DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

Regulations 2019

CHOICE BASED CREDIT SYSTEM

(I – IV SEMESTERS CURRICULUM)

Sri Eshwar College of Engineering

(An Autonomous Institution)

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai)

Kondampatti (Post), Kinathukadavu,

Coimbatore – 641202

M.E. COMPUTER SCIENCE AND ENGINEERING

Regulations 2019

Semester I

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	P19MA101	Mathematical Foundations of Computer Science	FC	5	3	2	0	4
2	P19CS101	Advanced Data Structures and Algorithms	PC	3	3	0	0	3
3	P19CS102	Advanced Operating System	PC	3	3	0	0	3
4	P19CS3XX	Program Elective I	PE	3	3	0	0	3
5	P19ED102	Research Methodology and IPR	MC	3	3	0	0	3
PRACTICALS								
6	P19CS111	Data Structures Laboratory	PC	4	0	0	4	2
7	P19CS112	Operating System Laboratory	PC	4	0	0	4	2
8	P19AC5XX	Audit Course I	AC	2	2	0	0	NC
TOTAL				**26**	**16**	**2**	**8**	**20**

Semester II

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	P19CS103	Machine Learning	PC	3	3	0	0	3
2	P19CS104	Big Data Analytics	PC	3	3	0	0	3
3	P19CS3XX	Program Elective II	PE	3	3	0	0	3
4	P19CS3XX	Program Elective III	PE	3	3	0	0	3
PRACTICALS								
6	P19CS113	Data Analytics Laboratory	PC	4	0	0	4	2
7	P19CS114	Machine Learning Laboratory	PC	4	0	0	4	2
8	P19CS201	Mini Project with Seminar	PW	4	0	0	4	2
9	P19AC5XX	Audit Course II	AC	2	2	0	0	NC
TOTAL				**26**	**14**	**0**	**12**	**18**

Semester II

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1	P19CS3XX	Program Elective IV	PE	3	3	0	0	3
2	P19CS4XX	Open Elective	OE	3	3	0	0	3
PRACTICALS								
6	P19CS202	Project Work – Phase I	PW	20	0	0	20	10
TOTAL				**26**	**6**	**0**	**20**	**16**

Semester IV

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
PRACTICALS								
1	P19CS203	Project Work – Phase II	PW	32	0	0	32	16
TOTAL				**32**	**0**	**0**	**32**	**16**

Total Number of Credits: 70

SUMMARY

Sl. No.	Course Category	Credits Per Semester				Credits	Credit %
		I	II	III	IV		
1	FC	4	-	-	-	4	5.7%
2	PC	10	10	-	-	20	28.6%
3	PE	3	6	3	-	12	17.1%
4	OE	-	-	3	-	3	4.3%
5	PW	-	2	10	16	28	40.0%
6	MC	3	-	-	-	3	4.3%
7	AC	✓	✓	-	-	-	-
Total		**20**	**20**	**16**	**16**	**70**	**100%**

FOUNDATION COURSES (FC)

Sl. No.	Course Code	Course Title	Category	L	T	P	C
1	P19MA101	Mathematical Foundations of Computer Science	FC	3	2	0	4

PROGRAM CORE (PC)

Sl. No.	Course Code	Course Title	Category	L	T	P	C
1	P19CS101	Advanced Data Structures and Algorithms	PC	3	0	0	3
2	P19CS102	Advanced Operating System	PC	3	0	0	3
3	P19CS103	Machine Learning	PC	3	0	0	3
4	P19CS104	Big Data Analytics	PC	3	0	0	3
5	P19CS111	Data Structures Laboratory	PC	0	0	4	2
6	P19CS112	Operating System Laboratory	PC	0	0	4	2
7	P19CS113	Data Analytics Laboratory	PC	0	0	4	2
8	P19CS114	Machine Learning Laboratory	PC	0	0	4	2

PROGRAM ELECTIVES (PE)

Sl. No.	Course Code	Course Title	Category	L	T	P	C
SEMESTER I – ELECTIVE I							
1	P19CS301	Advanced Databases	PE	3	0	0	3
2	P19CS302	Ethical Hacking	PE	3	0	0	3
3	P19CS303	Image Processing and Analysis	PE	3	0	0	3
4	P19CS304	Web Engineering	PE	3	0	0	3
5	P19CS305	Cloud Computing Technologies	PE	3	0	0	3
6	P19CS306	Computational Intelligence	PE	3	0	0	3
SEMESTER II – ELECTIVE II							
7	P19CS307	Real Time Systems	PE	3	0	0	3
8	P19CS308	Mobile and Pervasive Computing	PE	3	0	0	3
9	P19CS309	Information Storage Management	PE	3	0	0	3
10	P19CS310	Information Retrieval Techniques	PE	3	0	0	3
11	P19CS311	Software Architectures and Design	PE	3	0	0	3
12	P19CS312	Wireless Sensor Networks	PE	3	0	0	3
SEMESTER II – ELECTIVE III							
13	P19CS313	Data Visualization Techniques	PE	3	0	0	3
14	P19CS314	Natural Language Processing	PE	3	0	0	3
15	P19CS315	Computer Vision	PE	3	0	0	3
16	P19CS316	Soft Computing	PE	3	0	0	3
17	P19CS317	Software Quality Assurance and Testing	PE	3	0	0	3
18	P19CS318	Object Oriented Design	PE	3	0	0	3
SEMESTER III – ELECTIVE IV							
19	P19CS319	Bio Informatics	PE	3	0	0	3
20	P19CS320	Quantum Computing	PE	3	0	0	3
21	P19CS321	Social Network Analysis	PE	3	0	0	3
22	P19CS322	Bio-inspired Computing	PE	3	0	0	3
23	P19CS323	Compiler Optimization Techniques	PE	3	0	0	3
24	P19CS324	Ubiquitous computing	PE	3	0	0	3

OPEN ELECTIVES (OE)

Sl. No.	Course Code	Course Title	Category	L	T	P	C
1	P19OE401	Business Analytics	OE	3	0	0	3
2	P19OE402	Industrial Safety	OE	3	0	0	3
3	P19OE403	Operations Research	OE	3	0	0	3
4	P19OE404	Cost Management of Engineering Projects	OE	3	0	0	3
5	P19OE405	Composite Materials	OE	3	0	0	3
6	P19OE406	Waste to Energy	OE	3	0	0	3

PROJECT WORK (PW)

Sl. No.	Course Code	Course Title	Category	L	T	P	C
1	P19CS201	Mini Project with Seminar	PW	0	0	4	2
2	P19CS202	Project Work – Phase I	PW	0	0	20	10
3	P19CS203	Project Work – Phase II	PW	0	0	32	16

MANDATORY COURSE (MC)

Sl. No.	Course Code	Course Title	Category	L	T	P	C
1	P19MC509	Research Methodology and IPR	MC	3	0	0	3

AUDIT COURSES (AC)

Sl. No.	Course Code	Course Title	Category	L	T	P	C
1	P19AC501	English for Research Paper Writing	AC	2	0	0	NC
2	P19AC502	Disaster Management	AC	2	0	0	NC
3	P19AC503	Sanskrit for Technical Knowledge	AC	2	0	0	NC
4	P19AC504	Value Education	AC	2	0	0	NC
5	P19AC505	Constitution of India	AC	2	0	0	NC
6	P19AC506	Pedagogy Studies	AC	2	0	0	NC
7	P19AC507	Stress Management by Yoga	AC	2	0	0	NC
8	P19AC508	Personality Development through Life Enlightenment Skills	AC	2	0	0	NC

SEMESTER – I

P19MA101	MATHEMATICAL FOUNDATIONS FOR COMPUTER SCIENCE	L	T	P	C
		3	2	0	4

After completion of this course, students will be able to

Outcomes			
	CO1	(**Analyze**) Apply various methods in matrix theory to solve system of linear equations.	**K4**
	CO2	**(Apply)** Apply the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.	**K3**
	CO3	**(Analyze**) Analyze the components of decision problems to formulate and solve linear programming problem.	**K4**
	CO4	**(Analyze)** Estimate the values of parameters based on measured empirical data that has a random component.	**K4**
	CO5	(**Apply)** Apply the concept of number theory in engineering.	**K3**

MODULE I MATRIX THEORY 12

Cholesky decomposition - Generalized eigenvectors - QR factorization - Least squares method - Singular value decomposition.

MODULE II VECTOR SPACES 12

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Rank of a matrix – Bases and dimensions.

MODULE III LINEAR PROGRAMMING PROBLEM 12

Formulation of Linear programming problem – Simplex method – Dual simplex method – Transportation problem – Assignment problem.

MODULE IV ESTIMATION THEORY 12

Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares – Linear regression.

MODULE V DIOPHANTINE EQUATIONS AND CONGRUENCES 12

Linear Diophantine equations – Congruence‘s – Linear Congruence‘s – Applications: Divisibility tests – Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.

TOTAL: 60 Hours

TEXT BOOKS:

1. Taha, H.A., “Operations Research: An Introduction”, 9th Edition, Pearson Education, Asia, New Delhi, 2016.
2. Bronson, R., "Matrix Operations”, Schaum's Outline Series, 2nd Edition, McGraw Hill, 2011.
3. Koshy, T., —Elementary Number Theory with Applications, 2ndEdition, Elsevier Publications, New Delhi, 2002.
4. Friedberg, A.H., Insel, A.J. and Spence, L., “Linear Algebra”, 4th Edition, Prentice Hall of India, New Delhi, 2004.

P19CS101	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes			
	CO1	**(Apply)**Apply data structures and algorithms to solve computing problems	**K3**
	CO2	**(Apply)**Apply graph structure and various string matching algorithms to solve real-life problems	**K3**
	CO3	**(Apply)** Apply suitable design strategy for problem solving	**K3**
	CO4	**(Analyze)**Analyze the structure of the non-linear data structures like trees and graphs.	**K4**
	CO5	**(Evaluate)**Analyze the search complexity of the data arranged in non-linear structure	**K5**

MODULE I ROLE OF ALGORITHMS IN COMPUTING 12

Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method

MODULE II HIERARCHICAL DATA STRUCTURES 12

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of Btrees – Basic operations on B-Trees – Deleting a key from a B-Tree- Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree

MODULE III GRAPHS 12

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd Warshall Algorithm.

MODULE IV ALGORITHM DESIGN TECHNIQUES 12

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy- Huffman Codes.

MODULE V NP COMPLETE AND NP HARD 12

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducability – NP-Completeness Proofs – NP-Complete Problems

TOTAL: 60HOURS

TEXT BOOK

1 Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

2 Robert Sedgewick and Kevin Wayne, "ALGORITHMS", Fourth Edition, Pearson Education.

REFERENCES

1 S.Sridhar,Design and Analysis of Algorithms", First Edition, Oxford University Press. 2014

2 Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice-Hall, 2011.

P19CS102	ADVANCED OPERATING SYSTEM	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Analyse)**Knowledge about advanced concepts in OS.	**K4**
	CO2	**(Analyse)**Ability to develop OS for distributed systems.	**K4**
	CO3	**(Analyse)**Ability to develop modules for mobile devices.	**K4**
	CO4	**(Understand)**To understand the basics of distributed scheduling.	**K2**
	CO5	**(Analyse)**To evaluate the impact of database Operating Systems algorithms and validate the performance.	**K4**

MODULE I MULTIPROCESSOR OPERATING SYSTEMS 9

System Architectures- Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation- memory management.

MODULE II DISTRIBUTED OPERATING SYSTEMS 9

System Architectures- Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms- Distributed Deadlock detection

MODULE III DISTRIBUTED SCHEDULING 9

Distributed scheduling - Distributed shared memory - Distributed File system – Multimedia file systems - File placement – Caching.

MODULE IV DATABASE OPERATING SYSTEMS 9

Requirements of Database OS – Transaction process model – Synchronization primitives - Concurrency control algorithms.

MODULE V MOBILE OPERATING SYSTEMS 9

ARM and Intel architectures - Power Management - Mobile OS Architectures - Underlying OS - Kernel structure and native level programming - Runtime issues- Approaches to power management

TOTAL : 45 Hours

TEXT BOOKS

1 M Singhal and NG Shivaratri, "Advanced Concepts in Operating Systems:, Tata McGraw Hill Inc, 2001

REFERENCES

1 . S Tanenbaum, Distributed Operating Systems, Pearson Education Asia,2015

2 ource Wikipedia, Mobile Operating Systems, General Books LLC,2010

P19ED102	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		3	0	0	3

Outcomes

After completion of this course, the students will be able to

CO1	**(Understand)** Understand research problem formulation	**K2**
CO2	**(Analyze)** Analyze research related information and follow research ethics	**K3**
CO3	**(Understand)** Understand that Computer, Information Technology, controls today's world but tomorrow world will be ruled by ideas, concept, and creativity.	**K2**
CO4	**(Understand)** Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.	**K2**
CO5	**(Understand)** Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.	**K2**

MODULE I RESEARCH PROBLEM FORMULATION 9

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

MODULE II LITERATURE REVIEW & TECHNICAL WRITING 9

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

MODULE III INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) 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.

MODULE IV PATENT RIGHTS 9

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

MODULE V NEW DEVELOPMENTS IN IPR 9

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 45 Hours

REFERENCES:

1 Stuart Melville and Wayne Goddard, "Research methodology: An introduction for science & engineering students'"

2 Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3 Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guidefor beginners"

4 Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.

5 Mayall, "Industrial Design", McGraw Hill, 1992.

6 Niebel, "Product Design", McGraw Hill, 1974.

7 Asimov, "Introduction to Design", Prentice Hall, 1962.

8 Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Propertyin New Technological Age", 2016.

9 T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

P19CS111	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

Outcome(s)

After completion of this course, the students will be able to

CO1	**(Analyse)** Analyse and implement basic and advanced data structures extensively.	**K5**
CO2	**(Apply)** Apply algorithms using graph structures for the given problem.	**K4**
CO3	**(Create)** Develop efficient solutions using Stack and queues.	**K6**
CO4	**(Apply)** Develop solutions using nonlinear data structures.	**K3**
CO5	**(Create)**Develop solutions which satisfies time and space Complexity.	**K6**

Module – I LINEAR DATA STRUCTURES

- Linked Lists – Singly Linked List
- Circularly Linked List
- Doubly Linked lists
- Stack – Queue – Circular Queue – Double Ended Queues

Module – II NON-LINEAR TREE STRUCTURES

- Binary Tree
- Binary search tree
- AVL Tree – B-Tree
- Heap

Module – III Graph Data structure

- BFS
- DFS
- Hashing Algorithm-Key value pair
- Word Count program using Hashing
- Implementing Algorithms with Time and Space Complexity –Use case

Total: 60Hours

P19CS112	OPERATING SYSTEM LABORATORY	L	T	P	C
		0	0	4	2

Outcomes

After completion of this course, students will be able to

CO1	**(Apply)** Apply the concepts of Semaphores.	**K3**
CO2	**(Apply)** Apply the concepts of Network Operating Systems.	**K3**
CO3	**(Apply)** Apply the concepts of Real time operating systems.	**K3**

CO4	**(Apply)** ApplyDatabase operating systems	**K3**
CO5	**(Apply)** Apply Distributed operating systems	**K3**

MODULE I MULTIPROCESSOR OPERATING SYSTEMS 6

Semaphores - Multiprocessor operating systems

Assume there are three processes: Pa, Pb, and Pc.
Only Pa can output the letter A, Pb B, and Pc C. Utilizing only semaphores (and no other variables) the processes are synchronized so that the output satisfies the following conditions:

a) A B must be output before any C's can be output.

b) B's and C's must alternate in the output string, that is, after the first B is output, another B cannot be output until a C is output. Similarly, once a C is output, another C cannot be output until a B is output.

c) The total number of B's and C's which have been output at any given point in the outpstring cannot exceed the number of A's which have been output up to that point.

Examples

AACB -- invalid, violates a)
ABACAC -- invalid, violates b)
AABCABC -- invalid, violates c)
AABCAAABC -- valid
AAAABCBC -- valid
AB -- valid

Multiple sleeping barbers - Multiprocessor operating systems

Write a multi-class multithreaded Java program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single Customer class, each barber is instantiated from a single Barber class.

MODULE II Network operating systems 6

Network operating systems

Establish a Lab setup for the following network operating systems based programs based on the skills in networking on your own. E.g. for identifying networking hardware, identifying different kinds of network cabling and network interface cards can be done.

Exercises

1. Identifying Local Area Network Hardware
2. Exploring Local Area Network Configuration Options
3. Verifying TCP/IP Settings
4. Sharing Resources
5. Testing LAN Connections

MODULE III Real time operating systems 18

Real time operating systems

A real-time program implementing an alarm clock shall be developed. [Alarm clock, using C and Simple_OS]
The program shall fulfill the following requirements:
Clock with alarm functionality shall be implemented, It shall be possible to set the time, It shall be possible to set the alarm time, the alarm shall be *enabled* when the alarm time is set, the alarm shall be *activated* when the alarm is enabled, and when the current time is equal to the alarm time, an activated alarm must be acknowledged. Acknowledgement of an alarm shall lead to the alarm being *disabled, the* alarm is enabled again when a new alarm time is set, an alarm which is not acknowledged shall be repeated every 10 seconds. The program shall communicate with a graphical user interface, where the current time shall be displayed, and where the alarm time shall be displayed when the alarm is enabled. It shall be possible to terminate the program, using a command which is sent from the graphical user interface.

MODULE IV Database operating systems 18

Transactions and Concurrency -Database operating systemsExercises

Assume any application(e.g.banking) on your own and do the following exercises.

1. Investigate and implement the ObjectStore's concurrency options.

2. Implement the concurrency conflict that occurs between multiple client applications.
3. Observe and implement the implication of nested transactions.

MODULE V Distributed operating systems 12

Distributed operating systems

1.Design a RMI Lottery application. Each time you run the client program -- "**java LotteryClient n**", the server program "**LotteryServer**" will generate **n** set of Lottery numbers. Here **n** is a positive integer, representing the money you will spend on Lottery in sterling pounds. Write this program in a proper engineering manner, i.e. there should be specifications, design (flow chart, FD, or pseudo code), coding, test/debug, and documentation.

2. Consider a distributed system that consists of two processes which communicate with each other. Let P be a state predicate on the local state of one process and Q be a state predicate on the local state of the other process. Assume that neither P nor Q are stable (i.e. closed).

Design a superimposed computation which detects that there exists an interleaving of underlying events in this system where at some state P ^Q holds. (A superposed computation is one that does not a_ect the underlying system; it may \read" but not \write" the state of the underlying system. Events in a superposed computation may occur in at the same instant as the underlying events and/or at di_erent instants.) State any assumptions you make. [Hint: Use vector clocks.]

TOTAL : 60 Hours

Semester II

P19CS103	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Outcomes

After completion of this course, the students will be able to

CO1	**(Analyse)**Compare between, supervised, unsupervised and semi-supervised learning	**K4**
CO2	**(Apply)**Apply the appropriate machine learning strategy for any given problem	**K3**
CO3	**(Apply)**Choose supervised, unsupervised or semi-supervised learning algorithms for any given problem	**K3**
CO4	**(Analyse)**Examine systems that uses the appropriate graph models of machine learning	**K4**
CO5	**(Analyse)**Analyse existing machine learning algorithms to improve classification efficiency	**K4**

MODULE I FUNDAMENTALS OF MACHINE LEARNING 8

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search– Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

MODULE II LINEAR MODELS 9

Multi-layer Perceptron – Going Forwards – Going Backwards: Back Propagation Error – Multi- layer Perceptron in Practice – Examples of using the MLP – Overview – Deriving Back- Propagation – Radial Basis Functions and Splines – Concepts – RBF Network – Curse of Dimensionality – Interpolations and Basis Functions – Support Vector Machines.

MODULE III TREE AND PROBABILISTIC MODELS 8

Learning with Trees – Decision Trees – Constructing Decision Trees – Classification and Regression Trees – Ensemble Learning – Boosting – Bagging

MODULE IV PROBABILISTIC MODEL 9

Different ways to Combine Classifiers – Probability and Learning – Data into Probabilities – Basic Statistics – Gaussian Mixture Models – Nearest Neighbour Methods – Unsupervised Learning – K means Algorithms –Vector Quantization – Self Organizing Feature Map

MODULE V DIMENSIONALITY REDUCTION AND GENETIC ALGORITHMS 11

Dimensionality Reduction – Linear Discriminant Analysis – Principal Component Analysis – Factor Analysis – Independent Component Analysis – Locally Linear Embedding – Isomap – Least Squares Optimization - Genetic algorithms –Intuition behind Genetic Algorithms–Steps involved in Genetic Engineering–Applications-Getting Lost Example – Markov Decision Process

TOTAL: 45 HOURS

TEXT BOOKS

1. EthemAlpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014
2. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", First Edition, Wiley, 2014

REFERENCES

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
3. Tom M Mitchell, "Machine Learning", First Edition, McGraw Hill Education, 2013

P19CS104	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Outcomes

After completion of this course, the students will be able to

CO1	**(Understand)**Classify and understand the insights from big data analytics	**K2**
CO2	**(Analyze)**Analyze data by utilizing various statistical and data mining approaches	**K4**
CO3	**(Apply)**Apply concepts of analytics on real-time streaming data	**K3**
CO4	**(Analyze)**Analyze the various NoSQL alternative database models	**K4**
CO5	**(Evaluate)**Compare concepts of BigData Storage systems and architecture	**K5**

MODULE I Basics of BigData 8

Evolution of Big data – importance of structuring data- Best Practices for Big data Analytics – Big data characteristics – Validating – Big Data elements- Characteristics of Big Data Applications – Perception and Quantification of Value -Understanding Big Data Storage

MODULE II Understanding Hadoop2 Ecosystem and Map Reduce API 9

HDFS Overview-Architecture – Components of Hadoop2 Ecosystem-role of map and reduce in MapReduce -MapReduce steps-Sort and Shuffle –Uses of MapReduce-Data flow in MapReduce-MapReduce API-Map Reduce Word Count Application- roles HBase and Hive play in processing of Big Data and some applications of MapReduce.

MODULE III Working with MapReduce on YARN 9

MapReduce 2 framework-YARN Architecture-Components Of YARN-Benefits of YARN-Job Running in YARN-Failure Cases in YARN

MODULE IV Data Storage in Hadoop 2 - HDFS and HBase 9

HDFS files-role of HDFS Federation- architecture -role of HBase-characteristics of HBase schema design-implement basic programming for Hbase-HBase concepts- Advanced Usage - capabilities of HBase and HDFS for effective data storage.

MODULE V Hive and Pig 10

Hive Architecture - Data types - Hive Partioning-Hive Commands-Hive DDL and DML –Hive sort By – orderBy -Hive Joins-Pig Architecture–Usage of Pig-Pig Run modes-Pig Latin concepts-Pig data Types-PigUDF-Use case: Using Pig find the most occurred start letter.

TOTAL: 45 Hours

TEXT BOOKS

1. Bill Franks, —Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 2012.
2. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013.
3. Michael Berthold, David J. Hand, —Intelligent Data Analysis", Springer, Second Edition, 2007.

REFERENCES

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, O'Reilly Media, 2013.

P19CS113	DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

Outcome(s)

After completion of this course, the students will be able to

CO1	**(Apply)**Build big data using Hadoop framework	**K3**
CO2	**(Apply)**Build and apply linear and logistic regression models	**K3**
CO3	**(Apply)** Adapt data analysis with machine learning methods	**K3**
CO4	**(Apply)** Develop graphical data analysis	**K3**
CO5	**(Apply)** Develop an Application using BigData and analytics concepts	**K3**

List of Experiments

1. Install, configure and run Hadoop and HDFS
2. Create –Single Node Hadoop cluster
3. Create –Multi node Hadoop Cluster
4. Implement word count / char count programs using MapReduce
5. Implement HBase to import data of a file in HBase table.
6. Implement Hive joins
7. Using Pig find the most occurred start letter.
8. Convert Upper to lower case using Pig UDF in java
9. Implement an application that stores big data in Hbase / MongoDB / Pig using Hadoop / R

REFERENCES

1. Alan Gates and Daniel Dai, "Programming Pig – Dataflow scripting with Hadoop", O'Reilley, 2nd Edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie and Robert Tibshirani, —An Introduction to Statistical Learning with Applications in R", Springer Publications, 2015(Corrected 6th Printing)
3. Hadley Wickham,"ggplot2 – Elegant Graphics for Data Analysis", Springer Publications,2nd Edition, 2016
4. Kristina Chodorow, "MongoDB: The Definitive Guide – Powerful and Scalable Data Storage", O'Reilley, 2nd Edition, 2013.
5. Lars George, "HBase: The Definitive Guide", O'Reilley, 2015.

Total: 60 Hours

P19CS114	MACHINE LEARNING LABORATORY	L	T	P	C
		0	0	4	2

Outcomes

After completion of this course, students will be able to

CO1	(**Understand**) Understand the implementation procedures for the machine learning algorithms	**K2**
CO2	**(Apply)**Design python programs for various learning algorithms.	**K3**
CO3	**(Apply**) Apply appropriate data sets to the machine learning algorithms.	**K3**
CO4	**(Apply)**Identify and apply machine learning algorithms to solve real world problems.	**K3**
CO5	(**Apply)** Use data sets in implementing the machine learning algorithms	**K3**

List of Experiments

1. Implement and demonstrate the **FIND-S algorithm** for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the **Candidate-Elimination algorithm** to output a description of the set of all hypotheses consistent with the training examples.

3. Write a program to demonstrate the working of the decision tree based **ID3 algorithm.** Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the **Back propagation algorithm** and test the same using appropriate data sets.
5. Write a program to implement the **naïve Bayesian classifier** for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the **naïve Bayesian Classifier** model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a **Bayesian network** considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
8. Apply **EM algorithm** to cluster a set of data stored in a .CSV file. Use the same data set for clustering using **k-Means algorithm**. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
9. Write a program to implement **k-Nearest Neighbor algorithm** to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10. Implement the non-parametric **Locally Weighted Regression algorithm** in order to fit data points. Select appropriate data set for your experiment and draw graphs.

TOTAL: 60 Hours

REFERENCES

1 Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education.

2 Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, 2nd edition, Springer series in statistics.

3 EthemAlpaydın, Introduction to machine learning, second edition, MIT press.

PROGRAM ELECTIVES

SEMESTER I – ELECTIVE I

P19CS301	ADVANCED DATABASES	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)** Understand the storage and data access mechanisms of parallel and distributed databases.	**K2**
	CO2	**(Apply)** Design faster algorithms in solving practical database problems.	**K3**
	CO3	**(Understand)** Gain Knowledge in the XML Databases.	**K2**
	CO4	**(Understand)** Understand the mechanism of Mobile Databases.	**K2**
	CO5	**(Understand)** Understand the Multimedia Databases	**K2**

MODULE I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

MODULE II INTELLIGENT DATABASES 9

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases TSQL2- Deductive Databases-Recursive Queries in SQL- Spatial Databases- Spatial Data Types - Spatial Relationships-Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

MODULE III XML DATABASES 9

XML Databases: XML Data Model – DTD – XML Schema – XML Querying – Web Databases – Open Database Connectivity.

MODULE IV MOBILE DATABASES 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols

MODULE V MULTIMEDIA DATABASES 9

Multidimensional Data Structures – Image Databases – Text / Document Databases – Video Databases – Audio Databases – Multimedia Database Design.

TOTAL : 45 Hours

REFERENCES

1. C.J.Date, A.Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
2. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T. Snodgrass, V.S. Subrahmanian, Roberto Zicari,"Advanced Database Systems",MorganKaufmannpublishers,2006.
3. Henry FKorth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Sixth Edition, McGraw Hill, 2011.
4. R. Elmasri, S. B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education/Addison Wesley, 2010.
5. Vijay Kumar,"Mobile Database Systems"", John Wiley & Sons, 2006.

P19CS302	ETHICAL HACKING	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)**Comprehend the Cryptographic techniques and the basic concepts of Ethical Hacking	**K2**

CO2	**(Apply)**Identify the DNS, IP address, range and Operating System etc., related to a remote system.	**K3**
CO3	**(Analyze)** Analyze the packets and find the intruders	**K3**
CO4	**(Analyze)** Discover the liabilities in a web application and servers.	**K4**
CO5	**(Evaluate)**Implement Penetration testing tools	**K5**

MODULE I ETHICAL HACKING BASICS 9

Introduction to Ethical Hacking – Types of hacking – Phases of Ethical hacking. Cryptography: Cryptography and encryption – PKI, Digital certificates and digital signature – Encrypted communication and Cryptography attacks. Case Study: Sample problems in Encryption techniques

MODULE II RECONNAISSANCE AND SCANNING 9

Footprinting: Footprinting with DNS – Determining Network Range – Google Hacking. Scanning for targets: Identify Active machines – Port Scanning. Enumeration: Windows Security basics – Enumeration Techniques. Case Study: Gather complete information about a Computer System such as DNS, IP address, IP address range and finding the open ports

MODULE III SYSTEM ATTACK 9

Sniffing: Communications basics – Sniffing techniques and tools – Network Roadblocks: Intrusion Detection – Session hijacking, Firewalls and Honeypots, Denial of Service attacks. System Attack: Windows system hacking – Password Cracking – Exploiting privileges. Social Engineering: Human Based attack – Computer based attack. Case Study: Demonstration of Rainbow Crack, Cain & Abel tools to crack passwords and Kismet, Wireshark to intercept the messages.

MODULE IV WEB BASED AND WIRELESS HACKING 9

Physical Security. Web Server Hacking: Web service architecture – Web attacks. Web Applications: Web applications attack – Web resources protection. Wireless Attacks – Bluetooth attacks.Case Study: Cross-site Scripting, SQL –Injection demonstration

MODULE V MALWARES AND PENETRATION TESTING 9

Malware Attacks: Trojans, viruses and worms. Penetration Testing: Types of Penetration testing – Penetration testing methodologies – Penetration test tools. Case Study: Demonstration of pentest tools – Nmap, Wireshark.

TOTAL: 45 HOURS

TEXT BOOK

1. Matt Walker, "CEH- Certified Ethical Hackers Guide ", 4th Edition, McGraHill Education, 2019.
2. Michael Gregg," Certified Ethical Hacker (CEH) Version 9 Cert Guide", 2nd Edition, Pearson Education, 2018
3. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", 2nd Edition, Syngress , Elseveir, 2013

REFERENCES

1. Reginald Wong, "Mastering Reverse Engineering: Re-engineer your ethical hacking skills", Packt Publishing,2018.
2. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2nd Edition, John Weily & Sons, 2011

P19CS303	**IMAGE PROCESSING AND ANALYSIS**	**L T P C** **3 0 0 3**

After completion of this course, the students will be able to

Outcomes		
CO1	**(Understand)** Understand and master in the fundamentals of Image Processing.	**K2**
CO2	**(Apply)** Make use of Image Enhancement and Restoration techniques.	**K3**
CO3	**(Apply)** Experiment the images with various feature selection techniques.	**K3**

CO4 (Apply) Apply segmentations and classify various Features. **K3**

CO5 (Apply) Experiment various visualization techniques on images. **K3**

MODULE I IMAGE PROCESSING FUNDAMENTALS 9

Introduction – Elements of visual perception, Steps in Image Processing Systems – Digital Imaging System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical,
statistical and spatial operations.

MODULE II IMAGE ENHANCEMENT AND RESTORATION 9

Image Transforms -Discrete and Fast Fourier Transform and Discrete Cosine Transform ,Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

MODULE III IMAGE SEGMENTATION AND MORPHOLOGY 9

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations Distance Transforms- Basic morphological Algorithms. Features – Textures - Boundary representations and Descriptions- Component Labeling – Regional descriptors and Feature Selection Techniques.

MODULE IV IMAGE ANALYSIS AND CLASSIFICATION 9

Image segmentation- pixel based, edge based, Region based segmentation. Active contour models and Level sets for medical image segmentation, Image representation and analysis, Feature extraction and representation, Statistical, Shape, Texture, feature and statistical image classification.

MODULE V IMAGE REGISTRATION AND VISUALIZATION 9

Rigid body visualization, Principal axis registration, Interactive principal axis registration, Feature based registration, Elastic deformation based registration, Image visualization – 2D display methods, 3D display methods, virtual reality based interactive visualization.

TOTAL : 45 Hours

REFERENCES

1. Alasdair McAndrew, "Introduction to Digital Image Processing with Matlab", Cengage Learning 2011,India
2. Anil J Jain, "Fundamentals of Digital Image Processing", PHI, 2006.
3. Kavyan Najarianand Robert Splerstor,"Biomedical signals and Image processing",CRC – Taylor and Francis, New York,2006
4. Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", Third Edition, Pearson Education, 2008, New Delhi
5. S.Sridhar, "Digital Image Processing", Oxford University Press, 2011

P19CS304	WEB ENGINEERING	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes

CO1 (Understand) Understand the fundamentals of Web Engineering **K2**

CO2 (Apply) Make use of different architectures and Model web applications. **K3**

CO3 (Apply) Design web applications. **K3**

CO4 (Apply) Experiment with various testing approaches **K3**

CO5 (Apply) Make use of advanced concepts for building web applications **K3**

MODULE I INTRODUCTION TO WEB ENGINEERING 9

Motivation, Categories of Web Applications, Characteristics of Web Applications. Requirements of Engineering in Web Applications- Web Engineering-Components of Web Engineering-Web Engineering Process-Communication-Planning.

MODULE II **WEB APPLICATION ARCHITECTURES & MODELLING WEB APPLICATIONS** **9**

Introduction- Categorizing Architectures- Specifics of Web Application Architectures, Components of a Generic Web Application Architecture- Layered Architectures, 2-Layer Architectures, N-Layer Architectures-Data-aspect Architectures, Database-centric Architectures- Architectures for Web Document Management- Architectures for Multimedia Data- Modeling Specifics in Web Engineering, Levels, Aspects, Phases Customization, Modeling Requirements, Hypertext Modeling, Hypertext Structure Modeling Concepts, Access Modeling Concepts, Relation to Content Modeling, Presentation Modeling, Relation to Hypertext Modeling, Customization Modeling, Modelling Framework-Modeling languages- Analysis Modeling for Web Apps-The Content Model-The Interaction Model-Configuration Model.

MODULE III **WEB APPLICATION DESIGN** **9**

Design for WebApps- Goals-Design Process-Interactive Design- Principles and Guidelines- Workflow-Preliminaries-Design Steps- Usability- Issues- Information Design- Information Architecture-structuring- Accessing Information-Navigation Design- Functional Design-Wep App Functionality- Design Process- Functional Architecture- Detailed Functional Design

MODULE IV **TESTING WEB APPLICATIONS** **9**

Introduction-Fundamentals-Test Specifics in Web Engineering-Test Approaches- Conventional Approaches, Agile Approaches- Testing concepts- Testing Process -Test Scheme- Test Methods and Techniques- Link Testing- Browser Testing-Usability Testing- Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, -Content Testing-User Interface testing-Usability Testing-Compatibility Testing-Component Level Testing-Navigation Testing-Configuration testing-Security and Performance Testing- Test Automation

MODULE V **PROMOTING WEB APPLICATIONS AND WEB PROJECTMANAGEMENT** **9**

Introduction-challenges in launching the web Application-Promoting Web Application- Content Management-Usage Analysis-Web Project Management-Challenges in Web Project Management-Managing Web Team- Managing the Development Process of a Web Application- Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JS - web sockets

TOTAL : 45 Hours

REFERENCES

1 Chris Bates, "Web Programming: Building Internet Applications", 3rd Edition, Wiley India Edition, 2007.

2 GertiKappel,BirgitProll,'WebEngineering',JohnWileyandSonsLtd,2006.

3 Guy W. Lecky-Thompson, "Web Programming", Cengage Learning, 2008.

4 John Paul Mueller, "Web Development with Microsoft Visual Studio 2005", WileyDream tech, 2006.

5 Roger S. Pressman, David Lowe, 'Web Engineering', Tata McGraw Hill Publication, 2007

P19CS305	**CLOUD COMPUTING TECHNOLOGIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)**Classify the concepts of storage virtualization, network virtualization and its management	**K2**
	CO2	**(Apply)**Apply the concept of virtualization in the cloud computing	**K3**
	CO3	**(Apply)**Identify the architecture, infrastructure and delivery models of cloud computing	**K3**
	CO4	**(Analyze)**Examine services using Cloud computing	**K4**
	CO5	**(Apply)**Apply the security models in the cloud environment	**K3**

MODULE I **VIRTUALIZATION** **9**

Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization –Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization.

MODULE II VIRTUALIZATION INFRASTRUCTURE 9

Comprehensive Analysis – Resource Pool – Testing Environment – Server Virtualization – Virtual Workloads – Provision Virtual Machines – Desktop Virtualization – Application Virtualization – Implementation levels of virtualization- virtualization structure – virtualization of CPU , Memory and I/O devices – virtual clusters and resource management – virtualization for data center automation.

MODULE III CLOUD PLATFORM ARCHITECTURE 9

Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development – Virtualization Support and Disaster Recovery –Architectural Design Challenges - Public Cloud Platforms : GAE,AWS – Inter-cloud Resource Management.

MODULE IV PROGRAMMING MODEL 9

Introduction to Hadoop Framework – Map reduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster - Cloud Software Environments -Eucalyptus, Open Nebula, Open Stack, Nimbus.

MODULE V CLOUD SECURITY 9

Cloud Infrastructure security: network, host and application level – aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud –Cloud Security and Trust Management.

TOTAL : 45 Hours

REFERENCES

1. Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner's Guide‖ , McGraw-Hill Osborne Media, 2009.
2. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
3. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
4. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
5. Tim Mather, Subra Kumaraswamy, and Shahed Latif ,"Cloud Security and Privacy", O'Reilly Media, Inc.,2009.
6. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
7. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

P19CS306	COMPUTATIONAL INTELLIGENCE	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)** Classify the concepts of storage virtualization, network virtualization and its management	**K2**
	CO2	**(Apply)** Apply the concept of virtualization in the cloud computing	**K3**
	CO3	**(Apply)** Identify the architecture, infrastructure and delivery models of cloud computing	**K3**
	CO4	**(Analyze)** Examine services using Cloud computing	**K4**
	CO5	**(Apply)** Apply the security models in the cloud environment	**K3**

MODULE I COMPUTATIONAL INTELLIGENCE 9

Computational intelligence (CI): Adaptation, Self-organization and Evolution, Biological and artificial neuron, Neural Networks Basic Concepts,- Single Layer perceptron-Multilayer perceptron- Supervised and unsupervised learning- Back propagation networks-Kohnen's self-organizing networks-Hopfield networks- Implementations.

MODULE II FUZZY SYSTEMS 9

Fuzzy systems: Basic Concepts, Fuzzy sets- properties- membership functions- fuzzy operations, Applications, Implementation, Hybrid systems.

MODULE III EVOLUTIONARY COMPUTING 9

Evolutionary computing: Introduction to Genetic Algorithms. The GA computation process- natural evolution-parent selection-crossover-mutation-properties - classification – Advances in the theory GA. Genetic Programming, Particle Swarm optimization, Ant Colony optimization, artificial immune Systems

MODULE IV PROBABILITY BASICS 9

Probability basics – Bayes Rule and its Applications – Bayesian Networks – Exact and Approximate Inference in Bayesian Networks – Hidden Markov Models – Forms of Learning – Supervised Learning – Learning Decision Trees – Regression and Classification with Linear Models – Artificial Neural Networks – Nonparametric Models – Support Vector Machines – Statistical Learning – Learning with Complete Data – Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning

MODULE V COMPUTATIONAL INTELLIGENCE APPLICATIONS 9

CI application: case studies may include image processing, digital systems, control, forecasting and time-series predictions

TOTAL : 45 Hours

REFERENCES

1 R.C. Eberhart, "Computational Intelligence: Concept to Implementations", Morgan Kaufmann Publishers, 2007.

2 Laurence Fausett, "Fundamentals of Neural Networks",Prentice Hall,1994

3 Timothy J Rose, "Fuzzy Logic with Engineering Applications", Third Edition, Wiley, 1995.

4 A Konar, "Computational Intelligence: Principles, Techniques and Applications", Springer -Verlag, 2005.

SEMESTER II – ELECTIVE II

P19CS307	REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)** Understand concepts of Real-Time systems and modeling.	**K2**
	CO2	**(Apply)** Apply principles of real time system design techniques to develop real time applications.	**K3**
	CO3	**(Understand)** Gain Knowledge in characteristics of real time systems	**K2**
	CO4	**(Apply)** Make use of database in real time applications.	**K3**
	CO5	**(Apply)** Apply evaluation techniques in all applications.	**K3**

MODULE I REAL TIME SYSTEM AND SCHEDULING 9

Introduction– Structure of a Real Time System –Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Issues in Real Time Computing – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms –Fault Tolerant Scheduling.

MODULE II SOFTWARE REQUIREMENTS ENGINEERING 9

Requirements engineering process – types of requirements – requirements specification for real time systems – Formal methods in software specification – structured Analysis and Design – object oriented analysis and design and unified modeling language – organizing the requirements document – organizing and writing documents – requirements validation and revision.

MODULE III INTERTASK COMMUNICATION AND MEMORY MANAGEMENT 9

Buffering data – Time relative Buffering- Ring Buffers – Mailboxes – Queues – Critical regions – Semaphores – other Synchronization mechanisms – deadlock – priority inversion – process stack management – run time ring buffer – maximum stack size – multiple stack arrangement – memory management in task control block - swapping – overlays – Block page management – replacement algorithms – memory locking – working sets – real time garbage collection – contiguous file systems.

MODULE IV REAL TIME DATABASES 9

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

MODULE V EVALUATION TECHNIQUES AND CLOCK SYNCHRONIZATION 9

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy–Software error models. Clock Synchronization–Clock, A Nonfault– Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

TOTAL : 45 Hours

REFERENCES

1 C.M. Krishna, Kang G. Shin, —Real-Time Systems", McGraw-Hill International Editions,1997

2 Philip.A.Laplante, —Real Time System Design and Analysis", Prentice Hall of India, 3rd Edition, 2004

3 Rajib Mall, —Real-time systems: theory and practice", Pearson Education, 2009

4 R.J.A Buhur, D.L Bailey, —An Introduction to Real-Time Systems", Prentice Hall International, 1999

5 Stuart Bennett, —Real Time Computer Control-An Introduction", Prentice Hall of India, 1998

6 Allen Burns, Andy Wellings, —Real Time Systems and Programming Languages", Pearson Education, 2003.

P19CS308	MOBILE AND PERVASIVE COMPUTING	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)** Gain Knowledge about various wireless communications	**K2**
	CO2	**(Understand)** Understand the working of wireless communication protocols.	**K2**

CO3	**(Understand)** Outline the basics of pervasive computing.	**K2**
CO4	**(Understand)** Gain Knowledge about HCI in pervasive Computing	**K2**
CO5	**(Understand)** Learn about the mobile transactions in pervasive computing	**K2**

MODULE I INTRODUCTION 9

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G, WATM.- Mobile IP protocols - WAP push architecture - WML scripts and applications. Data networks – SMS – GPRS – EDGE – Hybrid Wireless100 Networks – ATM – Wireless ATM.

MODULE II OVERVIEW OF A MODERN 4G TELECOMMUNICATIONS SYSTEM 9

Introduction, LTE - A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core. LTE Requirements. LTE - Advanced. LTE-A in Release. OFDMA – Introduction. OFDM Principles. LTE Uplink—SC-FDMA. Summary of OFDMA.

MODULE III PERVASIVE CONCEPTS AND ELEMENTS 9

Technology Trend Overview - Pervasive Computing: Concepts - Challenges - Middleware - Context Awareness - Resource Management - Human–Computer Interaction – Pervasive Transaction Processing - Infrastructure and Devices - Wireless Networks - Middleware for Pervasive Computing Systems - Resource Management - User Tracking- Context Management -Service Management - Data Management - Security Management – Pervasive Computing Environments - Smart Car Space - Intelligent Campus.

MODULE IV HCI IN PERVASIVE COMPUTING 9

Prototype for Application Migration - Prototype for Multimodalities - Human–Computer Interface in Pervasive Environments - HCI Service and Interaction Migration - ContextDriven HCI Service Selection - Interaction Service Selection Overview - User Devices - Service-Oriented Middleware Support - User History and Preference - Context Manager - Local Service Matching - Global Combination - Effective Region - User Active Scope - Service Combination Selection Algorithm

MODULE V PERVASIVE MOBILE TRANSACTIONS 9

Pervasive Mobile Transactions - Introduction to Pervasive Transactions – Mobile Transaction Framework - Unavailable Transaction Service - Pervasive Transaction Processing Framework - Context-Aware Pervasive Transaction Model - Context Model for Pervasive Transaction Processing - Context-Aware Pervasive Transaction Model - A Case of Pervasive Transactions - Dynamic Transaction Management - Context-Aware Transaction Coordination Mechanism - Coordination Algorithm for Pervasive Transactions - Participant Discovery - Formal Transaction Verification - Petri Net with Selective Transition.

TOTAL : 45 Hours

REFERENCES

1. Alan Colman, Jun Han, and Muhammad AshadKabir, Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications, Springer, 2016.
2. J.Schiller, —Mobile Communication", Addison Wesley, 2000
3. JuhaKorhonen, —Introduction to 4G Mobile Communications" , Artech House Publishers, 2014
4. Kolomvatsos, Kostas, Intelligent Technologies and Techniques for Pervasive Computing, IGI Global, 2013.
5. M. Bala Krishna, Jaime Lloret Mauri, —Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks", CRC 2016
6. MinyiGuo, Jingyu Zhou, Feilong Tang, Yao Shen, — Pervasive Computing: Concepts, Technologies and Applications " CRC Press, 2016

P19CS309	**INFORMATION STORAGE MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)**Understand the logical and physical components of a Storage infrastructure.	**K2**
	CO2	**(Apply)** Select from various storage technologies to suit for required application	**K3**

CO3	**(Understand)**Gain Knowledge about storage architectures, including storage subsystems, DAS, SAN, NAS, and CAS.	**K2**
CO4	**(Understand)** Illustrate the different roles in providing disaster recovery and business continuity capabilities.	**K2**
CO5	**(Understand)** Understand the various forms and types of Storage Virtualization.	**K3**

MODULE I STORAGE TECHNOLOGY 9

Review data creation and the amount of data being created and understand the value of data to a business, challenges in data storage and data management, Solutions available for data storage, Core elements of a data center infrastructure, role of each element in supporting business activities.

MODULE II STORAGE SYSTEMS ARCHITECTURE 9

Hardware and software components of the host environment, Key protocols and concepts used by each component ,Physical and logical components of a connectivity environment ,Major physical components of a disk drive and their function, logical constructs of a physical disk, access characteristics, and performance Implications, Concept of RAID and its components, Different RAID levels and their suitability for different application environments: RAID 0, RAID 1, RAID 3, RAID 4, RAID 5, RAID 0+1, RAID 1+0, RAID 6, Compare and contrast integrated and modular storage systems ,Iligh-level architecture and working of an intelligent storage system.

MODULE III INTRODUCTION TO NETWORKED STORAGE 9

Evolution of networked storage, Architecture, components, and topologies of FC-SAN, NAS, and IP-SAN, Benefits of the different networked storage options, understand the need for long-term archiving solutions and describe how CAS full fill the need, understand the appropriateness of the different networked storage options for different application.

Environments

MODULE IV INFORMATION AVAILABILITY, MONITORING & MANAGING DATACENTERS 9

List reasons for planned/unplanned outages and the impact of downtime, Impact of downtime -Business continuity (BC) and disaster recovery (DR) ,RTO and RPO, Identify single points of failure in a storage infrastructure and list solutions to mitigate these failures, architecture of backup/recovery and the different backup/ recovery topologies, replication technologies and their role in ensuring information availability and business continuity, Remote replication technologies and their role in providing disaster recovery and business continuity capabilities. Identify key areas to monitor in a data center, Industry standards for data center monitoring and management, Key metrics to monitor for different components in a storage infrastructure, Key management tasks in a data center

MODULE V SECURING STORAGE AND STORAGE VIRTUALIZATION 9

Information security, Critical security attributes for information systems, Storage security domains,List and analyzes the common threats in each domain, Virtualization technologies, block-level and file-level virtualization technologies and processes.

TOTAL : 45 Hours

REFERENCES

1 EMC Corporation, "Information Storage and Management: Storing, Managing, and Protecting Digital Information", Wiley, India, 2010

2 Marc Farley, "Building Storage Networks", Tata McGraw Hill ,Osborne, 2001.

3 Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill , Osborne, 2003.

P19CS310 INFORMATION RETRIEVAL TECHNIQUES

L	T	P	C
3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)**Understand the basics of Search and retrieval.	**K2**
	CO2	**(Apply)** Build an Information Retrieval system using the available tools.	**K3**

CO3	**(Apply)** Use knowledge of data structures and indexing methods in information retrieval Systems	**K3**
CO4	**(Apply)** Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.	**K3**
CO5	**(Apply)** Experiment the web with various searching and indexing techniques.	**K3**

MODULE I INTRODUCTION: MOTIVATION 9

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR ––IR Versus Web Search–Components of a Search engine.

MODULE II MODELING 9

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

MODULE III INDEXING 9

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

MODULE IV CLASSIFICATION AND CLUSTERING 9

Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning.

MODULE V SEARCHING THE WEB 9

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries.

TOTAL : 45 Hours

REFERENCES

1. Christopher D. Manning, PrabhakarRaghavan, HinrichSchutze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2008
2. "Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts London, England, 2010
3. Ricardo Baeza – Yates, Berthier Ribeiro – Neto, "Modern Information Retrieval: The concepts and Technology behind Search" (ACM Press Books), Second Edition, 2011.
4. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval"

P19CS311	**SOFTWARE ARCHITECTURES AND DESIGN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)**Understand the need of software architecture for sustainable dynamic systems.	**K2**
	CO2	**(Apply)** Apply design principles to various architectures	**K3**
	CO3	**(Apply)**Design architectures for distributed heterogeneous systems	**K2**
	CO4	**(Apply)** Choose the architecture and build the system from the components	**K3**
	CO5	**(Apply)** Experiment with various architectural structures.	**K3**

MODULE I INTRODUCTION 9

Introduction to Software Architecture-Bridging Requirements and Implementation, Design Guidelines, Software Quality attributes. Software Architecture Design Space. Agile Approach to Software Architecture Design, Models for Software Architecture Description Languages (ADL).

MODULE II DESIGN PRINCIPLES 9

Object-Oriented Paradigm - Design Principles. Data-Centered Software Architecture: Repository Architecture, Blackboard Architecture. Hierarchical Architecture Main-Subroutine, Master-Slave, Layered, Virtual Machine. Interaction-Oriented Software Architectures: Model-View-Controller (MVC), Presentation-Abstraction-Control (PAC).

MODULE III HETEROGENEOUS ARCHITECTURES 9

Distributed Architecture: Client-Server, Middleware, Multi-tiers, Broker Architecture – MOM,CORBA Message Broker Architecture- Service-Oriented Architecture (SOA), SOAP, UDDI, SOA Implementation in Web Services, Grid/cloud Service Computing. Heterogeneous Architecture- Methodology of Architecture Decision, Quality Attributes

MODULE IV MODEL DRIVEN ARCHITECTURES 9

Architecture of User Interfaces containers, case study-web service. Product Line Architectures - methodologies, processes and tools. Software Reuse and Product Lines -Product Line Analysis, Design and implementation, configuration Models. Model Driven Architectures (MDA) –why MDA-Model transformation and software architecture, SOA and MDA. Eclipse modeling framework.

MODULE V ASPECT ORIENTED ARCHITECTURES 9

Aspect Oriented Architectures- AOP in UML, AOP tools, Architectural aspects and middleware Selection of Architectures, Evaluation of Architecture Designs, Case Study: Online Computer Vendor, order processing, manufacture &shipping –inventory, supply chain cloud service Management, semantic web services

TOTAL : 45 Hours

REFERENCES

1 Essentials of software Architecture , Ion Gorton, Second Edition, Springer-verlag, 2011

2 Software Architecture Design Illuminated, Kai Qian Jones and Bartlett Publishers Canada, 2010

P19CS312	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

Outcomes

Upon completion of this course, students will be able to

CO1	**(Understand)** Understand the basic concepts of wireless sensor networks.	**K2**
CO2	**(Analyze)** Analyze various sensor network architectures and their design issues.	**K3**
CO3	**(Understand)**Understand the different routing protocols.	**K2**
CO4	**(Analyze)** Analyze the challenges in QoS and their energy management issues.	**K3**
CO5	**(Analyze)** Analyze various case studies to understand WSN applications.	**K3**

MODULE I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Introduction to WSNs - Characteristic requirements for WSNs - Challenges for WSNs - Emerging Technologies for WSNs – Advantages of WSNs.

MODULE II SENSOR NETWORK - ARCHITECTURES 9

Single node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

MODULE III WIRELESS SENSOR NETWORK PROTOCOLS 9

MAC protocols for WSNs – SMAC – Contention based protocol – Routing protocol : AODV, DSDV, Power aware - Energy Efficient Routing,Routing Challenges and Design Issues in WSNs.

MODULE IV QoS AND ENERGY MANAGEMENT 9

Issues and Challenges in providing QoS, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power and system power management schemes.

MODULE V APPLICATIONS OF WIRELESS SENSOR NETWORKS 9

WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications.

TOTAL: 45 HOURS

REFERENCES:

1 Feng Zhao, Leonidas Guibas, —Wireless Sensor Networks: an information processing approach, Elsevier publication, 2004.

2 Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.

3 Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.

4 I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, —Wireless sensor networks: a survey, computer networks, Elsevier, 2002, 394 - 422.

5 K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349.

6 Anna Hac, "Wireless Sensor Network Designs", John Wiley & Sons Ltd.

SEMESTER II – ELECTIVE III

P19CS313	DATA VISUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)** Learn the Basic skills for Visualization.	**K2**
	CO2	**(Understand)**Understand the concepts of time series, ranking and deviation analysis.	**K3**
	CO3	**(Apply)** Apply core skills for visual analysis.	**K3**
	CO4	**(Apply)**Design information dashboard.	**K3**
	CO5	**(Apply)**Make use of Graphics in the Dashboard designed	**K3**

MODULE I CORE SKILLS FOR VISUAL ANALYSIS 9

Information visualization – effective data analysis – traits of meaningful data – visual perception – making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

MODULE II TIME-SERIES, RANKING, AND DEVIATION ANALYSIS 9

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices

MODULE III DISTRIBUTION, CORRELATION, AND MULTIVARIATE ANALYSIS 9

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

MODULE IV INFORMATION DASHBOARD DESIGN 9

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

MODULE V DESIGN PRACTICES 9

Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together- Unveiling the dashboard.

TOTAL : 45 Hours

REFERENCES

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.
3. Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.
4. Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
5. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
6. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.

P19CS314	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)** Understand the fundamentals of Grammar and parsing algorithms for syntax analysis.	**K2**

CO2	**(Understand)** Understand the Grammar and parsing algorithms for syntax analysis.	**K3**
CO3	**(Analyze)** Analyze the semantic content of a given text.	**K4**
CO4	**(Apply)** Familiarize neural language models and neural networks for language processing.	**K3**
CO5	**(Evaluate)** Develop question answering and Chat bots.	**K5**

MODULE I FUNDAMENTALS OF SENSOR NETWORKS 9

Introduction to NLP, Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit distance, N gram Language Models, Evaluating Language Models, Generalization and Zeros, Smoothing, Kneser-Ney Smoothing, The web and the stupid backoff, Advanced: Perplexity's Relation to Entropy.

MODULE II PART OF SPEECH TAGGING AND SYNTAX PARSING 9

English Word Classes, The Penn Treebank Part-of-Speech Tagset, Part-of-Speech Tagging, HMM Part-of Speech Tagging, Maximum Entropy Markov Models, Probabilistic Context-Free Grammars, Probabilistic CKY Parsing of PCFGs, Ways to Learn PCFG Rule Probabilities, Problems with PCFGs, Improving PCFGs by Splitting Non-Terminals, Probabilistic Lexicalized CFGs, Probabilistic CCG Parsing.

MODULE III SEMANTIC ANALYSIS 9

Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Applications of the tf-idf vector model, Point wise Mutual Information (PMI), Word2vec, Visualizing Embeddings, Semantic properties of embeddings, Bias and Embeddings, Evaluating Vector Models

MODULE IV NEURAL NETWORKS AND NEURAL LANGUAGE MODELS 9

The XOR problem , Feed-Forward Neural Networks , Training Neural Nets , Neural Language Models , Simple Recurrent Neural Networks, Applications of Recurrent Neural Networks, Deep Networks: Stacked and Bidirectional RNNs, Managing Context in RNNs: LSTMs and GRUs, Words, Subwords and Characters

MODULE V QUESTION ANSWERING & DIALOGUE SYSTEMS 9

IR based Factoid QA, Knowledge based QA, IBM's Watson, Properties of human conversation, Chatbots, Simple frame based dialogue systems, Dialogue system architecture, Evaluation of Dialogue system, Dialogue system design.

TOTAL: 45 HOURS

TEXT BOOK

1 Jacob Eisenstein. Natural Language Processing, MIT Press, 2018.ISBN :978-0262042840

2 Dan Jurafsky and James H. Martin. Speech and Language Processing (3rd ed. draft), 2019. ISBN: 978-0135041963

REFERENCES

1 Yoav Goldberg, University of Toronto, Neural Network Methods for Natural language Processing, Morgan & Claypool, 2017

2 Christopher D. Manning, and Hinrich Schütze. Foundations of statistical natural language processing. First Edition, MIT press, 1999

3 https://www.coursera.org/learn/language-processing

P19CS315	**COMPUTER VISION**	**L T P C** **3 0 0 3**
	After completion of this course, the students will be able to	
Outcomes	**CO1** **(Understand)** Understand the fundamental image processing techniques required for computer vision	**K2**
	CO2 **(Apply)** Apply shape analysis, chain codes and other region descriptors for images	**K3**

CO3	**(Apply)** Apply Hough Transform for line, circle, and ellipse detections.	**K3**
CO4	**(Apply)** Apply 3D vision techniques and implement motion related techniques.	**K3**
CO5	**(Apply)** Develop applications using computer vision techniques	**K3**

MODULE I IMAGE PROCESSING FOUNDATIONS 9

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture

MODULE II SHAPES AND REGIONS 9

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

MODULE III HOUGH TRANSFORM 9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

MODULE IV 3D VISION AND MOTION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

MODULE V APPLICATIONS 9

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians

TOTAL : 45 Hours

REFERENCES

1. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
2. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012
3. Jan Erik Solem, "Programming Computer Vision with Python: Tools and algorithms for analyzing images", O'Reilly Media, 2012
4. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", Third Edition, Academic Press, 2012.
5. R. Szeliski, —Computer Vision: Algorithms and Applications", Springer 2011
6. Simon J. D. Prince, —Computer Vision: Models, Learning, and Inference", Cambridge University Press, 2012.

P19CS316	**SOFT COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

After completion of this course, the students will be able to

Outcomes	**CO1** **(Understand)** Understand the Fuzzy logic and its applications	**K2**
	CO2 **(Understand)** Understand the Artificial neural networks and its applications.	**K2**
	CO3 **(Understand)** Understand the Solving single-objective optimization problems using GAs.	**K2**

	CO4	**(Understand)**Understand the Solving multi-objective optimization problems using Evolutionary algorithms (MOEAs).	**K2**
	CO5	**(Understand)** Understand the Applications of Soft computing to solve problems in varieties of application domains.	**K2**

MODULE I INTRODUCTION TO SOFT COMPUTING 9

Concept of computing systems - "Soft" computing versus "Hard" computing - Characteristics of Soft computing - Some applications of Soft computing techniques

MODULE II FUZZY LOGIC 9

Introduction to Fuzzy logic - Fuzzy sets and membership functions - Operations on Fuzzy sets - Fuzzy relations, rules, propositions, implications and inferences - Defuzzification techniques - Fuzzy logic controller design - Some applications of Fuzzy logic.

MODULE III GENETIC ALGORITHMS 9

Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques - Basic GA framework and different GA architectures - GA operators: Encoding, Crossover, Selection, Mutation, etc - Solving single-objective optimization problems using GAs.

MODULE IV MULTI-OBJECTIVE OPTIMIZATION PROBLEM SOLVING 9

Concept of multi-objective optimization problems (MOOPs) and issues of solving them - Multi-Objective Evolutionary Algorithm (MOEA) - Non-Pareto approaches to solve MOOPs - Pareto-based approaches to solve MOOPs - Some applications with MOEAs.

MODULE V ARTIFICIAL NEURAL NETWORKS 9

Biological neurons and its working - Simulation of biological neurons to problem solving - Different ANNs architectures - Training techniques for ANNs - Applications of ANNs to solve some real life problems.

TOTAL : 45 Hours

REFERENCES

1 Fuzzy Logic: A Practical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional, 2000.

2 Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.

3 Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.

4 Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elesvier Press, 2004.

5 An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.

6 Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.

7 Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.

8 Neural Networks, Fuzzy Logic and Genetic Algorithms : Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.

9 Soft Computing, D. K. Pratihar, Narosa, 2008.

10 Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.

11 Neural Networks and Learning Machines, (3rd Edn.), Simon Haykin, PHI Learning, 2011.

P19CS317	**SOFTWARE QUALITY ASSURANCE AND TESTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)**Gain Knowledge in the functional and non-functional tests in the life cycle of the software product.	**K2**
	CO2	**(Understand)** Understand system testing and test execution process	**K3**
	CO3	**(Apply)** Experiment with various system test categories.	**K3**
	CO4	**(Apply)** Apply techniques of quality assurance for typical applications.	**K3**
	CO5	**(Apply)**Choose defect prevention techniques and software quality assurance metrics	**K3**

MODULE I SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES 9

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group, System Test Team Hierarchy, Team Building

MODULE II SYSTEM TESTING 9

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built-in Testing. functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models

MODULE III SYSTEM TEST CATEGORIES 10

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests.

Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote. system test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. system test execution- Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness.

MODULE IV SOFTWARE QUALITY 8

Software quality - People‟s Quality Expectations, Frameworks and ISO-9126, McCall‟s Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement, Testing Maturity Model.

MODULE V SOFTWARE QUALITY ASSURANCE 9

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications.

TOTAL : 45 Hours

REFERENCES

1 Software Testing And Quality Assurance-Theory and Practice, KshirasagarNakPriyadarshiTripathy, John Wiley & Sons Inc,2008

2 Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005.

3 Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004

4 Software Quality Assurance, Milind Limaye, TMH ,New Delhi, 2011

SEMESTER III – ELECTIVE IV

P19CS319	BIO INFORMATICS	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes			
	CO1	**(Understand)** Deploy the genomics technologies in Bioinformatics.	K2
	CO2	**(Apply)**Differentiate efficient algorithm and issues.	K3
	CO3	**(Apply)**Deploy the DNA replication and molecular clocks in bioinformatics.	K3
	CO4	**(Understand)** Work on assemble genomes and sequences.	K2
	CO5	**(Apply)**Use the Microarray technologies for genome expression.	K3

MODULE I INTRODUCTION AND FUNDAMENTALS 9

Fundamentals of genes, genomics, molecular evolution – genomic technologies –beginning of bioinformatics - genetic data –sequence data formats – secondary database – examples – data retrieval systems.

MODULE II BIOINFORMATICS ALGORITHM AND ANALYSIS 9

Sequence alignment and similarity searching in genomic databases: BLAST and FASTA – additional bioinformatics analysis involving nucleic acid sequences-additional bioinformatics analysis involving protein sequences – Phylogenetic Analysis.

MODULE III DNA REPLICATION AND MOLECULAR CLOCKS 9

Beginning of DNA replication – open problems – multiple replication and finding replication – computing probabilities of patterns in a string-the frequency array-converting patterns-solving problems- finding frequents words-Big-O notation –case study-The Tower of Hanoi problem.

MODULE IV ASSEMBLE GENOMES AND SEQUENCES 9

Methods of assemble genomes – string reconstruction – De Bruijn graph – Euler's theorem – assembling genomes –DNA sequencing technologies – sequence antibiotics – Branch and Bound algorithm – open problems – comparing biological sequences- Case Study –Manhattan tourist Problem.

MODULE V HUMAN GENOME 9

Human and mouse genomes-random breakage model of chromosome evolution – sorting by reversals – greedy heuristic approach – break points- rearrangements in tumor and break point genomes-break point graps- synteny block construction -open problems and technologies.

TOTAL : 45 Hours

TEXT BOOKS

1 SupratimChoudhuri, "Bioinformatics for Beginners", Elsevier, 2014.

2 Philip Compeau and Pavel pevzner, "Bioinformatics Algorithms: An Active Learning Approach" Second edition volume I , Cousera, 2015.

REFERENCES

1 Ion Mandoiu and Alexander Zelikovsky**, "**Computational Methods for Next Generation Sequencing Data Analysis — Wiley series 2016.

2 Istvan Miklos, Renyi Institutue, "Introduction to algorithms in bioinformatics", Springer 2016

P19CS320	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes			
	CO1	**(Understand)**Express the definition of qubit, quantum logic gates, quantum circuits and quantum algorithms	K2
	CO2	**(Understand)**Trace how quantum parallelism is used in the simplest quantum algorithms such as Deutsch, period finding and quantum Fourier transform	K2

CO3	**(Apply)**Operate the Feynman processor numerically	**K3**
CO4	**(Apply)**Produce the basic requirements for implementation of quantum computers and classify the schemes for implementation of quantum computers	**K3**
CO5	**(Apply)**Transfer the selected original scientific papers about quantum computers and quantum information	**K3**

MODULE I INTRODUCTION TO QUANTUM COMPUTATION 9

Quantum bits, Bloch sphere representation of a qubit, multiple qubits, Hilber space, Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.

MODULE II QUANTUM CIRCUITS 9

Single qubit gates, multiple qubit gates, design of quantum circuits.

MODULE III QUANTUM INFORMATION AND CRYPTOGRAPHY 9

Comparison between classical and quantum information theory. Bell states. Quantum teleportation. Quantum Cryptography, no cloning theorem

MODULE IV QUANTUM ALGORITHMS 9

Classical computation on quantum computers. Relationship between quantum and classical complexity classes.Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search.

MODULE V NOISE AND ERROR CORRECTION 9

Graph states and codes, Quantum error correction, fault-tolerant computation

TOTAL : 45 Hours

REFERENCES

1 Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press., 2012.

2 Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. 2014

3 Pittenger A. O., An Introduction to Quantum Computing Algorithms. 2000

P19CS321	**SOCIAL NETWORK ANALYSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

After completion of this course, the students will be able to

Outcomes	**CO1** **(Understand)** Work on the internals components of the social network	**K2**
	CO2 **(Apply)** Model and visualize the social network	**K3**
	CO3 **(Understand)** Mine the behavior of the users in the social network	**K2**
	CO4 **(Analyze)** Predict the possible next outcome of the social network	**K4**
	CO5 **(Apply)** Apply social network in real time applications	**K3**

MODULE I INTRODUCTION 9

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

MODULE II MODELING AND VISUALIZATION 9

Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

MODULE III MINING COMMUNITIES 9

Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

MODULE IV EVOLUTION 9

Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.

MODULE V APPLICATIONS 9

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.

TOTAL : 45 Hours

REFERENCES

1. Ajith Abraham, Aboul Ella Hassanien, VáclavSnášel, "Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2012.
2. BorkoFurht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2011.
3. Charu C. Aggarwal, "Social Network Data Analytics", Springer, 2014.
4. Giles, Mark Smith, John Yen, "Advances in Social Network Mining and Analysis", Springer, 2010.
5. Guandong Xu , Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer, 1st edition, 2012.
6. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition, 2007.
7. PrzemyslawKazienko, NiteshChawla,"Applications of Social Media and Social Network Analysis", Springer,2015

P19CS322	BIO-INSPIRED COMPUTING	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Apply)** Implement and apply bio-inspired algorithms	**K3**
	CO2	**(Understand)** Explain random walk and simulated annealing	**K2**
	CO3	**(Apply)** Implement and apply genetic algorithms	**K3**
	CO4	**(Understand)** Explain swarm intelligence and ant colony for feature selection	**K2**
	CO5	**(Apply)** Apply bio-inspired techniques in image processing.	**K3**

MODULE I INTRODUCTION 9

Introduction to algorithm - Newton's method - optimization algorithm - No-Free-Lunch Theorems - Nature-Inspired Mata heuristics -Analysis of Algorithms -Nature Inspires Algorithms -Parameter tuning and parameter control.

MODULE II RANDOM WALK AND SIMULATED ANEALING 9

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling.

MODULE III GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION 9

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA variants - schema theorem - convergence analysis - introduction to differential evolution - variants - choice of parameters - convergence analysis - implementation.

MODULE IV SWARM OPTIMIZATION AND FIREFLY ALGORITHM 9

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - variants- Ant colony optimization toward feature selection.

MODULE V APPLICATION IN IMAGE PROCESSING 9

Bio-Inspired Computation and its Applications in Image Processing: An Overview - Fine-Tuning Enhanced Probabilistic Neural Networks Using Meta-heuristic-driven Optimization - Fine-Tuning Deep Belief Networks using Cuckoo Search - Improved Weighted Threshold Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm.

TOTAL : 45 Hours

TEXT BOOKS

1 Xin-She Yang, "Nature Ispired Optimization Algorithm,Elsevier First Edition 2014.

REFERENCES

1 Eiben,A.E.,Smith,James E, "Introduction to Evolutionary Computing", Springer 2015.

2 Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2013

3 Xin-She Yang , Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing",Elsevier 2016

4 Yang ,Cui,XIao,Gandomi,Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013

P19CS323	COMPILER OPTIMIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)** Identify different levels of intermediate language representation for a simple program blocks.	**K2**
	CO2	**(Understand)** Design performance enhancing optimization techniques.	**K2**
	CO3	**(Apply)** Perform the optimization on procedures.	**K3**
	CO4	**(Understand)** Perform the interprocedural optimizations.	**K2**
	CO5	**(Apply)** Ensure better utilization of resources.	**K3**

MODULE I INTERMEDIATE REPRESENTATIONS AND ANALYSIS 9

Review of Compiler Structure- Structure of an Optimizing Compiler – Intermediate Languages - LIR, MIR, HIR – Control Flow Analysis– Static Single Assignment – Dependence Relations - Dependences in Loops and Testing-Basic Block Dependence DAGs – Alias Analysis.

MODULE II EARLY AND LOOP OPTIMIZATIONS 9

Importance of Code Optimization Early Optimizations: Constant-Expression Evaluation - Scalar Replacement of Aggregates - Algebraic Simplifications and Re-association - Value Numbering - Copy Propagation - Sparse Conditional Constant Propagation. Redundancy Elimination: Common - Sub expression Elimination - Loop-Invariant Code Motion - Partial-Redundancy Elimination - Redundancy Elimination and Reassociation - Code Hoisting. Loop Optimizations: Induction Variable Optimizations - Unnecessary Bounds Checking Elimination.

MODULE III PROCEDURE OPTIMIZATION AND SCHEDULING 9

Procedure Optimizations: Tail-Call Optimization and Tail-Recursion Elimination - Procedure Integration - In-Line Expansion - Leaf-Routine Optimization and Shrink Wrapping. Code Scheduling: Instruction Scheduling - Speculative Loads and Boosting - Speculative Scheduling - Software Pipelining - Trace Scheduling - Percolation Scheduling. Control-Flow and Low-Level Optimizations: Unreachable-Code Elimination - Straightening - If Simplifications - Loop Simplifications -Loop Inversion – Un-switching - Branch Optimizations - Tail Merging or Cross Jumping - Conditional Moves - Dead-Code Elimination - Branch Prediction.

MODULE IV INTER PROCEDURAL OPTIMIZATION 9

Symbol table – Runtime Support - Interprocedural Analysis and Optimization: Interprocedural Control Flow Analysis - The Call Graph - Interprocedural Data-Flow Analysis - Interprocedural Constant Propagation - Interprocedural Alias Analysis - Interprocedural Optimizations - Interprocedural Register Allocation - Aggregation of Global References.

MODULE V REGISTER ALLOCATION AND OPTIMIZING FOR MEMORY 9

Register Allocation: Register Allocation and Assignment - Local Methods - Graph Coloring – Priority Based Graph Coloring - Other Approaches to Register Allocation. Optimization for the Memory Hierarchy: Impact of Data and Instruction Caches - Instruction-Cache Optimization - Scalar Replacement of Array Elements.

TOTAL : 45 Hours

TEXTBOOKS

1 Steven Muchnick, —Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers an imprint of Elsevier, 2014.

REFERENCES

1 Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Pearson India Education Services, 2015.

2 Andrew W. Appel, Jens Palsberg, "Modern Compiler Implementation in Java", Cambridge University Press, Second Edition, 2009.

3 Keith Cooper, Linda Torczon, "Engineering a Compiler", Morgan Kaufmann, Second Edition, 2011.

4 Robert Morgan ,"Building an Optimizing Compiler", Digital Press, 1998

5 Randy Allen and Ken Kennedy, —Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufman, 2001.

P19CS324	UBIQUITOUS COMPUTING	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes			
	CO1	**(Apply)** Apply the knowledge of ubiquitous computing on any software application.	**K3**
	CO2	**(Apply)** Apply the architecture and the resource allocation for the software.	**K3**
	CO3	**(Evaluate)** Compare and choose the location tracking and location based services for identifying an object in real world scenario.	**K3**
	CO4	**(Apply)** Apply the knowledge and skills needed for context aware computing on highly reliable systems.	**K3**
	CO5	**(Apply)** Apply the appropriate design technique for ubiquitous computing.	**K3**

MODULE I FUNDAMENTALS OF UBIQUITOUS COMPUTING 9

Definition, scope, essential elements of ubiquitous, pervasive, and mobile computing. An introduction, overview, and challenges to research topics in ubiquitous computing, including sensors, ambient displays, tangibles, middleware, mobility, and location and context awareness.

MODULE II ARCHITECTURE FOR UBIQUITOUS COMPUTING 9

Architecture for ubiquitous computing: new devices and communications; and software architectures. Wireless standards & protocols for ubiquitous networks: Near field communication (NFC), Bluetooth classic, Bluetooth Low Energy (BLE), WiFi, and WiFi Direct.

MODULE III LOCATION IN UBIQUITOUS COMPUTING 9

Location in ubiquitous computing: Personal assistants, Location aware computing, Location tracking, Architecture, Location based service and applications (Indoor Positioning Techniques), Tracking with cameras, Case studies: Active Badge, Ubisense, RADAR.

MODULE IV CONTEXT-AWARE COMPUTING 9

Integrating the physical and the virtual worlds: sensing and actuation; awareness and perception. Context-aware Computing, Issues and Challenges, Features for Context-Aware Applications, Developing Context-aware Applications: Tools for Building, System Architecture.

MODULE V APPLICATION OF UBIQUITOUS COMPUTING 9

Ubiquitous applications: the appropriate design; Weiser's vision of ubiquitous computing; mixed reality and sensible design. Wearable computing, Glass and Augmented Reality, Eye-Tracking, Digital Pen and Paper Mobile social networking & crowd sensing, Event based social network.

TOTAL : 45 Hours

TEXTBOOKS

1 Laurence T. Yang, EviSyukur, Seng W. Loke, "Handbook on Mobile and Ubiquitous Computing: Status and Perspective", CRC Press, 1st Edition, 2016

2 Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions", Wiley, 2011

REFERENCES

1 Adam Greenfield, "Everyware: The Dawning Age of Ubiquitous Computing", New Riders Publishing, 1st edition, 2006

2 John Krumm, "Ubiquitous Computing Fundamentals", CRC Press, 2010

OPEN ELECTIVES

P19OE401	BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

Outcomes

After completion of this course, the students will be able to

CO1	**(Apply)** Demonstrate knowledge of data analytics.	**K3**
CO2	**(Apply)** Demonstrate the ability of think critically in making decisions based on data and deep analytics.	**K3**
CO3	**(Apply)** Demonstrate the ability to use technical skills in predicative and	**K3**
CO4	**(Apply)** Demonstrate the ability to translate data into clear, actionable insights.	**K3**
CO5	**(Apply)** Prescriptive modelling to support business decision-making.	**K3**

MODULE I BUSINESS ANALYTICS **8**

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.
Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

MODULE II TRENDINESS AND REGRESSION ANALYSIS **8**

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.

MODULE III FORMING REQUIREMENTS **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.

MODULE IV FORECASTING TECHNIQUES **10**

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.

MODULE V DECISION ANALYSIS **10**

Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making

TOTAL : 45 Hours

REFERENCES

1 Business analyticsPrinciples, Concepts, and Applications by Marc J. Schniederjans, Dara G.Schniederjans,Christopher M.Starkey,Pearson FTPress.

2 Business Analytics by James Evans, persons Education

P19OE402	INDUSTRIAL SAFETY	L	T	P	C
		3	0	0	3

After completion of this course, the students will be able to

Outcomes	**CO1**	**(Understand)** Understand Importance of Safety and Important related Acts.	**K2**
	CO2	**(Apply)** Apply Maintenance techniques as per requirements and able to compare for with different technique for better performance.	**K3**
	CO3	**(Understand)** Understand wear and corrosion, its causes and remedial actions for preventions.	**K2**
	CO4	**(Apply)** Demonstrate fault tracing, its methods and application.	**K3**
	CO5	**(Understand)** Understand Importance of maintenance	**K2**

MODULE I INDUSTRIAL SAFETY 8

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.

MODULE II FUNDAMENTALS OF MAINTENANCE ENGINEERING 8

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.

MODULE III WEAR AND CORROSION AND THEIR PREVENTION 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.

MODULE IV FAULT TRACING 10

Fault tracing-concept and importance, decision treeconcept, 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

MODULE V PERIODIC AND PREVENTIVE MAINTENANCE 10

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

TOTAL : 45 Hours

REFERENCES

1 Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services
2 Maintenance Engineering, H. P. Garg, S. Chand and Company.
3 Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4 Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London

P19OE403	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

Outcomes

After completion of this course, the students will be able to

CO1	**(Understand)**Understand basics of operation research and optimization problems.	**K2**
CO2	**(Apply)**Apply transportation and network models.	**K3**
CO3	**(Understand)**Understand inventory control models	**K2**
CO4	**(Analyze)**Analyze the Queueing systems and models	**K3**
CO5	**(Apply)**Apply decision models for optimization problems	**K3**

MODULE I OPERATIONS RESEARCH **10**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

MODULE II TRANSPORTATION MODELS AND NETWORK MODELS **9**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models

MODULE III INVENTORY MODELS **8**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

MODULE IV QUEUEING MODELS **8**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi-server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

MODULE V DECISION MODELS **10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variability search technique – Dynamic Programming – Simple Problem.

TOTAL : 45 Hours

REFERENCES

1. Hillier and Libeberman, "Operations Research", Holden Day, 2005
2. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.
3. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 2009.
4. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
5. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
6. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
7. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002
8. H.A.Taha,"OperationsResearch,AnIntroduction",PHI, 2008

P19OE404	COST MANAGEMENT OF ENGINEERING PROJECTS	L	T	P	C
		3	0	0	3

Outcomes

After completion of this course, the students will be able to

CO1	**(Apply)** Apply modern software packages to conduct analysis of real world data.	**K3**
CO2	**(Understand)** Understand the technical underpinning of engineering economic analysis.	**K2**
CO3	**(Apply)** Apply the appropriate analytical techniques to a wide variety of real world problems and data sets.	**K3**
CO4	**(Understand)** Summarize and present the analysis results in a clear and coherent manner.	**K2**
CO5	**(Apply)** Make use of the principles of project management and its functions.	**K3**

MODULE I COSTCONCEPTS IN DECISION-MAKING 8

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.

MODULE II PROJECT 8

Meaning, Different types, why to manage, cost over runs centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical 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

MODULE III COSTBEHAVIORANDPROFITPLANNINGMARGINAL COSTING 9

Distinction between Marginal Costing and Absorption Costing; Break – even Analysis, Cost-Volume-Profit Analysis. Various decision - making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector

MODULE IV JUST-IN-TIME APPROACH 10

Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity - Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero – based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

MODULE V QUANTITATIVE TECHNIQUESFORCOSTMANAGEMENT 10

Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TOTAL : 45 Hours

REFERENCES

1 Cost Accounting A Managerial Emphasis, Prentice Hall of India, NewDelhi

2 Charles T. Horngren and George Foster, "Advanced Management Accounting"

3 J. 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.

P19OE405	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

Outcomes

After completion of this course, the students will be able to

CO1	**(Understand)** Understand the concepts of composites and its applications.	**K2**
CO2	**(Understand)** Learn about the fibres in composite, and its mechanical Behavior.	**K2**
CO3	**(Understand)** Gather Knowledge in matrix Composites and its different types.	**K2**
CO4	**(Understand)** Know about the manufacturing process of polymer matrix composites	**K2**
CO5	**(Understand)** Understand the concepts strength criteria of different types of composites in different applications level.	**K2**

MODULE I INTRODUCTION 8

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.

MODULE II REINFORCEMENTS 8

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.

MODULE III MANUFACTURING OF METAL MATRIX COMPOSITES 9

Casting – Solid State diffusion technique, Cladding– Hotiso static 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.

MODULE IV MANUFACTURINGOF POLYMER MATRIX COMPOSITES 10

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding– Reaction injection moulding. Properties and applications.

MODULE V STRENGTH 10

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.

TOTAL : 45 Hours

TEXT BOOKS

1 Material Science and Technology– Vol13– Composites by R. W. Cahn – VCH, West Germany

2 Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley& Sons, NY,Indianedition,2007

REFERENCES

1 Hand Book of Composite Materials – ed - Lubin.

2 Composite Materials – K.K.Chawla.

3 Composite Materials Science and Applications– Deborah D. L. Chung.

4 Composite Materials Design and Applications– Danial Gay, Suong V. Hoa,and Stephen W.Tasi.

P19OE406	WASTE TO ENERGY	L	T	P	C
		3	0	0	3

Outcomes

After completion of this course, the students will be able to

CO1	**(Understand)** Classify the types of waste and the conversion methods to extract the energy from the waste	**K2**
CO2	**(Understand)** Understand the Principles of Pyrolosis and its applications in Waste Management	**K2**
CO3	**(Understand)** Understand the principles of Gasifiers , design Gasifiers and its operation process	**K2**
CO4	**(Understand)** Gain knowledge on combustion in Waste to Energy Process.	**K2**
CO5	**(Understand)** Understand the concepts of Biogas and its Design, Operation Process etc.	**K2**

MODULE I INTRODUCTION TO ENERGY FROM WASTE 8

Classification of waste as fuel – Agro based, For estresi due, Industrial waste-MSW– Conversion devices – Incinerators, gasifiers, digestors

MODULE II BIOMASSPYROLYSIS 8

Pyrolysis – Types, slowfast–Manufacture of charcoal–Methods-Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

MODULE III BIOMASS GASIFICATION 9

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidizedbed gasifiers–Design, construction and operation – Gasifier burner arrangement for thermal heating– Gasifier engine arrangement and electrical power–Equilibrium and kinetic consideration in gasifier operation

MODULE IV BIOMASSCOMBUSTION 10

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.

MODULE V BIOGAS 10

Properties of biogas (Calorific value and composition) – Bio gas plant technology and 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 – bio chemical conversion - an aerobic digestion-Types of bio gas Plants–Applications -Alcohol production from biomass – Bio diesel production – Urban waste to energy conversion – Bio mass energy programme in India.

TOTAL : 45 Hours

REFERENCES

1. Non-Conventional Energy, Desai, AshokV., WileyEastern Ltd., 1990.
2. Biogas Technology-APracticalHandBook-Khandelwal,K.C.andMahdi,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, JohnWiley & Sons, 1996

AUDIT COURSES

P19AC501	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		2	0	0	0

After completion of this course, the students will be able to

Outcomes	**CO1** **(Understand)** Understand that how to improve your writing skills and level of readability.	**K2**
	CO2 **(Understand)** Learn about what to write in each section.	**K2**
	CO3 **(Understand)** Understand the skills needed when writing a Title	**K2**
	CO4 **(Understand)** Understand the skills needed when writing the Conclusion	**K2**
	CO5 **(Understand)** Ensure the good quality of paper at very first-time submission	**K2**

MODULE I INTRODUCTION TO RESEARCH PAPER WRITING **6**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

MODULE II PRESENTATION SKILLS **6**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts.

MODULE IV TITLE WRITING SKILLS **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.

MODULE V RESULT WRITING SKILLS **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

MODULE VI VERIFICATION SKILLS **6**

Useful phrases, how to ensure paper is as good as it could possibly be the first – time submission

TOTAL: 30Hours

REFERENCES:

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

P19AC502	DISASTERMANAGEMENT	L	T	P	C
		2	0	0	0

Outcomes

After completion of this course, students will be able to

CO1	**(Understand)** Ability to summarize basics of disaster	**K2**
CO2	**(Understand)** Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	**K2**
CO3	**(Understand)** Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	**K2**
CO4	**(Understand)** Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	**K2**
CO5	**(Understand)** Ability to develop the strengths and weaknesses of disaster management approaches	**K2**

MODULE I Introduction **6**

Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

MODULE II Repercussions Of Disasters and Hazards **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.

MODULE III Disaster Prone Areas In India **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

MODULE IV Disaster Preparedness And Management **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.

MODULE V Disaster Mitigation **6**

Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

TOTAL: 30 Hours

TEXT BOOKS:

1 R.Nishith, SinghAK,"DisasterManagementinIndia:Perspectives,issuesandstrategies"'New Royal book Company.

2 Sahni,PardeepEt.Al.(Eds.),"DisasterMitigationExperiencesAndReflections",PrenticeHallOf India, New Delhi.

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

P19AC503	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P	C
		2	0	0	0

Outcomes

After completion of this course, students will be able to

CO1	**(Understand)** Understanding basic Sanskrit language	**C2**
CO2	**(Apply)** Write sentences.	**C3**
CO3	**(Understand)** Know the order and roots of Sanskrit.	**C2**
CO4	**(Understand)** Know about technical information about Sanskrit literature.	**C2**
CO5	**(Understand)** Understand the technical concepts of Engineering	**C2**

MODULE I ALPHABETS **6**

Alphabets in Sanskrit

MODULE II TENSES AND SENTENCES **6**

Past/Present/Future Tense - Simple Sentences

MODULE II ORDER AND ROOTS **6**

Order - Introduction of roots

MODULE IV SANSKRIT LITERATURE **6**

Technical information about Sanskrit Literature

MODULE V TECHNICAL CONCEPTS OF ENGINEERING **6**

Technical concepts of Engineering - Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 Hours

REFRENCES:

1 "Abhyaspustakam", Dr.Vishwas, Samskrita -BhartiPublication,New Delhi

2 "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sansthanam, NewDelhiPublication

3 "India's Glorious Scientific Tradition", Suresh Soni, Oceanbooks(P) Ltd., NewDelhi.

P19AC504	VALUE EDUCATION	L	T	P	C
		2	0	0	0

Outcomes

After completion of this course, students will be able to

CO1	**(Understand)** Knowledge of self-development	**K2**
CO2	**(Understand)** Learn the importance of Human values	**K2**
CO3	**(Apply)** Developing the overall personality	**K3**
CO4	**(Understand)** Overcome the self-destructive habits with value education	**K2**
CO5	**(Understand)** Interpret social empowerment with value education	**K2**

MODULE I INTRODUCTION TO VALUE EDUCATION 6

Values and self-development – Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements

MODULE II IMPORTANCE OF VALUES 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

MODULE III INFLUENCE OF VALUE EDUCATION 6

Personality and Behavior development - Soul and Scientific attitude. Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship Happiness Vs suffering, love for truth.

MODULE IV REINCARNATION THROUGH VALUE EDUCATION 6

Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature Character and Competence – Holy books vs Blind faith, Self-management and Good health, Science of reincarnation

MODULE V VALUE EDUCATION IN SOCIAL EMPOWERMENT 6

Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

TOTAL: 30 Hours

REFERENCE:

1 Chakroborty,S.K."ValuesandEthicsfororganizationsTheoryandpractice",OxfordUniversity Press,NewDelhi

P19AC505	CONSTITUTIONOFINDIA	L	T	P	C
		2	0	0	0

Outcomes

After completion of this course, students will be able to

CO1	**(Understand)** Understand history and philosophy of Indian Constitution	**K2**
CO2	**(Understand)** Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective	**K2**
CO3	**(Understand)** Understand powers and functions of Indian government	**K2**
CO4	**(Understand)** Understand emergency rule	**K2**
CO5	**(Understand)** Understand structure and functions of local administration.	**K2**

MODULE I History of Making of the Indian Constitution **6**

History of Making of the Indian Constitution-Drafting Committee - Composition & Working - Philosophy of the Indian Constitution-Preamble-Salient Features

MODULE II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES **6**

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

MODULE III ORGANS OF GOVERNANCE **6**

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-ExecutivePresident-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges,Qualifications Powers and Functions

MODULE IV EMERGENCY PROVISIONS **4**

Emergency Provisions - National Emergency, President Rule, Financial Emergency

MODULE V LOCAL ADMINISTRATION **8**

District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- ZilaPachayat-Elected officials and their roles- CEO ZilaPachayat- Position and role-Block level- Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointedofficials-Importance of grass root democracy

TOTAL: 30 Hours

TEXT BOOKS:

1 The Constitution of India, 1950(Bare Act),Government Publication.

2 Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1stEdition, 2015.

3 M.P.Jain, Indian Constitution Law, 7thEdn.,LexisNexis, 2014.
D.D.Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

P19AC507	STRESSMANAGEMENTBY YOGA	L	T	P	C
		2	0	0	0

After completion of this course, students will be able to

Outcomes	**CO1**	**(Understand)** Develop healthy mind in a healthy body thus improving social health also.	**K2**
	CO2	**(Understand)** Learn Do's and Don'ts in life through Yam	**K2**
	CO3	**(Understand)** Learn Do's and Don'ts in life through Niyam	**K2**
	CO4	**(Understand)** Develop a healthy mind and body through YogAsans	**K2**
	CO5	**(Understand)** Learn breathing techniques through Pranayam	**K2**

MODULE I INTRODUCTION TO YOGA **6**

Definitions of Eight parts of yoga(Ashtanga)

MODULE II YAM **6**

Yamand Niyam - Do`s and Don'ts in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

MODULE III NIYAM **6**

Do`s and Don't's in life.
Ahinsa, satya, astheya, bramhacharya and aparigraha

MODULE IV ASAN **6**

Various yog poses and their benefits for mind & body

MODULE V PRANAYAM **6**

Regularization of breathing techniques and its effects-Types of pranayam

TOTAL: 30 Hours

TEXT BOOKS:

1 'YogicAsanasfor GroupTraining-Part-I", JanardanSwamiYogabhyasiMandal,Nagpur
2 "Rajayogaor conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama(PublicationDepartment),Kolkata

P19AC508	PERSONALITY DEVELOPMENTTHROUGHLIFE ENLIGHTENMENTSKILLS	L	T	P	C
		2	0	0	0

After completion of this course, students will be able to

Outcomes			
	CO1	**(Understand)** To develop basic personality skills holistically	**K2**
	CO2	**(Understand)** To develop deep personality skills holistically to achieve happy goals	**K2**
	CO3	**(Understand)** To rewrite the responsibilities	**K2**
	CO4	**(Understand)** To reframe a person with stable mind, pleasing personality and determination	**K2**
	CO5	**(Understand)** To awaken wisdom in students	**K2**

MODULE I NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - I 6

Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue)

MODULE II NEETISATAKAM-HOLISTIC DEVELOPMENT OF PERSONALITY - II 6

Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's)

MODULE III APPROACH TO DAY TO DAY WORK AND DUTIES 6

Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35. Chapter6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48

MODULE IV STATEMENTS OF BASIC KNOWLEDGE 6

Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68. Chapter12 - Verses 13, 14, 15, 16,17, 18

MODULE V PERSONALITY OF ROLE MODEL - SHRIMAD BHAGWADGEETA 6

Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 30 Hours

REFERENCES:

1 "Srimad Bhagavad Gita"Swami Swarupananda Advaita Ashram(Publication Department),Kolkata

2 Bhartrihari's Three Satakam (Niti-sringar-vairagya), P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.