on PC, Sampling fundamentals, ADCs, DACs, Calibration, Resolution, - analog inputs and outputs - Single-ended and differential inputs - Digital I/O, counters and timers, DMA, Data acquisition interface requirements - Issues involved in selection of Data acquisition cards - Use of timer-counter and analog outputs on the universal DAQ card.

UNIT-V DATA AQUISTION AND SIGNAL CONDITIONING (09)

Components of a DAQ system, Bus, Signal and accuracy consideration when choosing DAQ hardware – Measurement of analog signal with Finite and continuous buffered acquisition- analog output generation – Signal conditioning systems – Synchronizing measurements in single & multiple devices – Power quality analysis using Electrical Power Measurement tool kit.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Jeffrey Travis, Jim Kring, **'LabVIEW for Everyone: Graphical Programming Made Easy and Fun (3rd Edition),** Prentice Hall, 2006**.**

2. Sanjeev Gupta, **'Virtual Instrumentation using LabVIEW'** TMH, 2004

3. Gary W. Johnson, Richard Jennings, **'Lab-view Graphical Programming'**, McGraw Hill Professional Publishing, 2001

4. Robert H. Bishop, **'Learning with Lab-view'**, Prentice Hall, 2003.

5. Kevin James, '**PC Interfacing and Data Acquisition: Techniques for Measurement**, Instrumentation and Control', Newness, 2000

COURSE OUTCOMES:

CO1: Gain Knowledge of graphical programming techniques using LabVIEW software.

CO2: Explore the basics of programming and interfacing using related hardware.

CO3: Outline the aspects and utilization of PC based data acquisition and Instrument interfaces.

CO4: Create programs and Select proper instrument interface for a specific application.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	-	M	H	-	-	-	-	-	-
CO2	H	H	-	M	H	-	M	-	-	-	L
CO3			H	M	H						L
CO4	H	H	H	M	H	-	-	-	M	-	L

L – Low, M – Moderate (Medium), H- High

18PEOE23 ENERGY AUDITING **Category: OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVE:

To Comprehend energy management schemes and perform economic analysis and load management in electrical systems.

UNIT-I BASICS OF ENERGY MANAGEMENT **(09)**

Energy Scenario – Energy Sector Reforms – Impact on environment – Strategy for future and conservation – Basics of Energy and it forms (Thermal and Electrical). Energy Audit: Need – Types and Methodology - Audit Report – Energy Cost, Benchmarking and Energy performance – System Efficiency. Facility as an energy system – Methods for preparing process flow, Material and energy balance diagrams.

UNIT-II :ACTION PLANNING AND MONITORING **(09)**

Energy Management System – Performance assessment – Goal setting by Manager – Action plan implementation – Financial Management: Investment - Financial analysis techniques, ROI, Risk and sensitivity analysis, role of Energy Service Companies. Project management: Steps in detail. – Energy monitoring and interpretance of variances for remedial actions. Environmental concerns: UNFCC – Kyoto protocol – COP – CDM – PCF – Sustainable development.

UNIT-III STUDY OF THERMAL UTILITIES **(09)**

Combustion of Oil, Coal and Gas – Performance Evaluation of Boilers – Boiler blow down – Boiler water treatment – Energy Conservation Opportunity – Cogeneration: Principal – Options - Classification – Influencing Factors and technical parameters. Waste heat recovery: Classification – application – benefits - Different heat recovery devices.

UNIT-IV STUDY OF ELECTRICAL UTILITIES **(09)**

Electricity Billing – Electricity load management – Motor efficiency and tests – Energy efficient motors – Factors affecting motor efficiency and loss minimization – Motor load survey. Lighting System: Types and features – recommended luminance levels – Lighting system energy efficiency study – Energy Efficient Technologies: Maximum demand controllers – Intelligent PF controllers – Soft starters and VFDs – Variable torque load uses – Energy efficient transformers, Light controllers and Electronic ballasts.

UNIT-V ENERGY ASSESSMENT IN UTILITY SYSTEMS **(09)**

Performing Financial analysis: Fixed and variable costs – Payback period – methods – factors affecting analysis – Waste Minimization Techniques: Classification – Methodology. Performance assessment of HVAC Systems: Measurements, Procedure – Evaluation. Assessment of Pumps: Measurements, Procedure – Evaluation.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Murphy W.R. and G.Mckay Butter worth, "Energy Management", Heinemann Publications.

2. Paul o' Callaghan, "Energy Management",Mc-Graw Hill Book Company – 1st edition; 1998.

3. John.C.Andreas, "Energy Efficient Electric Motors", Marcel Dekker Inc Ltd – 2nd edition; 1995.

4. W.C.Turner, "Energy Management Handbook", John Wiley and Sons, Fifth edition, 2009.

5. "Energy Management and Good Lighting Practice: fuel efficiency" – booklet 12 – EEO.

6. www.em-ea.org/gbook1.asp

COURSE OUTCOMES:

CO1: Possess knowledge on energy management.

CO2: Analyze the feature of energy audit methodology and documentation of report.

CO3: Able to plan energy management action and develop the understanding of implementation.

CO4: Familiarize with thermal utilities.

CO5: Familiarize with electrical utilities.

CO6: Perform assessment of different systems.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	M	L	L	-	M	M	L	-	M
CO2	-	-	M	L	L	-	M	M	L	-	M
CO3	-	-	M	L	-	-	M	M	L	-	M
CO4	-	-	M	-	-	-	M	-	L	-	M
CO5	-	-	M	-	-	-	M	-	L	-	M
CO6	-	-	M	-	-	-	M	-	L	-	M

L – Low, M – Moderate (Medium), H- High

18PEOE24 ADVANCED ENERGY STORAGE TECHNOLOGY **Category : OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

To explore the fundamentals, technologies and applications of energy storage.

UNIT-I ENERGY STORAGE: HISTORICAL PERSPECTIVE, INTRODUCTION AND CHANGES **(09)**

Storage Needs- Variations in Energy Demand- Variations in Energy Supply- Interruptions in Energy Supply- Transmission Congestion - Demand for Portable Energy-Demand and scale requirements - Environmental and sustainability issues.

UNIT-II TECHNICAL METHODS OF STORAGE **(09)**

Introduction: Energy and Energy Transformations, Potential energy (pumped hydro, compressed air, springs)- Kinetic energy (mechanical flywheels)- Thermal energy without phase change passive (adobe) and active (water)-Thermal energy with phase change (ice, molten salts, steam)- Chemical energy (hydrogen, methane, gasoline, coal, oil)- Electrochemical energy (batteries, fuel cells)- Electrostatic energy (capacitors), Electromagnetic energy (superconducting magnets)- Different Types of Energy Storage Systems.

UNIT-III PERFORMANCE FACTORS OF ENERGY STORAGE SYSTEMS **(09)**

Energy capture rate and efficiency- Discharge rate and efficiency- Dispatch ability and load flowing characteristics, scale flexibility, durability – Cycle lifetime, mass and safety – Risks of fire, explosion, toxicity- Ease of materials, recycling and recovery- Environmental consideration and recycling , Merits and demerits of different types of Storage.

UNIT-IV APPLICATION CONSIDERATION **(09)**

Comparing Storage Technologies- Technology options- Performance factors and metrics- Efficiency of Energy Systems- Energy Recovery - Battery Storage System: Introduction with focus on Lead Acid and Lithium- Chemistry of Battery Operation, Power storage calculations, Reversible reactions, Charging patterns, Battery Management systems, System Performance, Areas of Application of Energy Storage: Waste heat recovery, Solar energy storage, Green house heating, Power plant applications, Drying and heating for process industries, energy storage in automotive applications in hybrid and electric vehicles.

UNIT-V HYDROGEN FUEL CELLS AND FLOW BATTERIES **(09)**

Hydrogen Economy and Generation Techniques, Storage of Hydrogen, Energy generation - Super capacitors: properties, power calculations – Operation and Design methods - Hybrid Energy Storage: Managing peak and Continuous power needs, options - Level 1: (Hybrid Power generation) Bacitor “Battery + Capacitor” Combinations: need, operation and Merits; Level 2: (Hybrid Power Generation) Bacitor + Fuel Cell or Flow Battery operation-Applications: Storage for Hybrid Electric Vehicles, Regenerative Power, capturing methods.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. DetlefStolten, **"Hydrogen and Fuel Cells: Fundamentals, Technologies and Applications"**, Wiley, 2010.
2. Jiujun Zhang, Lei Zhang, Hansan Liu, Andy Sun, Ru-Shi Liu**, "Electrochemical Technologies for Energy Storage and Conversion",** John Wiley and Sons, 2012.
3. Francois Beguin and ElzbietaFrackowiak, **"Super capacitors"**, Wiley, 2013.
4. Doughty Liaw, Narayan and Srinivasan, **"Batteries for Renewable Energy Storage"**, The Electrochemical Society, New Jersy, 2010.

COURSE OUTCOMES:

CO1: Recollect the historical perspective and technical methods of energy storage.

CO2: Learn the basics of different storage methods.

CO3: Determine the performance factors of energy storage systems.

CO4: Identify applications for renewable energy systems.

CO5: Understand the basics of Hydrogen cell and flow batteries.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	L	-	-	_	-	_	-	L	-	-
CO2	L	M	M	-	_	-	_	-	L	-	-
CO3	-	-	M	L	_	M	_	-	L	-	-
CO4	L	L	M	L	_	-	_	-	L	-	-
CO5	L	M	L	L	_	-	_	-	L	-	-

L – Low, M – Moderate (Medium), H- High

18AEOE25 DESIGN OF DIGITAL SYSTEMS **Category : OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

***COURSE OBJECTIVES*:**

- Design synchronous and asynchronous sequential circuits
- Develop VHDL code for digital circuits
- Implementation in PLDs
- Fault diagnosis

UNIT I SYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN **(9)**

Analysis of Clocked Synchronous Sequential Circuits - Modeling, state table reduction, state assignment, Design of Synchronous Sequential Networks, Design of iterative circuits - ASM chart - ASM realization.

UNIT II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN **(9)**

Analysis of Asynchronous Sequential Circuits - Races in ASC – Primitive Flow Table - Flow Table Reduction Techniques, State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers.

UNIT III SYSTEM DESIGN USING PLDS **(9)**

Basic concepts – Programming Technologies - Programmable Logic Element (PLE) - Programmable Array Logic (PLA) - Programmable Array Logic (PAL) –Design of combinational and sequential circuits using PLDs – Complex PLDs (CPLDs)

UNIT IV INTRODUCTION TO VHDL **(9)**

Design flow - Software tools – VHDL: Data Objects - Data types - Operators – Entities and Architectures – Components and Configurations – Signal Assignment –Concurrent and Sequential statements — Behavioral, Data flow and Structural modeling – Transport and Inertial delays – Delta delays - Attributes – Generics – Packages and Libraries

UNIT V LOGIC CIRCUIT TESTING AND TESTABLE DES **(9)**

Digital logic circuit testing - Fault models - Combinational logic circuit testing - Sequential logic circuit testing-Design for Testability - Built-in Self-test, Board and System Level Boundary Scan. Case Study: Traffic Light Controller

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Donald G. Givone, “Digital principles and Design”, Tata McGraw Hill, 2002.
2. Nelson, V.P., Nagale, H.T., Carroll, B.D., and Irwin, J.D., "Digital Logic Circuit Analysis and Design", Prentice Hall International, Inc., New Jersey, 1995
3. Volnei A. Pedroni, “Circuit Design with VHDL”, PHI Learning, 2011.
4. Parag K Lala, “Digital Circuit Testing and Testability”, Academic Press, 1997
5. Charles H Roth, “Digital Systems Design Using VHDL,” Cencage 2nd Edition 2012.
6. Nripendra N Biswas “Logic Design Theory” Prentice Hall of India, 2001

COURSE OUTCOMES*: *Upon completion of the course the students will be able to:

CO1: Design synchronous and asynchronous sequential circuits based on specifications

CO2: Develop algorithm and VHDL code for design of digital circuits

CO3: Illustrate digital design implementation on PLDs.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	M	-	H	-	-	-	-	-	-	-
CO2	-	-	M	M	-	-	-	-	-	-	-
CO3	L	M	-	-	H	-	-	-	-	-	-

L-LOW M-MEDIUM H-HIGH

18AEOE26 ADVANCED PROCESSORS **Category : OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

***COURSE OBJECTIVES*:**

- To introduce the basics of CISC and RISC
- Describe the architectural features of Pentium processors
- Describe ARM and Special processors

UNIT I MICROPROCESSOR ARCHITECTURE **(9)**

Instruction set – Data formats – Instruction formats – Addressing modes – Memory hierarchy – register file – Cache – Virtual memory and paging – Segmentation – Pipelining – The instruction pipeline – pipeline hazards – Instruction level parallelism – reduced instruction set – Computer principles – RISC versus CISC – RISC properties – RISC evaluation.

UNIT II HIGH PERFORMANCE CISC ARCHITECTURE –PENTIUM **(9)**

The software model – functional description – CPU pin descriptions – Addressing modes – Processor flags – Instruction set – Bus operations – Super scalar architecture – Pipe lining – Branch prediction – The instruction and caches – Floating point unit– Programming the Pentium processor.

UNIT III HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM INTERFACE **(9)**

Protected mode operation – Segmentation – paging – Protection – multitasking – Exception and interrupts - Input /Output – Virtual 8086 model – Interrupt processing.

UNIT IV HIGH PERFORMANCE RISC ARCHITECTURE: ARM **(9)**

ARM architecture – ARM assembly language program – ARM organization and implementation – ARM instruction set - Thumb instruction set.

UNIT V SPECIAL PURPOSE PROCESSORS **(9)**

Altera Cyclone Processor – Audio codec – Video codec design – Platforms – General purpose processor – Digital signal processor – Embedded processor – Media Processor – Video signal Processor – Custom Hardware – Co-Processor.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Daniel Tabak, “Advanced Microprocessors”, McGraw Hill. Inc., 2011.
2. James L. Antonakos, “The Pentium Microprocessor”, Pearson Education, 1997.
3. Steve Furber, “ARM System –On –Chip architecture”, Addison Wesley, 2009.
4. Gene .H. Miller, “Micro Computer Engineering”, Pearson Education, 2003.
5. Barry. B. Brey, “The Intel Microprocessors Architecture, Programming and Interfacing”, PHI, 2008.
6. Valvano, "Embedded Microcomputer Systems" Cencage Learing India Pvt Ltd, 2011.
7. Iain E.G.Richardson, “Video codec design”, John Wiley & sons Ltd, U.K, 2002.

COURSE OUTCOMES*: *Upon completion of the course the students will be able to:

CO1: Distinguish between RISC and CISC generic architectures.

CO2: Describe the architectural features of Pentium processors

CO3: Develop simple applications using ARM processors

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	H	-	-	M	-	-	-	-	-	-
CO2	H	-	M	-	-	-	-	-	-	-	-
CO3	-	M	H	M	-	-	-	-	-	-	-

L-LOW M-MEDIUM H-HIGH

18AEOE27 PATTERN RECOGNITION **Category : OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

***COURSE OBJECTIVES*:**

- To get knowledge in pattern recognition in computer vision techniques
- To get knowledge in structural pattern methods
- To get knowledge on neural networks and fuzzy systems.

UNIT I PATTERN CLASSIFIER (9)

Overview of pattern recognition -Discriminant functions-Supervised learning –Parametric estimation- Maximum likelihood estimation –Bayesian parameter estimation- Perceptron algorithm-LMSE algorithm – Problems with Bayes approach –Pattern classification by distance functions-Minimum distance pattern classifier.

UNIT II UNSUPERVISED CLASSIFICATION (9)

Clustering for unsupervised learning and classification - Clustering concept-C-means algorithm-Hierarchical clustering procedures- Graph theoretic approach to pattern clustering - Validity of clustering solutions.

UNIT III STRUCTURAL PATTERN RECOGNITION (9)

Elements of formal grammars-String generation as pattern description - recognition of syntactic description- Parsing-Stochastic grammars and applications - Graph based structural representation.

UNIT IV FEATURE EXTRACTION AND SELECTION (9)

Entropy minimization – Karhunen - Loeve transformation-feature selection through functions approximation- Binary feature selection.

UNIT V NEURAL NETWORKS (9)

Neural network structures for Pattern Recognition –Neural network based Pattern associators-Unsupervised learning in neural Pattern Recognition-Self organizing networks-Fuzzy logic-Fuzzy classifiers-Pattern classification using Genetic Algorithms.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. R. O Duda, P.E Hart and Stork, “Pattern Classification”, Wiley, 2012.
2. Robert J. Sehalkoff, “Pattern Recognition: Statistical, Structural and Neural Approaches”, JohnWiley & Sons Inc., 2007.
3. Tou & Gonzales, “Pattern Recognition Principles”, Wesley Publication Company, 2000.
4. Morton Nadier and P. Eric Smith, “Pattern Recognition Engineering”, John Wiley & SonsZ, 2000.

COURSE OUTCOMES*: *Upon completion of the course, the students will have:

CO1: Apply parametric estimation and supervised learning techniques for pattern classification.

CO2: Describe the structural pattern recognition methods

CO3: Apply neural networks, fuzzy systems and Genetic algorithms to pattern recognition and classification.

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CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	M	-	M	-	-	-	-	-	-	-
CO2	-	-	H	-	-	-	-	-	-	-	-
CO3	M	L	-	M	M	-	-	-	-	-	-

L-LOW M-MEDIUM H-HIGH

18VLOE28 VLSI DESIGN
(Common to all Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES

- To gain knowledge on MOS and CMOS Circuits with its characterization
- To design CMOS logic and sub-system
- To understand low power CMOS VLSI Design.

UNIT I INTRODUCTION TO MOS CIRCUITS (9)

MOS Transistor Theory -Introduction MOS Device Design Equations -MOS Transistor as a Switches - Pass Transistor - CMOS Transmission Gate -Complementary CMOS Inverter - Static Load MOS Inverters - Inverters with NMOS loads - Differential Inverter - Tri State Inverter - BiCMOS Inverter.

UNIT II CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION (9)

Delay Estimation, Logical Effort and Transistor Sizing, Power Dissipation, Sizing Routing Conductors, Charge Sharing, Design Margin and Reliability.

UNIT III CMOS CIRCUIT AND LOGIC DESIGN (9)

CMOS Logic Gate Design, Physical Design of CMOS Gate, Designing with Transmission Gates, CMOS Logic Structures, Clocking Strategies, I/O Structures.

UNIT IV CMOS SUB SYSTEM DESIGN (9)

Data Path Operations - Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multipliers, Shifters, Memory Elements, Control-FSM, Control Logic Implementation.

UNIT V LOW POWER CMOS VLSI DESIGN (9)

Introduction to Low Power Design, Power Dissipation in FET Devices, Power Dissipation in CMOS, Low-Power Design through Voltage Scaling – VTCMOS Circuits, MTCMOS Circuits, Architectural Level Approach – Pipelining and Parallel Processing Approaches, Low Power Basics CMOS Gate and Adder Design.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. Sung Ms Kang, Yusuf Lablebici, “CMOS Digital Integrated Circuits: Analysis & Design”, Tata Mc-Graw Hill, 2011.
2. N. Weste and K. Eshranghian, "Principles of CMOS VLSI Design", Addison Wesley, 1998.
3. Neil H.E. Weste, David Harris, Ayan Banerjee,”CMOS VLSI Design:A Circuits and Systems Perspective ”, 2013, Pearson Education
4. Kiat-Seng Yeo, Kaushik Roy, “Low-Voltage, Low-Power VLSI Subsystems” – McGraw-Hill Professional, 2004.

5. Gary K. Yeap,"Practical Low Power Digital VLSI Design", Kluwer Academic Press, 2002.
6. Jan M. Rabaey,"Digital Integrated Circuits: A Design Perspective",Pearson Education, 2003.

COURSE OUTCOMES*: *After completing this course, the students will have:

CO1: knowledge on MOS and CMOS Circuits with its characterization

CO2: an ability to design CMOS logic and sub-system

CO3: an understanding of low power CMOS VLSI Design

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	L	M	-	L	-	-	-	M	-	-
CO2	H	L	M	-	L	-	-	-	M	-	-
CO3	H	L	M	-	L	-	-	-	M	-	-

L-LOW M-MEDIUM H-HIGH

18VLOE29 ANALOG AND MIXED MODE VLSI CIRCUITS **Category : OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

***COURSE OBJECTIVES*:**

- To acquire knowledge on MOS circuit configuration and CMOS amplifier
- To analyze and design Operational amplifier
- To understand mixed signal circuits

UNIT I MOS CIRCUIT CONFIGURATION (9)

Basic CMOS Circuits - Basic Gain Stage - Gain Boosting Techniques - Super MOS Transistor - Primitive Analog Cells, Current Source, Sinks and References MOS Diode/Active resistor, Simple current sinks and mirror, Basic current mirrors, Advance current mirror, Current and Voltage references, Bandgap references.

UNIT II CMOS AMPLIFIER (9)

CMOS Amplifier Performances matrices of amplifier circuits, Common source amplifier, Common gate amplifier, Cascode amplifier, Frequency response of amplifiers and stability of amplifier.

UNIT III CMOS DIFFERENTIAL AMPLIFIER (9)

CMOS Differential Amplifier Differential signalling, source coupled pair, Current source load, Common mode rejection ratio, CMOS Differential amplifier with current mirror load, Differential to single ended conversion. Linear Voltage - Current Converters - CMOS, Bipolar and Low – Voltage BiCMOS Op - Amp Design - Instrumentation Amplifier Design.

UNIT IV BICMOS CIRCUIT TECHNIQUES AND CURRENT-MODE SIGNAL PROCESSING (9)

Basic BiCMOS Circuit Techniques, Current - Mode Signal Processing: Continuous - Time Signal Processing – Sampled - Data Signal Processing – Switched - Current Data Converters.

UNIT V ANALOG FILTERS AND A/D CONVERTERS (9)

Sampled - Data Analog Filters, Over Sampled A/D Converters and Analog Integrated Sensors: First - order and Second SC Circuits - Bilinear Transformation – Cascade Design – Switched - Capacitor Ladder Filter

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. *Behzad Razavi, **Design of Analog CMOS Integrated circuits**, Tata McGraw Hill Education, 2002.*
2. Mohammed Ismail, Terri Fiez, Analog VLSI signal and Information Processing, McGraw- Hill International Editons, 1994.
3. R. Jacob Baker, Harry W. Li, and David E. Boyce, CMOS: Circuit Design , Layout and Simulation, Prentice Hall of India, 1997.
4. David A. Johns and Ken Martin, Analog Integrated circuit Design, John Wiley & Son, 2013
5. Greogorian and Tames, Analog Integrated Circuit for Switched Capacitor Circuits,

COURSE OUTCOMES*: *Upon completion of this course, the students will have:

CO1: Knowledge on MOS circuit configuration and CMOS amplifier

CO2: To analyze and design Operational amplifier

CO3: An understanding on mixed signal circuits

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	-	L	-	-	-	-	-	M	L	-
CO2	H	-	L	-	-	-	-	-	M	L	-
CO3	H	-	L	-	-	-	-	-	M	L	-

L-LOW M-MEDIUM H-HIGH

18VLOE30 HARDWARE DESCRIPTION LANGUAGES **Category : OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES

- To gain knowledge on HDLs and Modeling styles
- To understand the VHDL and Verilog HDL.
- To design sub-systems USING VHDL/VERILOG

UNIT I BASIC CONCEPTS OF HARDWARE DESCRIPTION LANGUAGES (9)
VLSI Design flow, Features of VHDL, Capabilities, Hierarchy, Syntax and Semantics of VHDL; Basic Language Elements - Data objects - Variable signal, and constant, Data types, Operators and signal assignments, Design Suits - Entities, architecture declaration, configurations, Packages.

UNIT II MODELING STYLES (VHDL) (9)
Behavioral Modeling - Process statement, Sequential assignment statements, Loops, wait statement, assertion statement, Delay Model – Inertial delay Model, Transport delay model; Gate Level Modeling – Component instantiation statements; Data flow Modeling - Concurrent assignment statement, Conditional assignment statements, Procedures, functions, Generics, attributes, Model simulation - Writing a test bench, Logic Synthesis.

UNIT III INTRODUCTION TO VERILOG HARDWARE DESCRIPTION LANGUAGE (9)
Key features, Capabilities, Language Constructs and Conventions in Verilog, Syntax and Semantics of Verilog; Basic Language Elements: Operators, nets, registers, vectors, arrays, parameters, system tasks, complier directives, Module, port connection rules.

UNIT IV MODELING STYLES (VERILOG) (9)
Gate Level Modeling - Gate types, Gate delays; Dataflow Modeling – continuous assignment, Behavioral Modeling - Initial & Always Construct, Assignments with Delays, wait construct, Multiple always blocks, If and if - else, assign, Loop Construct, Sequential and Parallel blocks, Switch level modeling - MOS switches, CMOS switches.

UNIT V DESIGN SUB-SYSTEMS USING VHDL/VERILOG (9)
Combinational logics – Adder, Subtractor, Decoders, Encoders, Multiplexer, code Converter; Flip flop, state machines – Mealy type FSM, Moore type FSM, Counters and Shift register. Synthesis of digital logic circuits.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference books

1. J. Bhaskar, "A VHDL Primer, 3rd Edition, Pearson Education, 2015.
2. Douglas Perry, "VHDL", McGraw Hill International, New York, 1998.
3. S. Brown & Z. Vransesic, “Fundamental of digital Logic with Verilog design”, Tata McGraw Hill, 2002.
4. S. Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Prentice Hall

(NJ, USA), 2003.

5. Frank Vahid, “Digital Design”, Wiley, 2006.
6. Peter J Ashenden, “The Designer’s Guide to VHDL”, Morgan Kaufmann Publishers, 2008.
7. Navabi, “VHDL Analysis & Modeling of digital systems”, McGraw Hill, 1998.

COURSE OUTCOMES*: *After completing this course, the students will have:

CO1: knowledge on HDLs and Modeling styles

CO2: to write the VHDL and Verilog HDL codes

CO3: to design sub-systems USING VHDL/VERILOG

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	L	H	L	M	-	-	-	M	-	-
CO2	H	L	H	-	M	-	-	-	M	-	-
CO3	H	L	H	-	M	-	-	-	M	-	-

L-LOW M-MEDIUM H-HIGH

18CSOE31 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Artificial Intelligence and intelligent agents, history of Artificial Intelligence*
- *Building intelligent agents (search, games, constraint satisfaction problems)*
- *Machine Learning algorithms*
- *Applications of AI (Natural Language Processing, Robotics/Vision)*
- *Solving real AI problems through programming with Python, Tensor Flow and Keras library.*

UNIT I FOUNDATIONS OF AI L(9)

Introduction - History of Artificial Intelligence - Intelligent Agents - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Adversarial Search - Constraint Satisfaction Problems.

UNIT II SUPERVISED AND UNSUPERVISED LEARNING L(9)

Maximum likelihood estimation -Regression -Linear, Multiple, Logistic - bias-variance, Bayes rule, maximum a posteriori inference- Classification techniques - k-NN, naïve Bayes - Decision Trees - Clustering - k-means, hierarchical, high-dimensional- Expectation Maximization.

UNIT III ENSEMBLE TECHNIQUES AND REINFORCEMENT LEARNING L(9)

Graphical Models - Directed and Undirected Models - Inference - Learning- maximum margin, support vector machines - Boosting and Bagging - Random Forests - PCA and variations - Markov models, hidden Markov models -Reinforcement Learning- introduction - Markov Decision Processes - Value-based methods - Q-learning- Policy-based methods

UNIT IV DEEP LEARNING L(9)

Neural Network Basics - Deep Neural Networks - Recurrent Neural Networks (RNN) - Deep Learning applied to Images using CNN - Tensor Flow for Neural Networks & Deep Learning

UNIT V AI APPLICATIONS L(9)

Applications in Computer Vision: Object Detection- Face Recognition - Action and Activity Recognition -Human Pose Estimation.

Natural Language Processing - Statistical NLP and text similarity - Syntax and Parsing techniques - Text Summarization Techniques - Semantics and Generation - Application in NLP - Text Classification -speech Recognition - Machine Translation - Document Summarization - Question Answering

Applications in Robotics : Imitation Learning - Self-Supervised Learning -Assistive and Medical Technologies - Multi-Agent Learning

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Peter Norvig and Stuart J. Russell, "**Artificial Intelligence: A Modern Approach**", Third edition
2. Tom Mitchell, **"Machine Learning"**, McGraw-Hill, 1997
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courvillem, "**Deep Learning**", MIT press, 2016.
4. Michael Nielson , **"Neural Networks and Deep Learning"**
5. Christopher Bishop, **"Pattern Recognition and Machine Learning",** Springer, 2006
6. Richard Sutton and Andrew Barto, **Reinforcement Learning: An introduction",** MIT Press,1998
7. Kevin P. Murphy, **"Machine Learning: A Probabilistic Perspective"**, MIT Press, 2012.
8. Trevor Hastie, Robert Tibshirani, Jerome Friedman, **"The Elements of Statistical Learning"**, Second Edition ,Springer, 2011

***COURSE OUTCOMES**: Upon completion of this course, the students will be able to:*

CO1: Develop expertise in popular AI & ML technologies and problem-solving methodologies. ***[Familiarity]***

CO2: Use fundamental machine learning techniques, such as regression, clustering, knearest neighbor methods, etc. ***[Usage]***

CO3: Distinguish between supervised and unsupervised machine learning methods. ***[Usage]***

CO4: Gain knowledge of the different modalities of Deep learning currently used. ***[Familiarity]***

CO5: Use popular AI & ML technologies like Python, Tensorflow and Keras todevelop Applications. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	H	M	H	H			L		M
CO2	H	M	M	M	M	M			L		M
CO3	H	H	H	M	H	M			L		L
CO4	H	H	M	H	M	H			L		L
CO5	H	H	H	M	H	M			L		L

H = 3 ; M = 2 ; L = 1

18CSOE32 COMPUTER NETWORK ENGINEERING
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *The hardware and software architecture of Computer Networks*
- *The concepts of internetworking*
- *Issues in resource allocation*
- *End-to-end protocols and data transmission*
- *Network management models*

UNIT I FOUNDATION L(9)

Applications – Requirements – Network Architecture – Implementing Network software – Performance – Perspectives on connecting – Encoding – Framing – Error detection – Reliable transmission – Ethernet and Multiple Access Networks – Wireless.

UNIT II INTERNETWORKING L(9)

Switching and bridging – IP – Routing – Implementation and Performance – Advanced Internetworking – The Global Internet – Multicast – Multiprotocol and Label Switching – Routing among Mobile devices.

UNIT III CONGESTION CONTROL AND RESOURCE ALLOCATION L(9)

Issues in Resource allocation – Queuing disciplines – Congestion Control – Congestion avoidance mechanism – Quality of Service.

UNIT IV END-TO-END PROTCOLS AND DATA L(9)

Simple Demultiplexer – Reliable Byte Stream –Remote Procedure Call – RTP – Presentation formatting - Multimedia data.

UNIT V NETWORK MANAGEMENT L(9)

SNMPv1 and v2 Organization and information model - Communication model – Functional model - SNMP proxy server- Remote monitoring- RMON1 andRMON2.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. Larry L. Peterson, Bruce S. Davie, **"Computer Networks a Systems approach"**, Fifth edition, Elsevier, 2011.
2. Priscilla Oppenheimer, **"Top-down Network Design: A Systems Analysis Approach to Enterprise Network Design"**, 3rd Edition, Cisco Press, 2010.
3. James D. McCabe, Morgan Kaufmann, **"Network Analysis, Architecture, and Design"**, Third Edition, Elsevier, 2007.
4. William Stallings, **"SNMP, SNMPv2, SNMPv3, and RMON 1 and 2,"** Third Edition, Pearson Education, 2012

5 Mani Subramanian, **"Network Management Principles and practice"**, Pearson Education, 2010.

COURSE OUTCOMES: Upon completion of this course, the students will be able to:

CO1: Explain the architecture and applications of Computer Networks. ***[Familiarity]***
CO2: Analyze the performance of MAC protocols. ***[Assessment]***
CO3: Configure switches and Routers. ***[Assessment]***
CO4: Design algorithms to ensure congestion control and QOS. ***[Usage]***
CO5: Appreciate the performance of End-to-End protocols and data transmission techniques. ***[Assessment]***
CO6: Use SNMP and RMON. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	H	M	H	M	H			M		M
CO3	H	H	M	H	M	H			M		M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	M	H	M	H	L		M		M
CO6	H	H	H	M	H	M	L		M		M

H = 3 ; M = 2 ; L = 1

18CSOE33 BIG DATA ANALYTICS
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Statistical methods*
- *Bayesian, Support Vector and Kernel Methods*
- *Time Series Analysis and Rule Induction*
- *Neural networks and Fuzzy Logic*
- *Visualization Techniques*

UNIT I STATISTICAL CONCEPTS AND METHODS L(9)

Statistical Concepts: Probability, Sampling and Sampling Distributions, Statistical Inference, Prediction and Prediction Errors–Resampling- Statistical Method: Linear Models, Regression Modeling, Multivariate Analysis.

UNIT II BAYESIAN METHODS AND SUPPORT VECTOR AND KERNEL METHODS L(9)

Bayesian Methods: Bayesian Paradigm, modeling, inference and networks – Support Vector and Kernel Methods: Kernel Perceptron, Overfitting and Generalization Bounds, Support Vector Machines, Kernel PCA and CCA.

UNIT III TIME SERIES ANALYSIS AND RULE INDUCTION L(9)

Analysis of time series: linear systems analysis, nonlinear dynamics, Delay Coordinate Embedding - Rule induction: Propositional Rule Learning, Rule Learning as search, Evaluating quality of rules, Propositional rule induction, First order rules-ILP systems.

UNIT IV NEURAL NETWORKS AND FUZZY LOGIC L(9)

Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees.

UNIT V STOCHASTIC SEARCH METHODS AND VISUALIZATION L(9)

Stochastic Search Methods: Stochastic Search by Simulated Annealing, Adaptive Search by Evolution- Evolution Strategies- Genetic Algorithms & Programming- Visualization : Classification of Visual Data Analysis Techniques, Data Type to be Visualized, Visualization Techniques, Interaction Techniques and Specific Visual Data Analysis Techniques.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1 Michael Berthold, David J. Hand, **"Intelligent Data Analysis-An Introduction"**, Second Edition, Springer, 2007.

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

3 Jimmy Lin and Chris Dyer, **"Data Intensive Text Processing using Map Reduce"**, Morgan and Claypool Publishers, 2010.

4 Tom White, **"Hadoop: The Definitive Guide"**, O`Reilly Publishers, 2012

5 David Loshin, "**Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph**", Morgan Kaufmann, 2013.

6 Paul Zikopoulos, Chris Eaton, "**Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data**", McGraw-Hill Education, 2011.

***COURSE OUTCOMES**: Upon completion of this course, the students will be able to:*

CO1: Explain the statistical concepts and methods. ***[Familiarity]***
CO2: Use Bayesian, support vector and kernel Methods. ***[Usage]***
CO3: Perform Time series analysis. ***[Usage]***
CO4: Use Rule induction. ***[Usage]***
CO5: Apply Neural network and Fuzzy logic. ***[Usage]***
CO6: Use Stochastic search methods. ***[Usage]***
CO7: Explain Visualization Techniques. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	M	M	M			M		M
CO2	H	H	H	M	H	M			M		M
CO3	H	H	H	M	H	M	L		M	L	M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M	L		M		M
CO7	H	M	M	M	M	M			M	L	M

H = 3 ; M = 2 ; L = 1

18CSACZ1 ENGLISH FOR RESEARCH PAPER WRITING
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Writing quality research papers in English*

UNIT I **L(6)**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II **L(6)**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism

UNIT III **L(6)**

Sections of a Paper, Abstracts, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV **L(6)**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT V **L(6)**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions, useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Lecture: 30 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 30 Periods

Reference Books

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

COURSE OUTCOMES: Upon completion of this course the students will be able to,

CO1: Utilize writing skills to write best quality research paper and provide better readability. ***[Familiarity]***

CO2: Describe each section of a paper with clarity. ***[Familiarity]***

CO3: Review the papers efficiently. ***[Familiarity]***

CO4: Utilize the key skills to write title, abstract, introduction and literature review of the paper. ***[Familiarity]***

CO5: Write the methods, results, Discussion and Conclusion using the required skills and useful phrases. ***[Familiarity]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	H	L	L	M			H			
CO2	H	H	L	L	M			H			
CO3	H	H	L	L	M			H			
CO4	H	H	L	L	M			H			
CO5	H	H	L	L	M			H			

H = 3 ; M = 2 ; L = 1

18CSACZ2 DISASTER MANAGEMENT
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Key concepts in disaster risk reduction.*
- *Types of disasters and hazards.*
- *Disaster prone areas in India.*
- *Strengths and weaknesses of disaster management approaches.*
- *Risk assessment methods.*

UNIT I INTRODUCTION L(6)

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS L(6)

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA L(6)

Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT L(6)

Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

UNIT V RISK ASSESSMENT L(6)

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co- Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.

Lecture: 30 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 30 Periods

Reference Books

1. R. Nishith, Singh AK, **"Disaster Management in India: Perspectives, issues and strategies"** New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.), **"Disaster Mitigation Experiences And Reflections"**, Prentice Hall Of India, New Delhi.
3. Goel S. L., **"Disaster Administration And Management Text And Case Studies"** ,Deep & Deep Publication Pvt. Ltd., New Delhi.
4. Jagbir Singh, **"Disaster Management: Future Challenges and Opportunities",** I.K. International Publishing House Pvt. Ltd. , New Delhi, 2007.

COURSE OUTCOMES: Upon completion of this course the students will be able to,

CO1: Differentiate hazard and disaster and types of disasters.

CO2: Identify the causes and types of manmade and natural disaster.

CO3: Describe the disaster prone areas in India.

CO4: To predict and, where possible, prevent disasters, mitigate their impact on vulnerable populations, and respond to and effectively cope with their consequences

CO5: Provide survival strategies based on risk assessment.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	M		M	M	L		H		M		M
CO2	M		M	M	L		H		M		M
CO3	M		M	H	L		H		M		M
CO4	M		M	M	L		H		M		M
CO5	M		M	H	L		H		M		M

H = 3 ; M = 2 ; L = 1

18CSACZ3 VALUE EDUCATION
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES: Upon completion of this course, the students will be familiar with:

- *Value of education and self- development*
- *Requirements of good values in students*
- *Importance of character*

UNIT I ETHICS AND SELF-DEVELOPMENT L(6)

Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements.

UNIT II PERSONALITY AND BEHAVIOR DEVELOPMENT L(6)

Soul and Scientific attitude .Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness.Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.

UNIT III VALUES IN HUMAN LIFE L(6)

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature ,Discipline

UNIT IV VALUES IN SOCIETY L(6)

True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT V POSITIVE VALUES L(6)

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

Lecture: 30 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 30 Periods

Reference Books

1. Chakroborty, S.K. **"Values and Ethics for organizations Theory and practice"**, Oxford University Press, New Delhi
2. Dr. Yogesh Kumar Singh, **"Value Education"**, A.P.H Publishing Corporation,New Delhi
3. R.P Shukla, **"Value Education and Human Rights"**, Sarup and Sons, NewDelhi.
4. https://nptel.ac.in/courses/109104068/36

COURSE OUTCOMES: ***At the end of the course, students will be able to***

CO1: Understand the values and work ethics
CO2: Enhance personality and behaviour development
CO3: Apply the values in human life.
CO4: Gain Knowledge of values in society.
CO5. Learn the importance of positive values in human life.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	H	M	M	H		H				H	
CO2	H	M	M	H		H				M	
CO3	H	M	M	H		H				M	
CO4	H	M	M	H		H				M	
CO5	H	M	M	H		H				M	

H = 3 ; M = 2 ; L = 1

18CSACZ4 CONSTITUTION OF INDIA
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Indian constitution*
- *Constitutional rights & duties*
- *Organs of governance*
- *Local administration*
- *Roles and functions of Election commission*

UNIT I INDIAN CONSTITUTION **L(6)**

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working) - Philosophy of the Indian Constitution: Preamble Salient Features.

UNIT II CONSTITUTIONAL RIGHTS & DUTIES **L(6)**

Contours of Constitutional Rights & Duties: Fundamental Rights , Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT III ORGANS OF GOVERNANCE **L(6)**

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT IV LOCAL ADMINISTRATION **L(6)**

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT V ELECTION COMMISSION **L(6)**

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Lecture: 30 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 30 Periods

Reference Books

1 **The Constitution of India**, 1950 (Bare Act), Government Publication.

2 Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.

3 M. P. Jain, **Indian Constitution Law**, 7th Edn., Lexis Nexis, 2014.

4 D.D. Basu, **Introduction to the Constitution of India**, Lexis Nexis, 2015.

COURSE OUTCOMES: ***At the end of the course, students will be able to***

CO1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3: Understand the various organs of Indian governance.

CO4: Familiarize with the various levels of local administration.

CO5: Gain knowledge on election commission of India.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1				H		L	H			H	M
CO2				H		L	H			H	M
CO3				H		L	H			H	M
CO4				H		L	H			H	M
CO5				H		L	H			H	M

H = 3 ; M = 2 ; L = 1

18CSACZ5 PEDAGOGY STUDIES
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Understanding of various theories of learning, prevailing pedagogical practices and design of curriculum in engineering studies.*
- *Application of knowledge in modification of curriculum, its assessment and introduction of innovation in teaching methodology.*

UNIT I INTRODUCTION L(6)

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT II PEDAGOGICAL PRACTICES L(6)

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education. Evidence on the

UNIT III PEDAGOGICAL APPROACHES L(6)

How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teacher's attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT L(6)

Professional development: alignment with classroom practices and follow-up support. Peer support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.

UNIT V CURRICULUM AND ASSESSMENT L(6)

Research gaps and future directions Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.

Lecture: 30 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 30 Periods

Reference Books

1. Ackers J, Hardman F (2001) **Classroom interaction in Kenyan primary** schools,Compare, 31 (2): 245-261.
2. Agrawal M (2004) **Curricular reform in schools: The importance of evaluation,** Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) **Teacher training in Ghana - does it count?** Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4 Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5 Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

6 Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

7 www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE OUTCOMES: ***Upon completion of this course the students will be able to,***

CO1: Explain the concept of curriculum, formal and informal education systems and teacher education.

CO2: Explain the present pedagogical practices and the changes occurring in pedagogical approaches.

CO3: Understand the relation between teacher and community, support from various levels of teachers to students and limitation in resources and size of the class.

CO4: Perform research in design a problem in pedagogy and curriculum development.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1				H		H	M			H	L
CO2				H		H	M			H	M
CO3				H		H	M			H	M
CO4				H		H	H			H	M

H = 3 ; M = 2 ; L = 1

18CSACZ6 STRESS MANAGEMENT BY YOGA
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Eight parts of yoga*
- *Techniques to achieve overall health of body and mind*
- *Breathing techniques and its effects*

UNIT I **L(6)**

Definitions of Eight parts of yog. (Ashtanga).

UNIT II **L(6)**

Yam and Niyam.-Do`s and Don't's in life.

UNIT III **L(6)**

Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

UNIT IV **L(6)**

Asan and Pranayam : Various yog poses and their benefits for mind & body.

UNIT V **L(6)**

Regularization of breathing techniques and its effects-Types of pranayam.

Lecture: 30 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 30 Periods

Reference Books

1. **'Yogic Asanas for Group Tarining-Part-I"** :Janardan Swami Yogabhyasi Mandal, Nagpur
2. **"Rajayoga or conquering the Internal Nature"** by Swami Vivekananda, AdvaitaAshrama(Publication Department), Kolkata
3. Pandit Shambu Nath, **"Speaking of Stress Management Through Yoga and Meditation"**,New Dawn Press,New Delhi.
4. K.N Udupa**,"Stress and its management by Yoga",** Motilal Banarsidass Publ,New Delhi.

COURSE OUTCOMES*:****Upon completion of this course, the students will be able to:***

CO1: understand the basics of Yoga.
CO2: Identify Do's and Dont's in life.
CO3: Follow ethical and moral guidelines given by Yamas and Niyamas in life.
CO4: Develop healthy mind in a healthy body thus improving social health by Asan and Pranayam
CO5: Use breathing techniques to live a stress free life

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1				H		M	H			H	
CO2				H		M	H			H	L
CO3				H		M	H			H	
CO4				H		M	H			H	
CO5				H		M	H			H	

H = 3 ; M = 2 ; L = 1

18CSACZ7 PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Techniques to achieve the highest goal happily*
- *How to become a person with stable mind, pleasing personality and determination*
- *Awakening wisdom in students*

UNIT I **L(6)**

Neetisatakam-Holistic development of personality-Verses- 19,20,21,22 (wisdom)-Verses-29,31,32 (pride & heroism)-Verses- 26,28,63,65 (virtue)

UNIT II **L(6)**

Verses- 52, 53, 59 (dont's)-Verses- 71,73,75,78 (do's). - Approach to day to day work and duties.- Shrimad Bhagwad Geeta - Chapter 2-Verses 41, 47,48,

UNIT III **L(6)**

Shrimad Bhagwad Geeta -Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5, 13, 17, 23, 35,-Chapter 18-Verses 45, 46, 48.

UNIT IV **L(6)**

Statements of basic knowledge.-Shrimad Bhagwad Geeta: -Chapter2-Verses 56, 62, 68 -Chapter 12 -Verses 13, 14, 15, 16,17, 18-Personality of Role model.

UNIT V **L(6)**

Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39-Chapter18 – Verses 37,38,63

Lecture: 30 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 30 Periods

Reference Books

1. **"Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram** (Publication Department), Kolkata
2. **Bhartrihari's Three Satakam (Niti-sringar-vairagya)** by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.
3. **"Bhagavad Gita: The Song of God",** Swami Mukundananda, Jagadguru Kripaluji Yog, USA
4. **"Bhagavad-Gita As It Is",** A.C. Bhaktivedanta Swami Prabhupada,, Bhaktivedanta Book Trust Publications.

COURSE OUTCOMES : ***On completion of this course, students will be able to***

CO1: Understand the Holistic development
CO2: Understand the day to day to day work and duties
CO3: Understand mankind to peace and prosperity
CO4: Become versatile personality.

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1							H	M	L		H
CO2							H		M		H
CO3							H		M		H
CO4							H	M	M		H

H = 3 ; M = 2 ; L = 1

18CSACZ8 SANSKRIT FOR TECHNICAL KNOWLEDGE
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES: ***Upon completion of this course, the students will be familiar with:***

- *Alphabets and tense of the language.*
- *Sentence formation*
- *The Technical information in Sanskrit Literature*

UNIT I **L(6)**
Alphabets in Sanskrit, Past/Present/Future Tense

UNIT II **L(6)**
Simple Sentences - Order, Introduction of roots

UNIT III **L(6)**
Technical information about Sanskrit Literature

UNIT IV **L(6)**
Technical concepts of Engineering-Electrical, Mechanical

UNIT V **L(6)**
Technical concepts of Engineering-Architecture, Mathematics

Lecture: 30 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 30 Periods

Reference Books

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

COURSE OUTCOMES: ***Upon completion of this course the students will be able to,***

CO1: Read and write sentences ***[Familiarity]***

CO2: Explore the huge knowledge from ancient literature ***[Familiarity]***

CO3: Use technical concepts to develop logic in mathematics and engineering. ***[Usage]***

CORRELATION BETWEEN COURSE OUTCOMES AND PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1								M	L		H
CO2	L								M		H
CO3		L	H	H					H	M	H

H = 3 ; M = 2 ; L = 1