R.V.R. & J.C.COLLEGE OF ENGINEERING

(Autonomous)

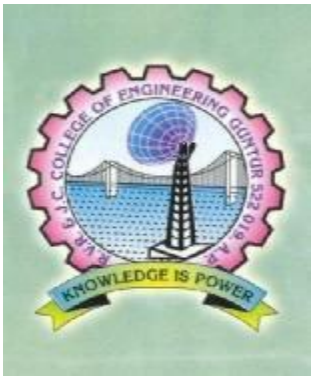
Regulations (R-17)

Scheme of Instruction, Examinations and Syllabi

for

Two year M.Tech. Degree Programme

(w.e.f. 2017-2018)



Computer Science & Engineering

R.V.R & J.C.COLLEGE OF ENGINEERING

Accredited by NBA and NAAC with "A" Grade

Chowdavaram, Guntur- 522019

Department Profile

The undergraduate program in Computer Science & Engineering (CSE) was introduced in 1994. Since its inception, the department has grown exponentially in terms of student intake, quality of academic work and student achievements. The initial student enrollment was 30. Since then, the B.Tech programme has seen a gradual increase in the student enrollment, and current annual intake stands at 180. Considering the needs of the academic institutions and the industry into cognizance, the department of CSE started M.Tech programme in the year 2003. The current annual intake for the M.Tech programme is 25. This programme helps to enhance the quality of the academic and research environment of the department.

The department has excellent infrastructure to support the teaching learning process. More than half of the class rooms of the department have the integrated computer-assisted teaching systems. The faculty of the department utilizes these systems to deliver lectures effectively. A training facility named E-class room was developed in the year 2009. The E-class room is one of a kind training facility capable of hosting 75 participants at a time with one dedicated computer terminal for each participant. The latest equipment required for video conferencing and remote lecture delivery are also available in the E-class room. The department of CSE also maintains the MOODLE, the learning management system for electronic distribution of lecture material, online references and question papers. The learning management system, MOODLE is also being used by the faculty members to conduct online examinations.

The department has state of the art laboratories to serve the teaching and research needs of the students and faculty members. The laboratories are equipped with the computers of latest hardware configuration procured from MNCs. All the computers are connected to the campus wide network using hi-speed fiber optic local area network. A dedicated leased line provides round-the clock Internet access to all the systems. The department also maintains a dedicated english language lab for improving the communication skills of the students.

The college and the department are well served by the central library. The central library has more than 5000 titles related to Computer Science and Engineering discipline. The central library has online subscription to various e-journals and INDEST (Indian National Digital Library in Engineering Science and Technology) consortium. The subscription provides online access to reputed engineering journals from professional societies like IEEE, ASME, ASCE, SPRINGER, ELSEVIER etc. There is also a dedicated department library to serve the needs of the department.

The department has a team of qualified and experienced faculty including six doctorates. The faculty members of the department actively pursue research in their respective areas and publish research papers in renowned journals. The students are encouraged to participate in national and international conferences, workshops, student symposiums and to publish papers in national / international journals.

The department strives towards delivering quality education to the students. This fact is attested to by the National Board of Accreditation (NBA). The department of CSE received accreditation from NBA for 4 times during 2002, 2007, 2012 and 2017. The department invites experts from premiere educational institutions and the industry to conduct seminars / workshops on the advanced topics in Computer Science.

The department of CSE is justly proud of its high performing students. The students successfully secured top ranks in the university examinations for the past several years. The students secured admissions in the IISc, IITs, IIITs, NITs and other premier institutions of India. A significant number of students also pursue their higher studies in renowned foreign universities. Students of this department are working in top MNC's like TCS, CTS, Infosys, Oracle, Accenture, IBM, Wipro, CISCO.

M.Tech. Computer Science & Engineering

Department Vision:

To produce globally competent engineers to cater the challenging computing needs of the society**.**

Department Mission:

To prepare graduates with

- Sound knowledge of Computer Science and Engineering discipline to solve real world problems.
- Adequate skills and behavior to exhibit code of conduct in their professional practice.

R.V.R. & J.C. COLLEGE OF ENGINEERING: GUNTUR

(Autonomous)

CHOICE BASED CREDIT SYSTEM REGULATIONS (R-17) for

2-YEAR MASTER OF TECHNOLOGY (M.Tech.) Degree Program

(w.e.f. the batch of students admitted into First Year M.Tech.

from the academic year 2017-18)

1. MINIMUM QUALIFICATIONS FOR ADMISSION

The eligibility criteria for admission into M.Tech. programme is as per the guidelines of Andhra Pradesh State Council of Higher Education(APSCHE), Amaravati.

1.1 Category – A Seats:

The seats under this category shall be filled by the Convener, PGCET Admissions.

1.2 Category – B Seats:

The seats under this category shall be filled by the College as per the guidelines of APSCHE

2. COURSES OF STUDY

M.Tech. Courses are offered in the following branches of study:

1	Civil Engineering	-	Structural Engineering
2	Computer Science & Engineering	-	Computer Science and Engineering
3	Electrical & Electronics Engineering	-	Power Systems Engineering
4	Electronics & Communication Engineering	-	Communication Engineering & Signal Processing
5	Information Technology	-	Computer Science & Technology
6	Mechanical Engineering	-	Machine Design

3. DURATION OF THE COURSE AND MEDIUM OF INSTRUCTION

3.1 The duration of the course is two academic years consisting of two semesters in each academic year.

3.2 The medium of instruction and examination is English.

4. MINIMUM INSTRUCTION DAYS

Each semester shall consist of a minimum number of 90 days of instruction excluding the days allotted for tests, examinations and preparation holidays.

5. REGISTERING THE COURSES OFFERED

5.1 A student has to register and secure 75 credits out of which 24 credits from laboratory courses including project work.

5.2 The structure of the M.Tech. Programme comprises of two semesters of course work consisting of 6 Core subjects + 6 Elective subjects +4 Labs or 3 Labs + 1 Seminar (or) 2 Labs + 2 Seminars, followed by two semesters of Project work.

5.3 MOOCS (Massive Open Online Courses) Requirements.

- Enrolment of MOOCS Course will be initiated from the date of commencement of class work for I Year I Semester.
- MOOCS course completion certificate of duration not less than 8 weeks, must be submitted on or before the last instruction day of II Year I Semester, for which 2 Credits will be awarded, otherwise his / her Semester End Examination results will not be declared.
- List of organizations offering MOOCS course(s) will be announced by the respective Board of Studies at the time of commencement of class work for I Year I Semester.

5.4 Internship / Industrial Training / Professional Certification:

- Internship / Industrial Training / Professional Certification should be taken up during the summer holidays for a period of 4 weeks.
- Internship / Industrial Training / Professional Certification completion certificate must be submitted along with a report and presentation during the II Year I Semester Internal evaluation, otherwise his / her Semester End Examination results will not be declared.

5.5 Project work shall be carried out under the Supervision of a Faculty Member in the concerned department. A student may, however, in certain cases, be permitted to work on his Project/Dissertation at the place of employment, any recognized Institution/R&D Organization/Industry with the approval of the Head of the Department concerned and Head of the Organization. In such cases, the Project Work shall be jointly supervised by a member of the faculty and a person from the Organization.

5.6 The student has to publish at least one paper in peer reviewed Journal related to his/her work to get eligibility to submit the project work.

6. EVALUATION

6.1 The performance of the student in each semester is evaluated subject wise. The Internal Examination consists of a Sessional Test for 30 Marks and Assignment for 10 Marks. The semester end examination is conducted for 60 marks. The Internal Evaluation for Theory subjects is based on the best of the performances in the two midterm examinations one held in the middle of the semester and the other held immediately after the completion of the instruction. The internal evaluation for practical subjects is based on the day to day performance and semester end internal practical Examination.

6.2 The marks for Seminar will be awarded by internal evaluation by a panel of the department.

6.3 For taking the Semester end examination in any theory or practical subject, students shall be required to obtain a minimum of 50% marks in Internal evaluation in that subject failing which he/she is required to repeat the subject when next offered.

6.4 For each theory subject, there is a comprehensive Semester End Examination at the end of each Semester.

6.5 For each Practical course the Semester End Examination is conducted by one internal and one external examiner appointed by the Principal of the College. The duration of the examination is specified in the detailed Schemes of Instruction & Examination.

6.6 Examination in Project Work is conducted by one internal examiner and one external examiner appointed by the Principal.

6.7 The performance of the students in each semester is evaluated subject wise. The distribution of marks between internal assessment and Semester End Examination is as follows:

Nature of the subject	Sessional Marks	Semester End Exam. Marks
Theory	40	60
Laboratory	40	60
Seminar / Internship / Professional Certification	100	--
Project work	40	60

7. LABORATORY / PRACTICAL COURSES

In any semester, a minimum of 10 experiments / exercises specified in the syllabus for laboratory course shall be completed by the student and get the record certified by the concerned Head of the Department, to be eligible to appear for the Semester End Examination in that Practical course.

8. ATTENDANCE

8.1 The student shall put up a minimum of 75% attendance in each subject.

8.2 Condonation of shortage in attendance up to 10% in any subject may be condoned by the Principal of the College for reasons of ill health and the application is submitted through proper channel at the time of actual illness and

is supported by a certificate from the authorized Medical Officer approved by the Principal.

8.3 If the student does not satisfy the attendance requirement in any subject he or she shall not be permitted to appear for the Semester End examination in that subject and has to repeat that subject when next offered.

9. CONDITION(S) FOR PROMOTION:

A student is eligible for promotion to next semester, if he/she satisfies the minimum requirements of attendance and Sessional marks in 50% of the Theory Subjects, as stipulated in ***Clauses 6 and 8***.

10. CONDITIONS FOR PASS

A student is declared to have passed in individual subject if he / she secures a minimum of 40% marks in theory and 50% marks in Laboratory /Project Work in Semester End Examination and a minimum of 50% marks in both Sessional & Semester End Examination put together.

11. AWARD OF CREDITS

Credits are awarded for each Theory/Practical/Seminar/Project Subject. Each theory subject is awarded 4 credits and each practical/Seminar subjects is awarded 2 credits. Project seminar in II Year I Semester is awarded 4 credits and Project work at the end of II Year II Semester is awarded 10 credits.

11.1 AWARD OF GRADES

S.No.	Range of Marks	Grade	Grade Points
1.	≥90%	S	10.0
2.	80%-89%	A	9.0
3.	70%-79%	B	8.0
4.	60%-69%	C	7.0
5.	55%-59%	D	6.0
6.	50%-54%	E	5.0
7.	≤49%	F	0.0
8.	The grade 'W' represents withdrawal / absent (subsequently changed into pass or E to S or F grade in the same semester)	W	0.0

11.2 A student securing 'F' grade in any subject there by securing zero grade points has to reappear and secure at least 'E' grade in the subsequent examinations for that subject.

11.3 After each semester, Grade sheet will be issued which will contain the following details:

- The list of subjects for each semester and corresponding credits and grades obtained
- The Semester Grade Point Average (SGPA) for each semester and
- The Cumulative Grade Point Average (CGPA) of all subjects put together up to that semester.

SGPA is calculated based on the following formula:

$$\frac{\sum[No.of\ credits \times Grade\ points]}{\sum No.of\ Credits}$$

CGPA will be calculated in a similar manner, considering all the subjects up to that semester.

11.4 A consolidated Grade Sheet shall be issued to the student, after completing all, indicating the CGPA of all the Four years put together.

11.5 Conversion of CGPA into equivalent Percentage of marks:

Percentage of Marks = 9.25 x CGPA.

12. ELIGIBILITY FOR AWARD OF M.TECH. DEGREE

The M.Tech. Degree shall be conferred on a student who satisfies the following requirements:

12.1 The student who satisfies the conditions for pass in all the subjects including laboratory of all the years as stipulated in ***Clauses 11***.

12.2 ***Maximum Time Limit for completion of M.Tech Degree***

A student, who fails to fulfill all the academic requirements for the award of the

degree within four academic years from the year of admission, shall forfeit his/her seat in M.Tech. Degree.

13. AWARD OF CLASS

A student who becomes eligible for the award of M.Tech. Degree as stipulated in ***Clause 12*** shall be placed in one of the following Classes.

S.No.	Class	CGPA
1	First Class With Distinction	8.0 or more
2	First Class	6.5 or more but less than 8.0
3	Second Class	5.0 or more but less than 6.5

14. AWARD OF RANK

The rank shall be awarded based on the following:

14.1 Ranks shall be awarded in each branch of study for the top ten percent of the students appearing for the Regular Semester End Examinations or the top two students whichever is minimum.

14.2 The Rank shall be awarded only to those students who complete their degree within two academic years.

14.3 For the purpose of awarding rank in each branch, only such students who passed all subjects in the first attempt shall be considered.

15. TRANSITORY REGULATIONS

A student, who is discontinued in any semester, on readmission shall be required to do all the subjects in the curriculum prescribed for such batch of students in which the students joins subsequently.

15.1 A student, studied under Acharya Nagarjuna University (ANU) regulations, discontinued at the end of the I Year I Semester, shall join in I Year I Semester of Autonomous batch of R-17 regulations.

15.2 A student, studied under ANU Regulations and discontinued at the end of the I year II Semester and also at the subsequent semesters will follow the same regulations of ANU and he/she has to complete the subject by appearing the examinations conducted by Acharya Nagarjuna University. The class will be awarded based on the academic performance of a student in ANU Regulations.

16. CONDUCT AND DISCIPLINE

16.1 Students shall conduct themselves within and outside the premises of the institute in a manner befitting the students of our institution.

16.2 As per the order of Hon'ble Supreme Court of India, ragging in any form is considered as a criminal offence and is banned. Any form of ragging will be severely dealt with.

16.3 The following acts of omission and / or commission shall constitute gross violation of the code of conduct and are liable to invoke disciplinary measures with regard to ragging.

a) Lack of courtesy and decorum, indecent behavior anywhere within or outside the campus.

b) Willful damage of college / individual property.

c) Possession, consumption or distribution of alcoholic drinks or any kind of narcotics or hallucinogenic drugs.

d) Mutilation or unauthorized possession of library books.

e) Noisy and unseemly behavior, disturbing studies of fellow students.

f) Hacking of computer systems (such as entering into other person's are as without prior permission, manipulation and / or damage of computer hardware and software or any other cyber-crime etc.)

g) Usage of camera / cell phone in the campus

h) Plagiarism of any nature

i) Any other acts of gross indiscipline as decided by the academic council from time to time.

16.4 Commensurate with the gravity of offence, the punishment may be reprimand, fine, expulsion from the institute / hostel, debar from examination, disallowing the use of certain facilities of the institute, rustication for a specified period or even outright expulsion from the institute or even handing over the case to appropriate law enforcement or the judiciary, as required by the circumstances.

16.5 For an offence committed in (i) a hostel (ii) a department or in a class room and (iii) elsewhere, the chief warden, the head of the department and the principal respectively, shall have the authority to reprimand or impose fine.

16.6 Cases of adoption of unfair means and / or any malpractice in an examination shall be reported to the principal for taking appropriate action.

16.7 All cases of serious offence, possibly requiring punishment other than reprimand, shall be reported to the academic council.

16.8 The institute level standing disciplinary action committee constituted by the academic council shall be the authority to investigate the details of the offence, and recommend disciplinary action based on the nature and extent of the offence committed.

16.9 The principal shall deal with any academic problem, which is not covered under these rules and regulations, in consultation with the department in an appropriate manner, and subsequently such actions shall be placed before the academic council for ratification. Any emergency modification of regulation, approved by the appropriate authority, shall be reported to the academic council for ratification.

16.10 "Grievance and Redressal Committee" (General) constituted by the Principal shall deal with all grievances pertaining to the academic / administrative / disciplinary matters.

17. MALPRACTICES

17.1 The Principal shall refer the cases of malpractices in internal assessment tests and semester-end examinations to a malpractice enquiry committee constituted by him / her for the purpose. Such committee shall follow the approved scales of

punishment. The principal shall take necessary action, against the erring students basing on the recommendations of the committee.

17.2 Any action on the part of a student during an examination trying to get undue advantage or trying to help another, or drive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the staff, who are in-charge of conducting examinations, valuing examination papers and preparing / keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned in the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

18. AMENDMENTS

The College may from time to time, revise, amend, or change the Regulations, Schemes of Examinations, and / or Syllabus.

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R V R & J C COLLEGE OF ENGINEERING, CHOWDAVARAM, GUNTUR-19*(Autonomous)*

(w.e.f. the academic year 2017-2018)

M.Tech., Computer Science & Engineering

I / IIM.Tech. I Semester:

S.NO.	CODE.NO	SUBJECT	SCHEME OF INSTRUCTION PERIODS PER WEEK		SCHEME OF EXAMINATION			TOTAL
			THEORY	LAB	INTERNAL MARKS	SEMESTER END EXAM MARKS	CREDITS	
1	CS511	Advanced Data Structures & Algorithms	4		40	60	4	100
2	CS512	Multi-Core Architectures & Programming	4		40	60	4	100
3	CS513	Data Science	4		40	60	4	100
4		ELECTIVE-I	4		40	60	4	100
6		ELECTIVE-II	4		40	60	4	100
7		ELECTIVE-III	4		40	60	4	100
8	CS551	Data Structures Lab		3	40	60	2	100
8	CS552	Data Science Lab		3	40	60	2	100
TOTAL			**24**	**6**	**320**	**480**	**28**	**800**

M.Tech (Computer Science & Engineering)

List of Electives

Elective	Code	Subject Name
Elective Courses for I Semester M.Tech(CSE)		
Three Electives need to be selected of which at least one elective should be LBD Course.	CS 571	Artificial Intelligence & Agent Technologies
	CS 572	Natural Language Processing
	CS 573	Advanced Databases
	CS 574	Distributed Computing
	CS 575	Wireless Networks & Mobile Computing
	CS 576	Agile Software Methodologies
	CS 577	Information Security
	CS 578	Design Thinking and Innovation
	CS 579	Network Technologies
	CS 580	Ethical Hacking & Computer Forensics**(LBD)**
	CS 581	Scripting Languages **(LBD)**
	CS 582	Mobile Application Development **(LBD)**

I/II M.Tech I Semester

CS 511	Advanced Data Structures & Algorithms	L	T	P	C
		4	0	0	4

Course Objectives:

1. To learn and implement hashing techniques.
2. To understand the concepts of data structures such as Disjoint sets, Binary Search trees, balanced search Trees.
3. To understand the working of graph algorithms like finding shortest paths and minimum spanning trees.
4. To learn greedy and dynamic programming algorithms.
5. To understand the string matching algorithms.

Course Outcomes:

1. Implement hashing techniques for solving the given problem.
2. Implement the concepts of data structures such as disjoint sets, Binary Search trees and balanced search Trees.
3. Implement graph algorithms like finding shortest paths and minimum spanning trees.
4. Implement greedy and dynamic programming algorithms.
5. Implement the string matching algorithms.

Course Content:

UNIT I 12 Periods

Hash Tables: Direct-address tables, Hash tables, Hash functions, Open addressing, Perfect hashing.
Binary Search Trees: What is a binary search tree? Querying a binary search tree, Insertion and deletion, Randomly built binary search trees.

UNIT II 12 Periods

Red-Black Trees: Properties of red-black trees, Rotations, Insertion, Deletion.
B-Trees:- Definition of B-trees, Basic operations on B-trees, Deleting a key from a B-tree.
Binomial Heaps: Binomial trees and binomial heaps, Operations on binomial heaps.

UNIT III ` 12 Periods

Data Structures for Disjoint Sets - Disjoint-set operations.
Elementary Graph Algorithms: Representation of graphs, Breadth-first search, Depth-first search.
Minimum Spanning Trees - Growing a minimum spanning tree, The algorithms of Kruskal and Prim.

UNIT IV 12 Periods

Single-Source Shortest Paths - The Bellman-Ford algorithm, Single-source shortest paths in directed acyclic graphs, Dijkstra's algorithm.All-Pairs Shortest Paths -The Floyd-Warshall algorithm.

Dynamic Programming: Matrix-chain multiplication, Elements of dynamic programming, Longest common subsequence, Optimal binary search trees.

UNIT V 12 Periods

Greedy Algorithms: An activity-selection problem, Elements of the greedy strategy, Huffman codes, A task-scheduling problem.

String Matching: The naive string-matching algorithm, The Rabin-Karp algorithm, String matching with finite automata, The Knuth-Morris-Pratt algorithm.

Learning Resources:

Text Book:

1. Charles E. Leiserson, Clifford Stein, Ronald Rivest, and Thomas H. Cormen, Introduction to Algorithms, 3rd Edition, Prentice Hall India Learning Private Limited, 2010.

Reference Books:

1. Brad Miller and David Ranum, Problem Solving with Algorithms and Data Structures, Franklin, Beedle& Associates Inc, 2nd edition.
2. Benjamin Baka and David Julian, Python Data Structures and Algorithms, Packt Publishing Limited.

CS 512	Multi-core Architectures & Programming	L	T	P	C
		4	0	0	4

Course Objectives:

1. Understand the challenges in parallel and multi-threaded programming.
2. Learn about the various parallel programming paradigms, and solutions.
3. Study the concepts of multi-threading and OPENMP.

Course Outcomes:

1. Identify performance related parameters in the field of Computer architecture.
2. Identify the limitations of ILP and the need for multi-core architectures.
3. Solve the issues related to multiprocessing and suggest solutions.
4. Point out the silent features of different multi-core architectures and how they exploit parallelism.
5. Understand the concept of multi-threading and OPENMP.

Course Content:

UNIT I 12 Periods

Introduction to Multi-Core Architecture, Motivation for concurrency in Software, Parallel Computing Platforms, Parallel Computing in Multiprocessors, Differentiating Multi-Core Architectures From Hyper-Threading Technology, Multi-Threading on Single-Core Versus Multi-Core Platforms, Understanding Performance, Amdahl' Law, Growing Returns: Gustafson's Law. System Overview of Threading.

Defining Threads, System View of Threads, Threading above the Operating System, Threads Inside the OS, Threads Inside the Hardware, What Happens When a Thread is Created, Application Programming Models and Threading, Virtual Environment:VMs and Platforms, Runtime Virtualization, System Virtualization.

UNIT II 12 Periods

Fundamental Concepts of Parallel Programming Designing for Threads, Task decomposition, Data Decomposition, Data Flow Decomposition, Implication of Different Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An alternate Approach: Parallel Error Diffusion, Other Alternatives.

UNIT III 12 Periods

Threading And Parallel Programming Constructs Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control-Based Concepts, Fence, Barrier, Implementation-Dependent Threading Features.

Threading APIs: Threading APIs For Microsoft Windows,Win32/MFC Thread APIs, Threading APIs

For Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread synchronization, POSIX Threads, Creating Threads, Mapping Threads, Thread Synchronization, Signaling, Compilation And Linking.

UNIT IV 12 Periods

Open MP: A Portable Solution for Threading Challenges in Threading A Loop, Loop-Carried dependence, Data-race Conditions, Managing Shared And Private Data, Loop Scheduling And Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-Sharing Sections, Performance-Oriented Programming, Using Barrier And No Wait, Interleaving single-Thread and Multi-Thread Execution ,Data Copy-In And Copy-Out, Protecting Updates of Shared Variables, Intel Task Queuing Extension to OPENMP, OPENMP Library Functions, OPENMP Environment Variables, Compilation, Debugging Performance.

UNIT V 12 Periods

Solutions to Common Parallel Programming Problems Too many threads, Data Races, Deadlocks And Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions For Heavily Contended Locks, Non-Blocking Algorithms, ABA Problem, Cache Line Ping-Ponging ,Memory Reclamation Problem, Recommendations , Thread-Safe functions and Libraries, Memory Issues, Bandwidth ,Working In the Cache, Memory Contention, Cache-Related issues, False Sharing, Memory consistency, Current IA-32 Architecture, Itanium Architecture, High-Level Languages, Avoiding Pipeline Stalls on IA-32 , Data Organization For High Performance.

Learning Resources:

Text Book:

1. Shameem Akhter and Jason Roberts, Multi-core Programming: Increasing Performance through software Multi-Threading, Intel Press, 2006.

Reference Books:

1. Peter S. Pacheco, An Introduction to Parallel Programming, Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, Multi-core Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011.
3. Michael J Quinn, Parallel programming in C with MPI and OPENMP, Tata McGraw Hill, 2003.

CS 513	Data Science	L	T	P	C
		4	0	0	4

Course Objectives:

1. Identify the field of data analytics-background and key concepts.
2. Know the basics of R programming.
3. Develop and gain an understanding of statistical analysis in R programming.
4. Have the knowledge of cluster & classification techniques used in R language.

Course Outcomes:

1. Find a meaningful patternS in data.
2. Graphically interpret data.
3. Implement the analytic algorithms.
4. Handle large scale analytics projects from various domains.
5. Develop intelligent decision support systems.

Course Content:

UNIT I 12 Periods

Data Definitions and Analysis Techniques

- Data Mining and Analysis
- Types of Data
- Levels of Measurement
- High Dimensionality
- Introduction to statistical learning and R-Programming

UNIT II 12Periods

Descriptive Statistics

- Measures of central tendency
- Measures of location of dispersions
- Practice and analysis with R

UNIT III 12Periods

Descriptive Statistics

- Basic analysis techniques
- Statistical hypothesis generation and testing
- Chi-Square test
- t-Test
- Analysis of variance
- Correlation analysis
- Maximum likelihood test
- Practice and analysis with R

UNITIV 12Periods

Data analysis techniques

- Regression analysis
- Classification techniques
- Practice and analysis with R

UNIT V 12Periods

Data analysis techniques

- Clustering
- Association rules analysis
- Practice and analysis with R
- Sensitivity Analysis

Learning Resources:

Text Books & Reference Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability & Statistics for Engineers & Scientists (9thEdn.), Prentice Hall Inc.
2. Trevor Hastie Robert Tibshirani Jerome Friedman, The Elements of Statistical Learning, Data Mining, Inference, and Prediction (2ndEdn.), Springer, 2014
3. G James, D. Witten, T Hastie, and R. Tibshirani, An Introduction to Statistical Learning: with Applications in R, Springer, 2013
4. John M. Chambers, Software for Data Analysis Programming with R (Statistics and Computing), Springer
5. A. Rajaraman and J. Ullman, Mining Massive Data Sets, Cambridge University Press, 2012
6. Anna Maria Paganoni and PiercesareSecchi, Advances in Complex Data Modeling and Computational Methods in Statistics, Springer, 2013
7. Mohammed J. Zaki, Wagner Meira, Data Mining and Analysis, Cambridge, 2012
8. Mark Gardener, Beginning R: The Statistical Programming Language, Wiley, 2013

CS 551	Data Structures Lab	L	T	P	C
		0	0	3	2

Course Objectives:

1. To learn and implement hashing techniques.
2. To understand the concepts of data structures such as Disjoint sets, Binary Search trees, balanced search Trees.
3. To understand the working of graph algorithms like finding shortest paths and minimum spanning trees.
4. To learn greedy and dynamic programming algorithms.
5. To understand the string matching algorithms.

Course Outcomes:

1. Implement hashing techniques for solving the given problem.
2. Implement the concepts of data structures such as disjoint sets, Binary Search trees and balanced search Trees.
3. Implement graph algorithms like finding shortest paths and minimum spanning trees.
4. Implement greedy and dynamic programming algorithms.
5. Implement the string matching algorithms.

List of Experiments:

1. Write a C program to implement hashing techniques
    a. Separate chaining.
    b. Open addressing.

2. Write a C program to implement the following operations on a binary search tree
    a. Insert a node.
    b. Delete a node.
    c. Find a node.
    d. Traverse the tree.

3. Write a C program to implement the following
    a. Disjoint sets operations.
    b. Breadth First Search and Depth First Search using adjacency list.

4. Write a C program to implement insertion and deletion operations on a B-tree.

5. Write a C program to find minimum spanning tree of a given graph using Kruskal's algorithm.

6. Write a C program to find minimum spanning tree of a given graph using Prim's algorithm.

7. Write a C program to find the lengths of the shortest paths from a source in the given weighted graph using Bellman-Ford algorithm.

8. Write a C program to find the length of the shortest path in the given weighted graph using Dijkstra's algorithm.

9. Write a C program to solve all pairs shortest path problem using Floyd-Warshall algorithm.

10. Write a C program to implement the string matching algorithms:
    a. Naïve.
    b. Robin-Karp.
    c. KMP.

CS 552	Data Science Lab	L	T	P	C
		0	0	3	2

Prerequisites:

1. A Strong mathematical background in Probability and Statistics.
2. Proficiency with algorithms.
3. Programming skills in C.
4. Critical thinking and problem solving skills.

Course Objectives:

1. Identify the field of data analytics-background and key concepts.
2. Know the basics of R programming.
3. Develop and gain an understanding of probability distributions and liner models in R programming.
4. Have the knowledge of cluster & classification techniques used in R language.

Course Outcomes:

1. Able to recognize the use of R interactive environment.
2. Able to memorize the packages available and basics of R programming.
3. Able to dramatize the data management and graphical representation in R programming.
4. Able to use statistical models like probability distributions and liner models on data using R programming.
5. Able to assess the data using cluster analysis and classification models using R programming.

List of Experiments:

1. (a) Demonstrate Data frames by using R-Language.
   (b) Demonstrate Calculator operations by using R-Language.

2. (a) Demonstrate Vectors and Lists by using R-Language.
   (b) Demonstrate the Column-Binding and Row-Binding by using matrices, data frames by using R- Language.

3. (a) Demonstrate the Statistical operations in using R-Language.
   (b) Demonstrate SQL operations in using R-Language, by using any sample Dataset (Ex: mtcars).

4. Demonstrate Functions and control statements by using R-Language.

5. (a) Demonstrate how to Import & Export .CSV files in R-Language.
(b) Demonstrate & Draw the GRAPHS with the help of IRIS Dataset.

(i)Histogram (ii) pi-chart
(iii) block plot (iv)bar plot.

6.Demonstrate the one-sample T-test using any appropriate data set in R.

7. Demonstrate the Two-sample T-Test using any appropriate data set in R.

8.Demonstrate the Nominal distribution using any appropriate data set in R.

9. Demonstrate the Bi-Nominal distribution using any appropriate data set in R.

10. Develop the Models using Simple Linear Regression for any appropriate data set & Identify the Best Model using Measures in R.

11. Develop the Models using Multiple Linear Regression for any appropriate data set & Identify the Best Model using Measures in R.

12.Build a classical decision tree with a binary outcome variable and a set of predictor variables using Breast cancer data set.

13. Develop the cluster solution using the method k-means clustering analysis for wine data set.

II/II M.Tech – II Semester

CS 521	**Machine Learning**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To develop skills of using recent machine learning software for solving practical problems.
3. To gain experience of doing independent study of problems and research.

Course Outcomes:

1. Describe and design the concepts of learning.
2. Describe and apply learning algorithms.
3. Explain the first principles of neural networks.
4. Describe basics of sampling theory and hypothesis testing.
5. Explain Bayesian learning theorem.

Course Content:

UNIT I 12 Periods

Introduction to machine learning: Concept Learning and the General to Specific Ordering: Concept learning task, concept learning as search, Find-S: finding a Maximally Specific hypothesis, Version Spaces and the Candidate-Elimination algorithm, remarks on Version Spaces and Candidate-Elimination and inductive bias.

UNIT II 12 Periods

Decision Tree Learning: Decision Tree representation, appropriate problems for Decision Tree learning, hypothesis space search in Decision Tree learning, inductive bias in Decision Tree learning and issues in Decision Tree learning.

Artificial Neural Networks: Neural Network representations, appropriate problems for Neural Network learning, Perceptrons, Multilayer Networks and the Backpropagation algorithm and remarks on the Backpropagation algorithm.

UNIT III 12 Periods

Evaluating Hypotheses: Estimating hypothesis accuracy, basics of sampling theory, general approach for deriving confidence intervals, difference in error of two hypotheses and comparing learning algorithms.

Bayesian Learning: Bayes theorem and concept learning, maximum likelihood and least squared error hypotheses, maximum likelihood hypotheses for predicting probabilities, minimum description length principle, Bayes optimal classier, Gibbs algorithm, Naive Bayes classier, Bayesian belief networks and EM algorithm.

UNIT IV 12 Periods

Computational learning theory: Introduction, probably learning an approximately correct hypothesis, sample complexity for finite hypothesis spaces, and sample complexity for infinite hypothesis spaces and mistake bound model of learning.

UNIT V 12 Periods

Instance Based Learning: Introduction, k-Nearest Neighbor learning, locally weighted regression, radial basis functions, Case Based Reasoning and remarks on Lazy and Eager learning.

Genetic Algorithms: Introduction, hypothesis space search, Genetic programming and models of evolution and learning.

Learning Resources:

Text Book:

1. Tom M. Mitchell, Machine Learning, Mc.Graw Hill Publishing.

Reference Books:

CS 522	Cloud Computing	L	T	P	C
		4	0	0	4

Course Objectives:

1. The student will learn about the cloud environment, building software, systems and components that scale to millions of users in modern Internet.
2. To study cloud concepts capabilities across the various cloud service models including Iaas, Paas, Saas.
3. To analyze cloud based software applications on top of cloud platforms.

Course Outcomes:

1. Understanding the key dimensions of the challenge of Cloud Computing.
2. Assessment of the economics, financial, and technological implications for selecting cloud computing for own organization.
3. Assessing the financial, technological, and organizational capacity of employer's for actively Initiating and installing cloud-based applications.
4. Assessment of own organizations' needs for capacity building and training in cloud Computing-related IT areas.

Course Content:

UNIT I 12 Periods

Introduction to cloud computing: Cloud Computing in a Nutshell, roots of Cloud Computing, Layers and Types of Clouds, Desired Features of Cloud, Cloud Infrastructure Management, Infrastructure as a Service Providers, Platform as a Service Providers, Challenge and Risks.

Migration into a Cloud: Introduction, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud.

Enriching the 'Integration as a Service' Paradigm for the Cloud Era: An Introduction, The Onset of Knowledge Era, The Evolution of SaaS, The challenges of SaaS paradigm, Approaching the SaaS integration enigma , New integration scenarios, The integration methodologies, Saas integration products and platforms, SaaS Integration Services, Business to Business Integration(B2Bi) Services, A Framework of Sensor-Cloud Integration ,SaaS Integration Appliances.

UNIT II 12 Periods

The Enterprise Cloud Computing Paradigm: Introduction, Background, Issues for Enterprise Applications on the Cloud, Transition Challenges, Enterprise Cloud Technology and Market Evolution, Business Drivers toward a Marketplace for Enterprise Cloud Computing, The Cloud Supply Chain.

Virtual Machines Provisioning and Migration Services: Introduction and Inspiration, Background and Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context, Future Research Directions.

UNIT III 12 Periods

On the Management of Virtual Machines for Cloud Infrastructures: The Anatomy of Cloud Infrastructures, Distributed Management of Virtual Infrastructures, Scheduling Techniques for Advance Reservation of Capacity, Capacity Management to meet SLA Commitments, Conclusions and Future Work.
Enhancing Cloud Computing Environments Using a Cluster as a Service: Introduction, Related Work, RVWS Design, Cluster as a Service: The Logical Design, Proof of Concept, Future Research Directions.
Secure Distributed Data Storage in Cloud Computing: Introduction, Cloud Storage: from LANs TO WANs, Technologies for Data Security in Cloud Computing Open Questions and Challenges.

UNIT IV 12 periods

Aneka—Integration of Private and Public Clouds , Introduction, Technologies and Tools for Cloud Computing , Hybrid Cloud Implementation, Visionary thoughts for Practitioners.
Workflow Engine for Clouds: Introduction, Workflow Management Systems and Clouds, Architecture of Workflow Management Systems , Utilizing Clouds for Workflow Execution , Case Study: Evolutionary Multi objective Optimizations, Visionary thoughts for Practitioners, Future Research Directions.

UNIT V 12 Periods
SLA Management in Cloud Computing: Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA Management in Cloud, Automated Policy-based Management.

Performance Prediction for HPC on Clouds: Introduction, Background, Grid and Cloud, HPC in the Cloud: Performance-related Issues.
Data Security in the Cloud: An Introduction to the Idea of Data Security , The Current State of Data Security in the Cloud, Homo Sapiens and Digital Information, Cloud Computing and Data Security Risk, Cloud Computing and Identity, The Cloud, Digital Identity, and Data Security, Content Level Security—Pros and Cons.

Learning Resources:

Text Books:

1. Rajkumar Buyya, James Broberg, AndrZej Goscinski, Cloud Computing Principles and Paradigms, Wiley Publications**.** (Chapters covered 1- 9 ,12,16,17,23)

References:

1. Michael Miller, Cloud Computing Web-Based Application That Change the Way You Work and Collaborate Online. Pearson Publications.
2. Thomas Erl, Zaigham Mahmood & Ricardo Puttini, Cloud Computing Concepts, Technology & Architecture., Pearson Publications.
3. Kai Hwang, Geoffrey C.Fox. Jack J. Dongarra, Distributed and Cloud Computing from Parallel Processing to the Internet of Things,, ELSEVIER Publications.

CS 523	Internet of Things	L	T	P	C
		4	0	0	4

Course Objectives:

1. To introduce the terminology, technology and applications of IoT.
2. To introduce the concept of M2M with necessary protocols.
3. To introduce the Raspberry PI platform.
4. To introduce the implementation of web based services on IoT devices.

Course Outcomes

1. Get familiarized to the terminology, technology and applications of IoT.
2. Understand the concept and protocols of M2M.
3. Develop IoT solutions using Raspberry PI platform.
4. Implement web based services on IoT devices.

Course Content:

UNIT I 12 Periods

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

UNIT II 12 Periods

IoT and M2M: Software defined networks, network function virtualization, difference between SDN and NFV for IoT.

Basics of IoT System Management with NETCONF, YANG- NETCONF, YANG, SNMP NETOPEER.

UNIT II 10 Periods

Getting Up and Running: A Tour of the Boards, The Proper Peripherals, The Case, Choose Your Distribution, Flash the SD Card, Booting Up, Configuring Your Pi, Getting Online, Shutting Down.

Getting Around Linux on the Raspberry Pi: Using the Command Line, More Linux Commands.

UNIT IV 14 Periods

Python on the Pi : Hello, Python, A Bit More Python, Objects and Modules, Even More Modules, Launching Other Programs from Python, Troubleshooting Errors, Basic Input and Output - Using Inputs and Outputs.

Programming Inputs and Outputs with Python: Installing and Testing GPIO in Python, Blinking an LED, Reading a Button.

UNIT V 12 Periods

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs.

Web Server: Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API.

Learning Resources:

Text Books:

1. ArshdeepBahga and Vijay Madisetti, Internet of Things A Hands-on Approach, Universities Press, 2015, ISBN: 9788173719547.
2. Matt Richardson & Shawn Wallace, Getting Started with Raspberry Pi, O'Reilly (SPD), 2014, ISBN: 978935023975.

Reference Books:

1. Dieter Uckelmann et.al, Architecting the Internet of Things, Springer, 2011.
2. Luigi Atzor et.al, The Internet of Things, A survey, Journal on Networks, Elsevier Publications, October, 2010.
3. CharalamposDoukas, Building Internet of Things With the Arduino, Create Space Independent Publishing Platform, 2012.

Web References:

1. http://postscapes.com/.
2. http://www.theinternetofthings.eu/what-is-the-internet-of-things.
3. https://www.youtube.com/channel/UCfY8sl5Q6VKndz0nLaGygPw.
4. https://www.codeproject.com/Learn/IoT/.

CS 561 **Machine Learning Lab** **L T P C**

0 0 3 2

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To develop skills of using recent machine learning software for solving practical problems.
3. To gain experience of doing independent study and research.

Course Outcomes:

1. Implement Adaline and use for playing 2 player games.
2. Build neural network to solve classification problems.
3. Build optimal classifiers using genetic algorithms.
4. Develop Perception for linearly separable problems.

List of Experiments:

1. Design and implement machine learning algorithm using least means square learning rule to play checkers game. The training experience should be generated by the system playing game with itself.

2. Implement a machine learning program to play 5× 5 Tic tac toe game.

3. Design and implement a feed forward neural network with 5 inputs, 3 hidden and 1 output units. It should use back-propagation algorithm with batch update to train the neural network to generate odd parity bit on its output given any 5 bit binary pattern on its inputs.

4. Construct decision tree for the training examples given in following table for Play tennis domain using ID3 algorithm. Target attribute is Play tennis.

Outlook	Temp	Humidity	Windy	Play tennis
Sunny	75	70	true	play
Sunny	80	90	true	no play
Sunny	85	85	false	no play
Sunny	72	95	false	no play
Sunny	69	70	false	play
Overcast	72	90	true	play
Overcast	83	78	false	play
Overcast	64	65	true	play
rainy	81	75	false	play
rainy	71	80	true	no play
rainy	65	70	true	no play
rainy	75	80	false	play
rainy	68	80	false	play

5. Implement perception learning algorithm and attempt to solve two input i) AND gate ii) Or Gate iii) EXOR gate problems.

6. Implement the Gabil's method of using genetic algorithm to obtain the classifier for the 2 input EXOR gate.

7. Design and implement genetic algorithm to learn conjunctive classification rules for the *Play-golf* problem described in following table.

Outlook	Temperature	Humidity	Wind	Play Golf
Sunny	Hot	High	Weak	No
Sunny	Hot	High	Strong	No
Overcast	Hot	High	Weak	Yes
Rain	Mild	High	Weak	Yes
Rain	Cool	Normal	Weak	Yes
Rain	Cool	Normal	Strong	No
Overcast	Cool	Normal	Strong	Yes
Sunny	Mild	High	Weak	No
Sunny	Cool	Normal	Weak	Yes
Rain	Mild	Normal	Weak	Yes

8. Implement the Candidate-Elimination Algorithm on following Data

Sky	Air Temp	Humidity	Wind	Water	Forecast	Enjoy sport
Sunny	warm	Normal	light	warm	same	yes
Sunny	Warm	High	strong	cool	change	yes
Rainy	Cold	High	Strong	Warm	Change	No
Sunny	Warm	High	Strong	Warm	Same	Yes
Sunny	Warm	Normal	Strong	Warm	Same	yes

Text Book:

1. Tom Mitchell, *Machine Learning*, McGraw Hill International Edition.

CS 562	Internet of Things Lab	L	T	P	C
		0	0	3	2

Course Objectives:

1. Learn how to execute Linux commands and Python programs on Raspberry Pi.
2. Learn how to interface and control different sensors and actuators on Raspberry Pi.
3. Develop simple IoT Applications.

Course Outcomes:

1. Able to execute different Linux commands on Raspberry Pi.
2. Write and execute Python programs on Raspberry Pi.
3. Interface LEDs and program them on Raspberry Pi.
4. Use various sensors like temperature, humidity, smoke, light, etc. and be able to control web camera, network, and relays connected to the Raspberry Pi.

List of Experiments:

1. Execute various Linux commands in command terminal window on Raspberry Pi:
   ls, cd, touch, mv, rm, man, mkdir, rmdir, tar, gzip, cat, more, less, ps, sudo,cron, chown, chgrp, ping etc.

2. Run some Python programs on Raspberry Pi:
   a. Read your name and print Hello message with name.
   b. Read two numbers and print their sum, difference, product and division.
   c. Word and character count of a given string.
   d. Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input.
   e. Print a name 'n' times, where name and n are read from standard input, using for and while loops.
   f. Handle Divided by Zero Exception.
   g. Print current time for 10 times with an interval of 10 seconds.
   h. Read a file line by line and print the word count of each line.

3. Light an LED through Python program.

4. Get input from two switches and switch on corresponding LEDs.

5. Flash an LED at a given on time and off time cycle, where the two times are taken from a file.

6. Flash an LED based on cron output (acts as an alarm).

7. Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.

8. Access an image through a Raspberry Pi web cam.

9. Control a light source using web page.

10. Implement an intruder system that sends an alert to the given email.

11. Get the status of a bulb at a remote place (on the LAN) through web.

12. Get an alarm from a remote area (through LAN) if smoke is detected.

Elective Courses for I Semester

CS 571	**Artificial Intelligence & Agent Technologies**	**L**	**T**	**P**	**C**
		4	**0**	**0**	**4**

Course objectives:

1. To apply a given AI technique to a given concrete problem.
2. To Implement non-trivial AI techniques in a relatively large systems.
3. To understand uncertainty and Problem solving techniques.
4. To understand various symbolic knowledge representation to specify domains and reasoning tasks of a situated software agent.
5. To understand different logical systems for inference over formal domain representations, and trace how a particular inference algorithm works on a given problem specification.
6. To understand various learning techniques and agent technology.

Course Outcomes:

1. Design intelligent agents for problem solving, reasoning, planning, and decision making, and learning. Specific design and performance constraints, and when needed, design variants of existing algorithms.
2. Apply AI technique on current applications.
3. Problem solving, knowledge representation, reasoning, and learning.
4. Demonstrating how to write a programs for Artificial Intelligence
5. Analyzing and Solving Artificial Intelligence programs by using Backtracking methods

Course Content:

UNIT I 12 Periods

Artificial Intelligence: The AI Problems, The Underlying assumption, What is an AI Technique?, The Level of the model, Criteria for success, some general references, One final word and beyond.

Problems, problem spaces, and search: Defining, the problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search programs, Additional Problems.

Intelligent Agents: Agents and Environments, The nature of environments, The structure of agents.

UNIT II 12 Periods

Heuristic search techniques: Generate-and-test, Hill climbing, best-first search, Problem reduction, Constraint satisfaction, Mean-ends analysis.

Knowledge representation issues: Representations and mappings, Approaches to knowledge representation, Issues in knowledge representation, The frame problem.

Using predicate logic: Representing simple facts in logic, representing instance and ISA relationships, Computable functions and predicates, Resolution, Natural Deduction.

Logical Agents: Knowledge –based agents, the Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic.

UNIT III 12 Periods

Symbolic Reasoning Under Uncertainty: Introduction to non-monotonic reasoning, Logic for non-monotonic reasoning, Implementation Issues, Augmenting a problem-solver, Implementation: Depth-first search, Implementation: Breadth-first search.

Statistical Reasoning: Probability and bayes Theorem, Certainty factors and rule-based systems, Bayesian Networks, Dempster-Shafer Theory, Fuzzy logic.

Quantifying Uncertainty: Acting under uncertainty, Basic probability notation, Inference using full joint distributions, Independence, Bayes' rule and its use, The Wumpus world revisited.

UNIT IV 12 Periods

Weak Slot-and-filter structures: Semantic Nets, Frames.

Strong slot-and –filler structures: Conceptual dependency, scripts, CYC.

Adversarial Search: Games, Optimal Decision in Games, Alpha-Beta Pruning, Imperfect Real-Time Decisions, Stochastic Games, Partially Observable Games, State-Of-The-Art Game Programs, Alternative Approaches.

UNIT V 12 Periods

Learning From examples: Forms of learning, Supervised learning, Learning decision trees, Evaluating and choosing the best hypothesis, The theory of learning ,PAC, Regression and Classification with linear models, Nonparametric models, Support vector machines, Ensemble learning.

Learning Probabilistic Models: Statistical learning, learning with complete data, learning with hidden variables: The EM algorithm.

Learning Resources:

Text Books:

1. Elaine Rich, Kevin Knight, Shivashanka B Nair, Artificial Intelligence, Tata MCGraw Hill 3rd edition. 2013.Chapter 1,2,3,4,7,8,9 & 10.
2. Stuart Russel, Peter Norvig, Artificial Intelligence, A Modern Approach, Pearson 3rd edition 2013.Chapter 2,5,6,13,18 & 20.

Reference Books:

1. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, ISBN-13: 9780934613101.
2. George F.Luger, Artificial Intelligence Structures and Strategies for Complex Problem Solving, Pearson Education .PHI, 2002.

CS 572	Natural Language Processing	L	T	P	C
		4	0	0	4

Course Objectives:

1. To understand the underlying concepts and techniques required for natural language processing.
2. To create computational models for enabling effective and natural language processing.

Course Outcomes:

1. Ability to determine the structural components of sentences for a given Grammar.
2. Ability to produce logical form that represents context-independent meaning of a sentence.
3. Ability to link logical forms with syntactic structures for semantic interpretation of the sentence.
4. Ability to understand the ambiguity in natural language constructs and identify possible interpretations of a sentence.
5. Ability to map the logical form to the Knowledge representation to generate contextual representation.
6. Ability to understand the applications of natural language processing.

Course Content:

UNIT I 12 Periods

Introduction to Natural Language Understanding: Applications of Natural Language Understanding, Evaluating language Understanding Systems, The Different levels of Language Analysis.

Syntactic Processing: Grammars and Parsing, Grammars and Sentence Structure, Top- down parser, Bottom up chart parser, Transition network grammars, Top-down chart parsing, Finite state models and Morphological processing.

UNIT II 12 Periods

Features and Augmented Grammars: Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, A Simple Grammar Using Features, Parsing with Features, Augmented Transition Networks.

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling Questions in Context-Free Grammars.

Toward Efficient Parsing: Human preferences in parsing, Encoding Uncertainty-Shift-Reduce Parsers, A Deterministic Parser.

UNIT III 12 Periods

Ambiguity Resolution: Statistical Methods: Part of Speech tagging, Obtaining lexical probabilities, Probabilistic Context-Free Grammars, Best-First Parsing.

Semantic Interpretation:

Semantics and logical Form: Semantics and Logical Form ,Word Senses and Ambiguity, The Basic Logical Form Language, Encoding Ambiguity in the Logical Form, Verbs and States in Logical Form.

Linking Syntax and Semantics: Semantic Interpretation and Compositionality, A Simple grammar and Lexicon with Semantic Interpretation, Prepositional Phrases and Verb Phrases.

UNIT IV 12 Periods

Ambiguity Resolution: Selectional Restrictions, Semantic Filtering Using Selectional Restrictions, Statistical Word Sense Disambiguation.

Context and World Knowledge:

Knowledge Representation and Reasoning: Knowledge representation, A Representation based on FOPC, Frames: representing Stereotypical Information, Handling Natural Language Quantification.

Local discourse context and Reference: Defining Local Discourse Context and Discourse Entities, A Simple Model of Anaphora Based on History Lists, pronouns and Centering, Define Descriptions.

UNIT V 12 Periods

Using World Knowledge: Using world knowledge: Establishing Coherence, Matching Against Expectations, Reference and Matching Expectations, Using Knowledge About Action and Casualty, Scripts: Understanding Stereotypical Situations

Discourse Structure: The Need for Discourse Structure, Segmentation and Cue Phrases, Discourse Structure and Reference, Relating Discourse Structure and Inference, Discourse Structure, Tense and Aspect, Managing the Attentional stack

Learning Resources:

Text Book:

1. James Allen, Natural Language Understanding, Second Edition, Pearson Education.

Reference Books:

1. Daniel Jurafsky, James H.Martin, Speech and Language Processing.
2. Christopher Manning, HinrichSchutze, Foundations of Statistical Natural Language Processing, MIT Press.
3. Elaine Rich and Kevin Knight, Artificial Intelligence, Second Edition, Tata McGraw Hill.

CS 573	Advanced Databases	L	T	P	C
		4	0	0	4

Course Objectives:

1. Understand Distributed Database Process, Architecture, and Design Principles.
2. Distributed Query Optimization Techniques and Algorithms.
3. Apply Distributed Query Optimization Techniques and Algorithms.
4. Analyze and apply Concurrency Control and Reliability Techniques.
5. Characterize Parallel Databases and Distributed Object Databases

Course Outcomes:

1. Demonstrate knowledge of query evaluation by describing and implementing various evaluation algorithms used by database systems.
2. Demonstrate knowledge of cost-based query optimization by describing search space exploration and different optimization paradigms.
3. Demonstrate knowledge of transaction processing and concurrency control using lock tables and/or optimistic methods of concurrency control.
   Demonstrate knowledge of crash recovery by describing the methodologies and algorithms employed by a database system in the event of a crash.
4. Demonstrate knowledge of storage methods by enumerating various indexing techniques over single- and multi-dimensional data

Course Content:

UNIT I 12 Periods

Algorithms for Query Processing and Optimization: Translating SQL queries into relational algebra-algorithms for external sorting-algorithms for select and join operations-algorithms for project and set operations implementing aggregate operations and outer joins-combining operations using pipelining-using heuristics in query optimization.

Database systems architecture and the system Catalog: System architectures for DBMSs, Catalogs for Relational DBMSs, System catalogs for Relational DBMSs, System catalog information in oracle.

UNIT II 12 Periods

Practical database design and tuning: Physical Database Design in Relational Databases-an overview of Databases-an overview of Database Tuning in Relational systems

Distributed DBMS Concepts and Design: Introduction-function and architecture of Distributed DBMS-Distributed Relational Database Design-transparencies in a Distributed DBMS-Date's Twelve Rules for Distributed DBMS.

UNIT III 12 Periods

Distributed DBMS-Advanced Concepts: Distributed Transaction Management-Distributed Concurrency Control –Distributed Deadlock Management-Distributed Database recovery-the X/Open Distributed Transaction processing model-Replication Servers

Introduction to Object DBMSs: Advanced Database Applications Weaknesses of RDBMSs-Object oriented Concepts-Storing objects in a Relational Database-Next generation Database systems

Object-Oriented DBMSs-Concepts and Design: Introduction to Object-Oriented Data Models and DBMSs-OODBMS perspectives-Persistence Issues in OODBMSs-the object oriented database systems Manifesto Advantages and Disadvantages of OODBMSs-Object oriented database design

UNIT IV 12 Periods

Object-Oriented DBMS-Standards and Systems: Object management group-Object Database standard ODMG3.0, 1999-Object store.

Object relational DBMSs: Introduction to Object-relational Databases systems-the third generation Database manifesto-postgres-an early ORDBMS-SQL3.

Emerging database technologies and applications: Mobile databases-multimedia databases-geographic information systems-genome data management.

UNIT V 12 Periods

XML and internet databases: Structured, semi structured, and unstructured data-XML Hierarchical (Tree) Data model-XML documents, DTD and XML Schema-XML Documents and Databases-XML querying.

Enhanced data models for advanced applications: Active database concepts and triggers-temporal database concepts-multimedia databases-introduction to deductive databases .

Learning Resources:

Text Books:

1.Thomas M Connolly And Carolyn E.Begg, Database Systems A Practical Approach To Design, Implementation And Management.
2. Elmasri Navrate, Fundamentals of Database Systems, 5/E, Pearson Education.

Reference Book:

1. Ozsu, Principles of Distributed Database Systems, 2/e, PHI.

CS 574	Distributed Computing	L	T	P	C
		4	0	0	4

Course Objectives:

1. To expose and understand the differences among: concurrent, networked, distributed systems.
2. To learn the concepts and principles related to Design and build newer distributed computing.
3. To know about algorithms and applications programs on distributed systems.
4. To study about performance and flexibility issues related to systems design and mechanisms

Course Outcomes:

1. Understand models of distributed computing.
2. Analyze issues of distributed systems.
3. Analyze distributed algorithms for deadlocks and mutual exclusion.
4. Analyze rollback and recovery in distributed system.

Course Content:

UNIT I 12 Periods

Introduction: Definitions, Motivation, Relation to parallel multiprocessor/multicomputer systems, Message passing systems versus shared memory systems, Primitives for distributed communication, synchronous versus asynchronous execution, design issues and challenges.

A Model of Distributed Computations: A Model of distributed executions, Models of communication networks, Global state of a distributed system, Cuts of a distributed computation, Past and future cones of an event, Models of process communication.

Logical Time: A framework for a system of Logical clocks, scalar time, vector time, efficient implementation of vector clocks, Matrix time, Physical clock synchronization: NTP.

UNIT II 12 Periods

Global State and Snapshot Recording Algorithms: System model, Snapshot algorithms for FIFO channels, Variations of Chandy-Lamport algorithm, Snapshot algorithms for non-FIFO channels, Snapshots in a causal delivery system, Monitoring global state, Necessary and sufficient conditions for consistent global snapshots.

Message Ordering and Group Communication: Message ordering paradigms, Asynchronous execution with synchronous communication, Synchronous program order on an asynchronous system, Group communication, Causal order (CO), Total order, A nomenclature for multicast, Propagation trees for multicast, Classification of application-level multicast algorithms, Semantics of fault-tolerant group communication, Distributed multicast algorithms at the network layer.

UNIT III 12 Periods

Termination Detection: System model of a distributed computation, Termination detection using distributed snapshots, Termination detection by weight throwing, A spanning- tree-based termination detection algorithm, Message-optimal termination detection, Termination detection in a very general distributed computing model, Termination detection in the atomic computation model.

Distributed Mutual Exclusion Algorithms: Preliminaries, Lamport'salgorithm,Ricart–Agrawala algorithm, Singhal's dynamic information-structure algorithm,Lodha and Kshemkalyani's fair mutual exclusion algorithm, Quorum-based mutual exclusion algorithms,Maekawa's algorithm.

UNIT IV 12 Periods

Deadlock Detection in Distributed Systems: System model, Preliminaries, Models of deadlocks, Knapp's classification of distributed deadlock detection algorithms, Mitchell and Merritt's algorithm for the single resource model, Chandy–Misra–Haas algorithm for the AND model, Chandy–Misra– Haas algorithm for the OR model.

Distributed Shared Memory: Abstraction and advantages, Memory consistency models, Shared memory mutual exclusion.

UNIT V 12 Periods

Check Pointing and Rollback Recovery: Issues in failure recovery, Checkpoint based recovery, Log-based rollback recovery, Koo–Toueg coordinated check pointing algorithm, Juang–Venkatesan algorithm for asynchronous check pointing and recovery, Manivannan–Singhal quasi-synchronous check pointing algorithm.

Consensus and agreement algorithms: Problem definition, Overview of Results ,Agreement in (message-passing) synchronous systems with failures.

Learning Resources:

Text Book:

1. Ajay D. Kshema kalyani, Mukesh Singhal, Distributed Computing, Cambridge University Press, 2008.

Reference Book:

1. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems Principles and Paradigms, Prentice Hall India, 2004.

CS 575	Wireless Networks & Mobile Computing	L	T	P	C
		4	0	0	4

Course Objectives:

1. To study about Simplified Reference model, MAC Control and applications in Mobile Communications.
2. To Know about the predominant communication systems in wireless domain.
3. To understand wireless LAN technologies.
4. To learn about the protocols used in Wireless Networks.

Course Outcomes:

1. Understand the basics of Wireless Transmission Technology.
2. Understand the media access Technologies.
3. Know about Wireless communication systems GSM, UMTS and IMT-2000.
4. Know about satellite and digital broadcast systems and acquire knowledge of wireless LAN technologies.
5. Be aware of mobile IP, the extension of IP Protocol for mobile users.
6. Know the Architecture of WAP, The wireless application protocol used for wireless and mobile access using different transport systems.

Course Content:

UNIT I 12 Periods

Introduction Applications: A short History of wireless communication, A market for mobile communications, A simplified reference model.

Wireless transmission: Frequencies for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum.

Medium access control Motivation for a specialized MAC, SDMA, FDMA, TDMA, CDMA, comparison Of S/T/F/CDMA.

UNIT II 12 Periods

GSM and Other 2G Architectures: GSM, Radio Interface of GSM, Protocols of GSM, Localization, Call Handling, Handover, Security, New data services, General packet radio service, High-speed circuit switched data.

IP and Mobile IP network layers: IP and mobile IP network layers, Packet delivery and handover management, Location management, Registration, Tunnelling and encapsulation, Route optimization, Dynamic host configuration protocol, VoIP, IPsec.

UNIT III 12 Periods

Mobile Transport layer Conventional TCP/IP Transport Layer Protocols: Indirect TCP, Snooping TCP, Mobile TCP, other methods of mobile TCP layer transmission, TCP over 2.5G/3G mobile networks.

Database and Mobile Computing: Data Organization, Database Transactional Models-ACID Rules, Query Processing, Data Recovery process ,Database hoarding Techniques, Data caching, Client-Server Computing for Mobile Computing and Adaptation, Adaptation Software for Mobile Computing, Power-aware Mobile Computing, Context-aware Mobile Computing.

UNIT IV 12 Periods

Data Dissemination and Systems for Broadcasting: Communication Asymmetry, Classification of data-delivery mechanisms, Data Dissemination broadcast models, Selective tuning and Indexing techniques, Digital Audio broadcasting(DAB),Digital video broadcasting.

Data Synchronization in Mobile Computing Systems: Synchronization, Synchronization software for Mobile devices, Synchronization protocols, Sync-Synchronization language for mobile computing, Sync4J (Funambol), Synchronized Multimedia Markup language (SMIL).

UNIT V 12 Periods

Mobile Devices: Application Servers and Management: Mobile Agent, Application framework, Application server, Gateways, Service discovery, Device management, Mobile file systems, Security.

Mobile Wireless Short-range Networks and Mobile Internet: Wireless LAN 802.11 Architecture and protocol layers, Wireless application protocol(WAP),Wireless application protocol-WAP 2.0,Bluetooth-enabled devices network, Layers in Bluetooth protocol, Security in Bluetooth protocol, IrDA protocols, ZigBee.

Learning Resources:

Text Books:

1. J.Schiller, Mobile communications, Addison-Wesley, 2003.
2. Raj Kamal, Mobile Computing, Oxford University Press.

Reference Books:

1. Asoke K Talukder, et al, Mobile Computing, Tata McGraw Hill, 2008.
2. William Stallings, Wireless Communication Networks.
3. UWE Hansmann, LotherMerk, Martin S.Nicklous, Thomas Stober, Principles of Mobile Computing, 2nd Edition.
4. Yu-KwongR.Kwok and Vincent K.N.Lau, Wireless internet and Mobile computing, John Wiley & sons, 2007.

CS 576	Agile Software Methodologies	L	T	P	C
		4	0	0	4

Course Objectives:

1. To understand how an iterative, incremental development
2. To learn about software process leads to faster delivery of more useful software.
3. To understand the essence of agile development methods.
4. To understand the principles and practices of extreme programming.

Course Outcomes:

1. To understand the basic concepts of Agile Software Process.
2. To gain knowledge in the area of various Agile Methodologies.
3. To develop Agile Software Process.
4. To know the principles of Agile Testing.

Course Content:

UNIT I 12 Periods

Introduction: Software is new product development – Iterative development – Risk-Driven and Client-Driven iterative planning – Time boxed iterative development – During the iteration, No changes from external stakeholders – Evolutionary and adaptive development - Evolutionary requirements analysis – Early "Top Ten" high-level requirements and skilful analysis – Evolutionary and adaptive planning – Incremental delivery – Evolutionary delivery – The most common mistake – Specific iterative and Evolutionary methods.

UNIT II 12 Periods

Agile And Its Significance: Agile development – Classification of methods – The agile manifesto and principles – Agile project management – Embrace communication and feedback – Simple practices and project tools – Empirical Vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline: The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Research evidence – Early historical project evidence – Standards-Body evidence – Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

UNIT III 12 Periods

AGILE METHODOLOGY Method Overview: Lifecycle – Work products, Roles and Practices values – Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus "Other" history.

UNIT IV 12 Periods

Planning Vision: Release Planning, Risk Management, Iteration Planning, Stories, Estimating Developing-Incremental Requirements, Customer Tests, Test- Driven Development, Refactoring, Incremental Design and Architecture, Spike Solutions, Performance Optimization.

Case Study: Agile – Motivation – Evidence – Scrum – Extreme Programming – Unified Process – Evo – Practice Tips.

UNIT V 12 Periods

Agile Practicing And Testing : Project management – Environment – Requirements – Test – The agile alliances – The manifesto – Supporting the values – Agile testing – Nine principles and six concrete practices for testing on agile teams.

Learning Resources:

Text Books:

1. Craig Larman, Agile and Iterative Development, A Manager's Guide, Pearson Education 2004.
2. Elisabeth Hendrickson, Quality Tree Software Inc, Agile Testing, 2008.
3. James Shore and Shane Warden, The Art of Agile Development, O'REILLY, 2007.

Web References:

1. Agile Software Development – Wikipedia.
2. Alistair, Agile Software Development series, Cockburn – 2001.
3. www.agileintro.wordpress.com/2008.
4. www.serena.com/docs/repository/solutions/intro-to-agile-devel.pdf.
5. www.qualitytree.com.
6. en.eikipedia.org/wiki/agile_software_development.

CS 577	Information Security	L	T	P	C
		4	0	0	4

Course Objectives:

1. To understand key terms and critical concepts of information security.
2. To describe how risk is identified and assessed.
3. To identify the technology that enables the use of firewalls and virtual private networks.
4. To discuss the placement, nature and execution of the dominant methods used in cryptosystems.

Course Outcomes:

1. To enumerate the phases of the system security development life cycle.
2. To recognize the existing conceptual frameworks for evaluating risk controls and formulate a cost benefit analysis.
3. To recognize the importance of access control in computerized information systems and identify widely used intrusion detection and prevention systems.
4. To describe the operating principles of the most popular cryptographic tools.
5. To describe the significance of the project manager's role in the success of an information security project.
6. To understand how to build readiness and review procedures into information security maintenance.

Course Content:

UNIT I 12 Periods

Introduction to Information Security: What is Information Security? CNSS Security Model, Components of information security, Balancing information Security and Access, The Security SDLC.

Need For Security: Business Needs, Threats, Attacks, And Secure Software Development.

UNIT II 12 Periods

Risk Management: Introduction, Overview of risk management, Risk Identification, Risk Assessment, Risk Control Strategies.

Security Technology: Firewalls and VPNs.
Introduction, Access Control, Firewalls, Protecting Remote Connections.

UNIT III 12 Periods

Security Technology: Intrusion Detection and Prevention Systems, Introduction, Intrusion Detection and Prevention systems, Honey pots and Honey nets and Padded cell systems, Scanning and analysis tools, Biometric Access Controls

Cryptography: Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems.

UNIT IV 14 Periods

Implementing Information Security: Introduction, Information Security Project management, Technical aspects of implementation, Information Systems Security Certification and accreditation.

Security and Personnel: Introduction, Positioning and staffing the security functions, Credentials for information Security Professionals.

UNIT V 10 Periods

Information Security Maintenance: Introduction, Security Management Maintenance Protocols, Digital Forensics.

Learning Resources:

Text Book:

1. Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003.

Reference Books:

1. Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, Hacking Exposed, Tata McGraw-Hill,2003.
3. Matt Bishop, Computer Security Art and Science, Pearson/PHI, 2002.

CS 578	Design Thinking and Innovation	L	T	P	C
		4	0	0	4

Course Objectives:

1. To study a problem from multiple perspectives.
2. To learn how to frame the design challenge properly.
3. To know about Ideate, prototype, and iterate solutions.
4. Ability to communicate their ideas clearly in design reviews, reports and presentations.
5. To participate and learn from the overall design process how to create value, prepare for their careers, and participate more fully in society

Course Outcomes:

1. to understand the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices.
2. to examine critical theories of design, systems thinking, and design methodologies.
3. to demonstrate sound thinking, creative inquiry, and diverse modes of reasoning-visual, perceptual, conceptual, inductive, deductive, analytical, logical, critical, organizational, and creative-through discussion and writing.
4. to solve problems and address social concerns with innovative approaches to design and exploratory methodologies.
5. to recognize the role of the individual designer in delivering meaning through design thinking and discuss the central role of beliefs and ethics in visual communication through art and design.

Course Content:

UNITI 12 Periods

Design Thinking as Mindset, Process, and Toolbox.

Measurement of Design Front End: Radical Innovation Approach.

Design Thinking for revolutionizing from your Business Models.

UNIT II 12 Periods

Design Thinking in IS Research of Projects.

Dynagrams: Enhancing Design Thinking Through Dynamic Diagrams.

What if? Strategy Design for Enacting Enterprise Performance.

UNIT III 12 Periods

Periods Effectuation: Control the Future with the Entrepreneurial Method.

Making Is Thinking: The Design Practice of Crafting Strategy,

Context Dependency in Design Research.

UNIT IV 12 Periods

What Is It That Design Thinking and Marketing Management Can Learn from Each Other?

Design Thinking: Process or Culture?

UNITV 12 Periods

Designing from the Future.

Industrial Design Thinking at Siemens Corporate Technology, China: Case Study.

Learning Resources:

Text Book:

1. Walter Brenner and Falk Uebernickel, Design Thinking for Innovation Research and Practice, Springer ,2016.

Reference Books:

1. Emrah Yayici, Design Thinking Methodology, ISBN-13: 978-6058603752.
2. Rachel Cooper, ,Sabine Junginger ,Thomas LockwoodThe Handbook of Design Management, Bloomsbury Academics - 2013.

CS 579	Network Technologies	L	T	P	C
		4	0	0	4

Course Objectives:

1. To learn about integrated and differentiated services architectures.
2. To understand the working of wireless network protocols.
3. To study the evolution made in cellular networks.
4. To get familiarized with next generation networks.

Course Outcomes:

1. Identify the different features of integrated and differentiated services.
2. Demonstrate various protocols of wireless and cellular networks.
3. Discuss the features of 4G and 5G networks.
4. Discuss the features of SDN framework.

Course Content:

UNIT I 12 Periods

Network Architecture And Qos: Overview of TCP/IP Network Architecture – Integrated Services Architecture – Approach – Components – Services – Queuing Discipline – FQ – PS – BRFQ – GPS – WFQ – Random Early Detection – Differentiated Services.

UNIT II 12 Periods

Wireless Networks:IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX - 802.16e.

Network Infrastructure – WLAN – Configuration – Management Operation – Security – IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS – Bluetooth – Protocol Stack – Security – Profiles.

UNIT III 12 Periods

Cellular Networks: GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management – Mobility Management and Session Management – Small Screen Web Browsing over.

UNIT IV 12 Periods

GPRS and EDGE: MMS over GPRS – UMTS – Channel Structure on the Air Interface – UTRAN –Core and Radio Network Mobility Management – UMTS Security

4G NETWORKS LTE: Network Architecture and Interfaces – FDD Air Interface and Radio Networks –Scheduling – Mobility Management and Power Optimization – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced (3GPPP Release 10)

UNIT V 12 Periods

4G Networks and Composite Radio Environment: Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modeling for 4G – Introduction to 5G

Learning Resources:

Reference Books:

1. William Stallings, High Speed Networks and Internets Performance and Quality of Service, Prentice Hall, Second Edition, 2002.
2. Martin Sauter, From GSM to LTE, An Introduction to Mobile Networks and Mobile Broadband, Wiley, 2014.
3. Savo G Glisic, Advanced Wireless Networks – 4G Technologies, John Wiley & Sons, 2007.
4. Jonathan Rodriguez, Fundamentals of 5G Mobile Networks, Wiley, 2015.
5. Martin Sauter, Beyond 3G - Bringing Networks, Terminals and the Web Together: LTE, WiMAX, IMS, 4G Devices and the Mobile Web 2.0, Wiley, 2009.
6. Naveen Chilamkurti, SheraliZeadally, HakimaChaouchi, Next-Generation Wireless Technologies", Springer, 2013.
7. Erik Dahlman, Stefan Parkvall, Johan Skold, 4G: LTE/LTE-Advanced for Mobile Broadband, Academic Press, 2013.

CS 580	Ethical Hacking & Computer Forensics	L	T	P	C
		4	0	0	4

Course Objectives:

1. To identify and analyze the stages an ethical hacker requires to take in order to compromise a target system.
2. To identify tools and techniques to carry out ethical hacking.
3. To understand the fundamentals of computer forensics.
4. To have an overview on different types of computer forensic technologies and data recovery mechanisms.

Course Outcomes:

1. To identify various threats and attacks associated with security.
2. To apply passive and active reconnaissance techniques.
3. To demonstrate systematic procedure of Google and Web hacking.
4. To apply the concepts of computer forensics.
5. To design tools and tactics associated with cyber forensics.

Course Content:

UNIT I 12 Periods

Essential Terminology: Elements Of Security, Threat, Attack, Vulnerability, Exploit, Hacker, Cracker, Script Kiddy, Ethical Hackers, Hacker Classes, Hacking Life Cycle.

Reconnaissance: Passive Reconnaissance, Vulnerability Databases, Vulnerability Research Web Sites, Httrack Web Site Copier, Web Data Extractor, Web Site Watcher, Sam Spade, Physical Location, Domain Name Service And Records, Active Reconnaissance, Trace Data Packets & Discover, Network Range.

UNIT II 12 Periods

Google Hacking: What Is Google Hacking?, Beyond Vulnerability, Google Proxy, Google Cache, Directory Listings, Specific Directory, Specific File Error Pages, Default Pages, Login Pages, Locating Cgi-Bin, Online Devices, Google Hacking Database.

Scanning: Scanning Types, Network Scanning, Angry Ip Scanner, Look@Lan, Port Scanning, Port Scanning Types, Connect Scan , Syn Stealth Scan / Half Open Scan, Fin Scan, Ack Scan, Window Scan, Xmas Tree Scan, Null Scan Idle Scan, Udp Scan, Ftp Scan, Fragmented Packet Port Scan, Network Mapper Security Scanner (Nmap), Superscan 4, Advanced Port Scanner Lanview, Operating System Fingerprinting, Active Stack Fingerprinting Passive Fingerprinting, Active Fingerprinting By Telnet, Httprint Fingerprinting, Vulnerability Scanners, Nessus Vulnerability Scanner Core Impact Professional, Shadow Security Scanner.

UNIT III 12 Periods

Web Server & Web Application Hacking: Web Site Defacement, Iis Vulnerabilities, Default Installation Of Operating System And Applications, Accounts With Weak Or Nonexistent Passwords, Large Number Of Open Ports, Windows License Logging Service Overflow, Iisxploit.Exe, Sever Hacking , Countermeasure, Server mask, Cache right, Linkdeny, Metasploit Cross Site Scripting (Xss), Xss Countermeasure, Error Message Interception, Instant Source, Black widow, Burp Curl.

Denial Of Service (Dos): Ping Of Death, Teardrop Attack, Syn Flooding, Land Attack, Smurf Attack, Fraggle Attack, Snork Attack, Oob Attack, Mail Bomb Attack Distributed Denial Of Service (Ddos) Attack, Targa Hacking Tool Nemesy, Panther 2.

UNIT IV 12 Periods

Computer Forensics Fundamentals: Introduction To Computer Forensics, Use Of Computer Forensics In Law Enforcement, Computer Forensic Assistance To Human Resources/Employment Proceedings, Computer Forensics Services, Benefits Of Professional Forensics Methodology, Steps Taken By Computer Forensics Specialists, Who Can Use Computer Forensic Evidence?

Types Of Computer Forensics Technology: Types Of Military Computer Forensic Technology, Types Of Law Enforcement: Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data And How To Find It, Spyware And Adware, Encryption Methods And Vulnerabilities, Protecting Data From Being Compromised, Internet Tracing Methods, Security And Wireless Technologies, Avoiding Pitfalls With Firewalls.

UNIT V 12 Periods

Types of Computer Forensics Systems: Internet Security Systems, Intrusion Detection Systems, Firewall Security Systems, Storage Area Network Security Systems, Network Disaster Recovery Systems, Public Key Infrastructure Systems, Wireless Network Security Systems, Satellite Encryption Security Systems, Instant Messaging(IM) Security Systems, Net Privacy Systems, Identity Management Security Systems, Identity Theft, Biometric Security Systems.

Data Recovery: Data Recovery Defined, Data Backup and Recovery, The role of Backup in Data Recovery, The Data Recovery Solution, Hiding and Recovering Hidden Data.

Learning Resources:

Text Books:

1. Ali Jahangiri, Live Hacking The Ultimate Guide to Hacking techniques and countermeasures for ethical hackers & IT Security experts, 2009.
2. John R.Vacca, Computer Forensics Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005.

Reference Books:

1. ChristofPaar, San Pelzl, Understanding Cryptography, A Textbook for Students and Practioners,2nd Edition, Springer's, 2010.
2. Computer Forensics: Investigating Network Intrusions and Cyber Crime(EC-Council Process Series Computer Forensics), 2010.

CS 581	Scripting Languages	L	T	P	C
		4	0	0	4

Course Objectives:

1. The PHP Scripting Language syntax and semantic specifications.
2. The regular expressions, arrays, strings and Functions.
3. Database applications with rich, highly responsive user interfaces.
4. the Python Scripting Language syntax and semantic specifications.
5. Development of web applications and Services using Python.

Course Outcomes:

1. Apply basic concepts of PHP programming.
2. Develop and deploy PHP Web applications.
3. Apply advanced concepts of PHP programming.
4. Apply basic concepts of PHP programming.
5. Develop and deploy Python Web applications using Frameworks.

Course Content:

UNIT I 12 Periods

PHP Basics 1: PHP Basics- Features, Embedding PHP Code in you'r Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures.

UNIT II 12 Periods

PHP Basics 2: Function, Creating a Function, Function Libraries, Arrays, strings and Regular Expressions, PHP and Web Forms, Files.

UNIT III 12 Periods

Advanced PHP Programming: PHP Authentication and Methodologies -Hard Coded, File Based, Database Based, IP Based, Login Administration, Uploading Files with PHP, Sending Email using PHP, PHP Encryption Functions, the Mcrypt package, Building Web sites for the World.

UNIT IV 12 Periods

Python Basics: Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python.

UNIT V 12 Periods

Advanced Python Programming: Exception Handling, Integrated Web Applications in Python — Building Small, Efficient Python Web Systems, Web Application Framework.

Learning Resources:

Text Books:

1. Steve Holden and David Beazley, Python Web Programming, New Riders Publications.
2. Jason Gilmore, Beginning PHP and MySQL, 3rd Edition, Apress Publications (Dream tech.).

Reference Books:

1. J.Lee and B.Ware, Open Source Web Development with LAMP using Linux, Apache, MySQL, Pen and PHP, (Addison Wesley) Pearson Education.
2. M.Lutz, SPD., Programming Python,
3. Julie Meloni and Matt Telles, PHP 6 Fast and Easy Web Development, Cengage Learning Publications.
4. Bayross and S.Shah, PHP 5.1,l. The X Team, SPD.
5. Chun ,Core Python Programming, , Pearson Education.
6. M.Dawson, Guide to Programming with Python, Cengage Learning.
7. E.Quigley, PHP and MySQL by Example, Prentice HalI(Pearson).
8. V.Vaswani, PHP Programming solutions, TMH.

CS 582	Mobile Application Development	L	T	P	C
		4	0	0	4

Course Objectives:

1. To demonstrate their understanding of the fundamentals of Android operating systems.
2. To demonstrate their skills of using Android software development tools.
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform.
4. To demonstrate their ability to deploy software to mobile devices.
5. To demonstrate their ability to debug programs running on mobile devices.

Course Outcomes:

1. Develop the basic Android App using Activity Lifecycle methods.
2. Design Android User Interfaces & Event Handling mechanisms.
3. Implement the different Intents and Notifications.
4. Design and Implement back end Android App using SQLite database.
5. Develop advanced Android App using location based services.

Course Content:

UNIT I 12 Periods

Android Programming: What Is Android? Obtaining The Required Tools, Creating Your First Android Application.
Android studio for Application development: Exploring IDE, Using code completion, Debugging your Application, Generating a signed APK.

UNIT II 12 Periods

Activities, Fragments, And Intents: Understanding Activities, Linking Activities Using Intents, Fragments, Displaying Notifications.
Android User Interface: Components of A Screen, Adapting To Display Orientation, Managing Changes To Screen Orientation, Utilizing The Action Bar, Creating The User Interface Programmatically, Listening For UI Notifications.

UNIT III 12 Periods

User Interface With Views: Using Basic Views, Using Picker Views, Using List Views To Display Long Lists, Understanding Specialized Fragments.
Pictures and Menus With Views: Using Image Views To Display Pictures, Using Menus With Views, Using Web View.
Notifications – Creating and Displaying notifications, Displaying Toasts.

UNIT IV 12 Periods

Data Persistence: Saving And Loading User Preferences, Persisting Data To Files, Creating And Using Databases.
Content Providers: Using a Content Provider, Creating Your Own Content Providers.
Messaging : SMS Messaging, Sending E-Mail.

UNITV 12 Periods

Location-Based Services: Displaying Maps, Getting Location Data, Monitoring A Location.

Developing Android Services: Creating Your Own Services, Establishing Communication Between A Service And An Activity, Binding Activities To Services, Understanding Threading.

Learning Resources:

Text Books:

1. Beginning Android Programming with Android Studio, J.F.DiMarzio, Wiley India (Wrox), 2017.

Reference Book:

1. Wei-Meng Lee, Beginning Android 4 Application Development, Wiley India (Wrox), 2012.
2. Reto Meier, Professional Android 4 Application Development, Wiley India, (Wrox) , 2012.
3. James C Sheusi, Android Application Development For Java Programmers, Cengage Learning, 2013.