

COURSE STRUCTURE AND DETAILED SYLLABUS (MR14 Regulations)

for

M.Tech (Computer Science and Engineering)

(Applicable for the batches admitted from 2014-15)



**Department of Computer Science and Engineering
MALLA REDDY ENGINEERING COLLEGE**

(AUTONOMOUS)

(An Autonomous institution, Autonomy granted by UGC and affiliated to JNTUH, Accredited by NAAC with 'A' Grade, Accredited by NBA (2008-11) & Recipient of World Bank Assistance under TEQIP phase – II S.C.1.1 for the period (2011-14))

Maisammaguda, Dhulapally (Post. Via. Kompally), Secunderabad – 500 100.

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ACADEMIC REGULATIONS FOR M. TECH. (REGULAR)

(MR14 Regulations)

(Effective for the students admitted into first year from the academic year 2014-2015)

The M.Tech Degree of Malla Reddy Engineering College, Hyderabad shall be conferred on candidates by the Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad who are admitted to the program and fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to the eligibility, qualifications and specialization prescribed by the university/college from time to time.

Admissions shall be made on the basis of merit rank obtained by the qualifying candidate at an Entrance Test conducted by the university/college or on the basis of any other order of merit approved by the university/college (say **PGE CET / GATE**) subject to reservations prescribed by the university/college from time to time.

Candidates seeking admission to programmes on a part time basis should be working in or around the place where the programme is being run after passing qualifying examination.

2.0 AWARD OF M. TECH. DEGREE

2.1 A student shall be declared eligible for the award of the M. Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years. However, he is permitted to write the examinations for two more years after four academic years of course work.

2.2 A student, who fails to fulfill all the academic requirements for the award of the degree within four Academic years from the year of his admission, shall forfeit his seat in M. Tech. course.

2.3 The student shall register for all 88 credits and secure all the 88 credits.

2.4 The minimum instruction days in each semester are 90.

3.0 A. COURSES OF STUDY

A candidate after securing admission must pursue the prescribed course of study for the following duration.

M.Tech - Four Semesters

Each Semester shall be of 22 Weeks of duration including examinations.

A candidate admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.

The following specializations are offered at present for the M. Tech. course of study.

1. Advanced manufacturing systems
2. Computer Science
3. Computer Science and Engineering
4. Control Systems
5. Digital Systems and Computer Electronics
6. Embedded Systems

7. Geotechnical Engineering
8. Power Electronics and Electric drives
9. Structural Engineering
10. Transportation Engineering
11. Thermal Engineering
12. VLSI System Design

The following specializations are proposed for the academic year 2014-15 for the M. Tech. course of study.

1. Electrical Power Systems
2. Machine Designs

and any other course as approved by the University/College from time to time.

Each subject is assigned certain number of credits depending upon the number of contact hours as follows.

<i>Theory subjects</i>	<i>4 Periods / Week</i>	<i>3 Credits</i>
<i>Practical/ Drawing</i>	<i>4 Periods / Week</i>	<i>2 Credits</i>
<i>Seminar</i>	<i>–</i>	<i>2 Credits</i>
<i>Comprehensive viva-voce/Independent study</i>		<i>2 Credits</i>
<i>Project Work</i>		<i>40 Credits</i>

(Each period will be of 50 minutes duration)

3.0 B.Tech Departments offering M. Tech. Programmes with specializations are noted below:

Civil Engineering Department.	<ol style="list-style-type: none"> 1. Structural Engineering 2. Transportation Engineering 3. Geotechnical Engineering
Computer Science & Engineering Department	<ol style="list-style-type: none"> 1. Computer Science 2. Computer Science and Engineering
Electrical & Electronics Department	<ol style="list-style-type: none"> 1. Control Systems 2. Power Electronics and Electric Drives 3. Electrical Power Systems
Electronics & Communication Department	<ol style="list-style-type: none"> 1. Digital Systems and Computer Electronics 2. VLSI System Design 3. Embedded Systems
Mechanical Engineering	<ol style="list-style-type: none"> 1. Thermal Engineering 2. Advanced manufacturing systems 3. Machine Designs

4.0 ATTENDANCE

The programs are offered on a unit basis with each subject being considered a unit.

4.1 A candidate shall be deemed to have eligibility to write end semester examinations in a subject if he has put in at least 65% of attendance in that subject.

4.2 ***Shortage of attendance up to 10% in any subject (i.e. 65% and above and below 75%) may be condoned by the College Academic Committee on genuine and valid reasons on representation by the candidate with supporting evidence.***

4.3 A candidate shall get minimum required attendance at least in three (3) theory subjects in the present semester to get promoted to the next semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

4.4 ***Shortage of attendance below 65% shall in no case be condoned.***

4.5 ***A stipulated fee shall be payable towards condonation of shortage of attendance.***

4.6 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

4.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirements of the previous semester including the days of attendance in sports, games, NCC and NSS activities.

5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

5.1. For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination, 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted one in the middle of the Semester and the other immediately after the completion of instruction each for a total of 30 marks. Each midterm examination shall be conducted for a duration of 120 minutes with 4 questions to be answered out of 6 questions. In addition, there shall be two assignments evaluated for 10 marks each and average of the two taken as the final assignment mark. The average of the two mid examinations and the assignment marks obtained shall be the final marks for internal evaluation.

5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations, 40 marks shall be awarded as internal Marks. ***Out of 40 internal marks 25 marks to be awarded by conducting an internal laboratory test and 15 marks based on the day-to-day performance The End Examination shall be conducted by the teacher concerned and another faculty member of the same Department, as suggested by the Head of Department.***

5.3. There shall be two seminar presentations during I year I semester and II Semesters. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the Department in a report form and shall make an oral presentation before the Departmental Committee. The Departmental Committee consists of Head of the Department, supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful. *There shall be no external examination for Seminar.*

5.4 Every candidate shall be required to execute his P.G. Project and submit his Dissertation, after taking up a topic approved by the Project Review Committee (PRC). The PRC shall be constituted by the Head of the Department, and shall consist of the Head of the Department, the Project supervisor, and a Senior faculty member of the Department. The PG project shall start immediately after

completion of the I Year II Semester, and shall be of one year duration. The student has to decide his topic for his M.Tech Project Work within the first 6 weeks of the summer vacation at the end of the II semester and should submit his PG Project Work Proposal to the PRC, on whose approval he can register for the PG project. The PRC will monitor the progress of the project work through Two-Seminar presentations - one during II Year I Semester, and one before the submission of the PG Project/ Dissertation. The student shall submit a project Report to the PRC at the end of that semester and the PRC will evaluate it as SATISFACTORY or UNSATISFACTORY. In the case of Unsatisfactory declaration, the student shall resubmit the Project report after carrying out the necessary modifications / additions in the Project work, within the specified time as suggested by the PRC. The student can submit the Dissertation, only after completion of 40 weeks from the Date of Registration, after obtaining the approval from PRC. Extension of time, within the total permissible limit for the completion of the Degree, may be considered by the PRC, on sufficient valid/ genuine grounds.

5.5 There shall be a Seminar presentation in the II year I Semester, for the award of 50 marks. The seminar shall be on the topic chosen for PG Project/ Dissertation Work and the assessment will be done by the same PRC as constituted above. There shall be no external marks for the Seminar.

There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members in that area of specialization. The Comprehensive Viva-Voce is aimed to assess the students' understanding in various subjects he/she studies during the M.Tech course of study. The Comprehensive Viva-Voce is valued for 100 marks by the Committee. There are no internal marks for the Comprehensive viva-Voce

5.6 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

5.7 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.6) he has to reappear for the End Examination in that subject. A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and he has failed in the end examination. In such case candidate must re-register for the subject(s) and secure required minimum attendance. Attendance in the re-registered subject(s) has to be calculated separately to become eligible to write the end examination in the re-registered subject(s). The attendance of re-registered subject(s) shall be calculated separately to decide upon the eligibility for writing the end examination in those subject(s). In the event of taking another chance, the internal marks and end examination marks obtained in the previous attempt are nullified.

5.8 In case the candidate secures less than the required attendance in any subject(s), he shall not be permitted to appear for the End Examination in that subject(s). He shall re-register the subject when next offered.

5.9 Laboratory examination for M.Tech courses must be conducted with two Examiners, one of them being Laboratory Class Teacher and second examiner shall be other Laboratory Teacher or any other member from inside/outside of the college.

6.0 EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation after taking up a topic approved by the Project Review Committee.

6.1 A Project Review Committee (PRC) shall be constituted with Principal as chair person Heads of all the Departments which are offering the M.Tech programs and two other senior faculty members.

6.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).

6.3 After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the Departmental Academic Committee for its approval. Only after obtaining the approval of the Departmental Academic Committee can the student initiate the Project work. ***Departmental Committee Consists of Head of the Department as Chairman, along with two Senior Professors and few subject experts too.***

6.4 If a candidate wishes to change his supervisor or topic of the project he can do so with approval of Departmental Committee. However, the Departmental Committee shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If so, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

6.5 Candidate shall submit status report (in a bound-form) in two stages at least with a gap of 3 months between them.

6.6 The work on the project shall be initiated in the beginning of the second year and the duration of the project is for two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Principal (through Head of the Department) and shall make an oral presentation/demonstration before the PRC.

6.7 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/Institute.

6.8 The thesis shall be adjudicated by one examiner selected by the College. For this, Head of the Department shall submit a panel of 5 examiners to the Principal of the College, who are eminent in that field with the help of the concerned guide and Head of the department.

6.9 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as described by PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

6.10 If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis.

The Board shall jointly report the candidate's work as one of the following:

- A. Excellent
- B. Good
- C. Satisfactory
- D. Unsatisfactory

The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.

If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce

examination, he will not be eligible for the award of the degree unless he is asked to revise and resubmit by the Board.

7.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	% of marks to be secured	Program Credits
First Class with Distinction	70% and above	From the Aggregate secured for all the 88 credits
First Class	Below 70 but not less than 60%	
Second Class	Below 60% but not less than 50%	

(The marks in internal evaluation and end examination shall be shown separately in the memorandum of marks.)

8.0 WITH-HOLDING OF RESULTS: If the candidate has not paid any dues to the university or if any case of in-discipline is pending against him, the result of the candidate will be withheld and he will not be allowed into the next higher semester. The issue of the degree is liable to be withheld in such cases.

9.0 TRANSITORY REGULATIONS: Candidate who have discontinued or have been detained for want of attendance or who have failed after having undergone the course are eligible for admission to the same or equivalent subjects as and when subjects are offered.

10.0 GENERAL:

10.1 The academic regulations should be read as a whole for purpose of any interpretation.

10.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.

10.3 The College may change or amend the academic regulations and syllabus at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the College.

10.4 Wherever the word he, him or his occur, it will also include she, her and hers. **10.5** Wherever the word 'Subject' occurs in the above regulations, it implies the 'Theory Subject' and 'Practical Subject' or 'Lab'.

10.5 Transfers not allowed among group colleges.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	<i>If the candidate:</i>	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any mark son the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over top the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (includingpracticals and project work) already appeared and shallot be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also

		debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject
6	Refuses to obey the orders of the Chief Superintendent/Assistant –Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-incharge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police cases registered against them.

	which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination	
7	Leaves the exam hall taking away answer scriptor intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the

		candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action toward suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
 - (i) A show cause notice shall be issued to the college.
 - (ii) Impose a suitable fine on the college.
 - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

I Year I Semester

Code	Group	Subject	L	T/P/D	C
45101		Data Structures and Algorithm Analysis	3	0	3
45102		Computer System Design	3	0	3
45103		Computer and Communication Networks	3	0	3
45104		Advanced Database Systems	3	0	3
451A1	Elective –I	Software Process and Project Management	3	0	3
451A2		Software Quality Assurance and Testing			
451A3		Software Architecture and Design Patterns			
451B1	Elective –II	Distributed Systems	3	0	3
451B2		Compiler Design			
451B3		Natural Language Processing			
45105	Lab	Data Structures Lab	0	3	2
45106		Seminar	-	-	2
		Total	18	3	22

I Year II Semester

Code	Group	Subject	L	T/P/D	C
45107		Cryptography and Network Security	3	0	3
45108		Web Technologies	3	0	3
45109		Web Services and Service Oriented Architecture	3	0	3
45110		Machine Learning	3	0	3
451C1	Elective –III	Advanced Data Mining	3	0	3
451C2		Storage Area Networks			
451C3		Grid and Cloud Computing			
451D1	Elective –IV	Semantic Web and Social Networks	3	0	3
451D2		Wireless Networks and Mobile Computing			
451D3		Research Methodologies			
45111	Lab	Software Technologies Lab	0	3	2
45112		Seminar	-	-	2
		Total	18	3	22

II Year I & II Semester

Code	Group	Subject	L	T/P/D	C
45113		Comprehensive Viva	-	-	4
45114		Project Work	-	-	40
		Total	-	-	44

DATA STRUCTURES AND ALGORITHM ANALYSIS**Objectives:**

- The fundamental design, analysis, and implementation of basic data structures.
- Basic concepts in the specification and analysis of programs.
- Principles for good program design, especially the uses of data abstraction.
- Significance of algorithms in the computer field
- Various aspects of algorithm development
- Qualities of a good solution.

UNIT I

Algorithms, Performance analysis- time complexity and space complexity, Asymptotic Notation-Big Oh, Omega and Theta notations, Complexity Analysis Examples. Data structures-Linear and nonlinear data structures, ADT concept, Linear List ADT, Array representation, Linked representation, Vector representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations, circular lists. Representation of single, two dimensional arrays, sparse matrices and their representation.

UNIT II

Stack and Queue ADTs, array and linked list representations, infix to postfix conversion using stack, implementation of recursion, Circular queue-insertion and deletion, Dequeue ADT, array and linked list representations, Priority queue ADT, implementation using Heaps, Insertion into a Max Heap, Deletion from a Max Heap, java.util package-Array List, Linked List, Vector classes, Stacks and Queues in java.util, Iterators in java.util.

UNIT III

Searching-Linear and binary search methods, Hashing-Hash functions, Collision Resolution methods-Open Addressing, Chaining, Hashing in java.util-HashMap,HashSet, Hash table. Sorting -Bubble sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort, comparison of sorting methods.

UNIT IV

Trees- Ordinary and Binary trees terminology, Properties of Binary trees, Binary tree ADT, representations, recursive and non-recursive traversals, Java code for traversals, Threaded binary trees. Graphs-Graphs terminology, Graph ADT, representations, graph traversals/search methods-dfs and bfs, Java code for graph traversals, Applications of Graphs-Minimum cost spanning tree using Kruskal's algorithm, Dijkstra's algorithm for Single Source Shortest Path Problem.

UNIT V

Search trees- Binary search tree-Binary search tree ADT, insertion, deletion and searching operations, Balanced search trees, AVL trees-Definition and examples only, Red Black trees - Definition and examples only, B-Trees-definition, insertion and searching operations, Trees in java.util- Tree Set, Tree Map Classes, Tries(examples only),Comparison of Search trees. Text compression-Huffman coding and decoding, Pattern matching-KMP algorithm.

TEXT BOOKS:

1. Data structures, Algorithms and Applications in Java, S.Sahni, Universities Press.
2. Data structures and Algorithms in Java, Adam Drozdek, 3rd edition, Cengage Learning.
3. Data structures and Algorithm Analysis in Java, M.A.Weiss, 2nd edition, Addison-Wesley (Pearson Education).

REFERENCE BOOKS:

1. Java for Programmers, Deitel and Deitel, Pearson education.
2. Data structures and Algorithms in Java, R.Lafore, Pearson education.
3. Java: The Complete Reference, 8th editon, Herbert Schildt, TMH.
4. Data structures and Algorithms in Java, M.T.Goodrich, R.Tomassia, 3rd edition, Wiley India Edition.
5. Data structures and the Java Collection Frame work, W.J.Collins, Mc Graw Hill.
6. Classic Data structures in Java, T.Budd, Addison-Wesley (Pearson Education).
7. Data structures with Java, Ford and Topp, Pearson Education.
8. Data structures using Java, D.S.Malik and P.S.Nair, Cengage learning.
9. Data structures with Java, J.R.Hubbard and A.Huray, PHI Pvt. Ltd.
10. Data structures and Software Development in an Object-Oriented Domain, J.P.Tremblay and G.A.Cheston, Java edition, Pearson Education.

COMPUTER SYSTEM DESIGN**Objectives:**

- To apply the fundamentals of Computer Systems Design and IT in devising IT solutions.
- To Design, simulate, and analyze digital hardware.
- To Interface between basic hardware and software computing systems.
- To Simulate and evaluate different computing architectures.

UNIT I

Computer Structure – Hardware, software, system software, Von-Neumann architecture – case study. IA -32 Pentium: registers and addressing, instructions, assembly language, program flow control, logic and shift/rotate instructions, multiply, divide MMX, SIMD instructions, I/O operations, subroutines. Input/output organization, interrupts, DMA, Buses, Interface circuits, I/O interfaces, device drivers in windows, interrupt handlers

UNIT II

Processing Unit: Execution of a complete instruction, multiple bus organization, hardwired control, micro programmed control.

Pipelining: data hazards, instruction hazards, influence on instruction sets, data path & control consideration, and RISC architecture introduction.

UNIT III

Memory: types and hierarchy, model level organization, cache memory, performance considerations, mapping, virtual memory, swapping, paging, segmentation, replacement policies.

UNIT IV

Processes and Threads: processes, threads, inter process communication, classical IPC problems, Deadlocks.

UNIT – V

File system: Files, directories, Implementation, UNIX file system

Security: Threats, intruders, accident data loss, basics of cryptography, user authentication.

TEXT BOOKS:

1. Computer Organization – Car Hamacher, Zvonks Vranesic, SafeaZaky, Vth Edition, McGraw Hill.
2. Modern Operating Systems, Andrew S Tanenbaum 2nd edition Pearson/PHI

REFERENCE BOOKS:

1. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson /PHI
2. Morris Mano- Computer System Architecture –3rd Edition-Pearson Education.
3. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
4. Operating Systems – Internals and Design Principles Stallings, Fifth Edition–2005, Pearson Education/PHI

COMPUTER AND COMMUNICATION NETWORKS

Objectives:

- To understand basic concepts of Internet and networking protocols
- To study the operations performed by different layers of TCP/IP reference model
- To understand the concept of wireless networks and Mobile IP
- To understand the concept of VPN and Multimedia Networking
- To study the Adhoc and Sensor Network with their related features

UNIT I

Computer Networks and the Internet: What is the Internet, The Network edge, The Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks, history of Computer Networking and the Internet .

Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model. Internet Protocols and Addressing, Equal-Sized Packets Model: ATM.

Networking Devices: Multiplexers, Modems, Internet Access Devices, Switching and Routing Devices, Router Structure.

UNIT II

The Link Layer and Local Area Networks: Link Layer: Introduction and Services, Error-Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol. Link Virtualization

Routing and Internetworking: Network-, Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Inter domain Routing Protocols , Inter domain Routing Protocols. Congestion Control at Network Layer

UNIT III

Logical Addressing: IPv4 Addresses, IPv6 Addresses - Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6 -- Multicasting Techniques and Protocols: Basic Definitions and Techniques, Inter domain Multicast Protocols, Inter domain Multicast Protocols, Node-Level Multicast algorithms –

Transport and End-to-End Protocols: Transport Layer, Transmission Control Protocol (TCP). User Datagram Protocol (UDP), Mobile Transport Protocols. TCP Congestion Control – **Application Layer:** Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet. Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP, Building a Simple Web Server

UNIT IV

Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs) –

Optical Networks and WDM Systems: Overview of Optical Networks, Basic Optical Networking Devices, Large-Scale Optical Switches. Optical Routers, Wavelength Allocation in Networks. Case Study: An All-Optical Switch

UNIT V

VPNs, Tunneling and Overlay Networks: Virtual Private Networks (VPNs), Multiprotocol Label Switching (MPLS). Overlay Networks –

VoIP and Multimedia Networking: Overview of IP Telephony, VoIP Signaling Protocols, Real-Time Media Transport Protocols, Distributed Multimedia Networking, Stream Control Transmission Protocol.

Mobile Ad-Hoc Networks: Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks –

Wireless Sensor Networks: Sensor Networks and Protocol Structures, Communication Energy Model, Clustering Protocols, Routing Protocols.

TEXT BOOKS:

1. Computer Networking: A Top-Down Approach Featuring the Internet, *James F Kurose, Keith W. Ross*. Third Edition, Pearson Education. 2007
2. Computer and Communication Networks, *Noda F Mir*. Pearson Education, 2007

REFERENCE BOOKS:

1. Data Communications and Networking, *Behrouz, A. Forouzan*, Fourth Edition, Tata McGraw Hill, 2007
2. Guide to Networking Essentials, *Greg Tomsho, Ed Tittel, David Johnson*, Fifth Edition, Thomson.
3. An Engineering Approach to Computer Networking, *S.Keshav*, Pearson Education.
4. Campus Network Design Fundamentals, *Diane Teare, Catherine Paquet*, Pearson Education (CISCO Press)
5. Computer Networks, *Andrew S. Tanenbaum*, Fourth Edition, Prentice Hall.
6. The Internet and Its Protocols, *A. Farrel*, Elsevier

ADVANCED DATABASE SYSTEMS

Objectives:

- History and Structure of database How to design a database
- How to convert the design into the appropriate tables
- Handling Keys appropriately
- Enforcing Integrity Constraints to keep the database consistent
- Normalizing the tables to eliminate redundancies
- Querying relational data
- Optimizing and processing the queries
- Storage Strategies for easy retrieval of data through index
- Triggers, procedures and Cursors ,Transaction management
- Distributed databases management system concepts and Implementation

UNIT I

Database System Applications, Purpose of Database Systems, View of Data – Data Abstraction, Instances and Schemas, Data Models – the ER Model, Relational Model, Other Models – database Languages – DDL,DML, Database Access from Applications Programs, Transaction management, Data Storage and Querying, Database Architecture, Database Users and Administrators, ER diagrams,. Relational Model: Introduction to the Relational Model – Integrity Constraints Over Relations, Enforcing Integrity constraints, Querying relational data, Logical data base Design, Introduction to Views –Altering Tables and Views, Relational Algebra, Basic SQL Queries, Nested Queries, Complex Integrity Constraints in SQL, Triggers

UNIT II

Introduction to Schema Refinement – Problems Caused by redundancy, Decompositions – Problem related to decomposition, Functional Dependencies - Reasoning about FDS, Normal Forms – FIRST, SECOND, THIRD Normal forms – BCNF –Properties of Decompositions- Loss less- join Decomposition, Dependency preserving Decomposition, Schema Refinement in Data base Design – Multi valued Dependencies – FOURTH Normal Form, Join Dependencies, FIFTH Normal form.

UNIT III

Transaction Management: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions – Lock Based Concurrency Control, Deadlocks – Performance of Locking –Transaction Support in SQL.Concurrency Control: Serializability, and recoverability – Introduction to Lock Management – LockConversions, Dealing with Dead Locks, Specialized Locking Techniques – Concurrency Control without Locking.Crash recovery: Introduction to Crash recovery, Introduction to ARIES, the Log, and Other Recovery related Structures, the Write-Ahead Log Protocol, Check pointing, recovering from a System Crash, Media recovery

UNIT IV

Overview of Storage and Indexing: Data on External Storage, File Organization and Indexing –Clustered Indexes, Primary and Secondary Indexes, Index data Structures – Hash Based ndexing,Tree based Indexing Storing data

Disks and Files: -The Memory Hierarchy – Redundant Arrays of Independent Disks. Tree Structured Indexing: Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM) B+ Trees: A Dynamic Index Structure, Search, Insert, Delete. Hash Based Indexing: Static Hashing, Extendable hashing, Linear Hashing, Extendable vs. Linear Hashing.

UNIT V

Distributed databases: Introduction to distributed databases, Distributed DBMS architectures, Storing data in a distributed DBMS, Distributed catalog management, Distributed query processing Updating distributed data, Distributed transactions, Distributed concurrency control, Distributed

TEXT BOOKS:

1. Data base Management Systems, Raghu Ramakrishna, Johannes Gehrke, TMH, 3rd Edition,2003.
2. Data base System Concepts, A.Silberschatz, H.F. Korth, S.Sudarshan, McGraw hill, VIedition,2006.
3. Fundamentals of Database Systems 5th edition. Ramez Elmasri, Shamkant B.Navathe,Pearson Education, 2008.

REFERENCE BOOKS:

1. Introduction to Database Systems, C.J.Date, Pearson Education.
2. Database Management System Oracle SQL and PL/SQL, P.K.Das Gupta, PHI.
3. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning, 2008.
4. Database Systems, A Practical approach to Design Implementation andManagement Fourth edition, Thomas Connolly, Carolyn Begg, Pearson education.
5. Database-Principles, Programming, and Performance, P.O'Neil&E.O'Neil, 2nd ed., LSEVIER

6. Fundamentals of Relational Database Management Systems, S.Sumathi, S.Esakkirajan, Springer.
7. Introduction to Database Management, M.L.Gillenson and others, Wiley Student Edition.
8. Database Development and Management, Lee Chao, Auerbach publications, Taylor & Francis Group.
9. Distributed Databases Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, TMH.
10. Principles of Distributed Database Systems, M. Tamer Ozs, Patrick Valduriez, Pearson Education, 2nd Edition.
11. Distributed Database Systems, Chhanda Ray, Pearson.
12. Distributed Database Management Systems, S.K.Rahimi and F.S.Haug, Wiley.

**SOFTWARE PROCESS AND PROJECT MANAGEMENT
(ELECTIVE – I)**

Objectives:

- Describe and determine the purpose and importance of project management from the perspectives of planning, tracking and completion of project.
- Compare and differentiate organization structures and project structures.
- Implement a project to manage project schedule, expenses and resources with the application of suitable project management tools.

UNIT I

Software Process Maturity: Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process, The Repeatable Process, The Defined Process, The Managed Process, The Optimizing Process.

Process Reference Models: Capability Maturity Model (CMM), CMMI, PCMM, PSP, TSP.

UNIT II

Software Project Management Renaissance: Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.

Life-Cycle Phases and Process artifacts: Engineering and Production stages, inception phase, elaboration phase, construction phase, transition phase, artifact sets, management artifacts, engineering artifacts and pragmatic artifacts, model based software architectures.

UNIT III

Workflows and Checkpoints of process: Software process workflows, Iteration workflows, Major milestones, Minor milestones, Periodic status assessments.

Process Planning: Work breakdown structures, Planning guidelines, cost and schedule estimating process, iteration planning process, Pragmatic planning.

UNIT IV

Project Organizations: Line-of- business organizations, project organizations, evolution of organizations, process automation.

Project Control and process instrumentation: The seven core metrics, management indicators, quality indicators, life-cycle expectations, Pragmatic software metrics, and metrics automation.

UNIT V

CCPDS-R Case Study and Future Software Project Management Practices: Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions.

TEXT BOOKS:

1. Managing the Software Process, *Watts S. Humphrey*, Pearson Education.
2. Software Project Management, *Walker Royce*, Pearson Education.

REFERENCE BOOKS:

1. Effective Project Management: Traditional, Agile, Extreme, Robert Wysocki, Sixth edition, Wiley India, rp2011.
2. An Introduction to the Team Software Process, Watts S. Humphrey, Pearson Education, 2000
3. Process Improvement essentials, James R. Persse, O'Reilly, 2006
3. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, TMH, 2006
4. Applied Software Project Management, Andrew Stellman & Jennifer Greene, O'Reilly, 2006.
5. Head First PMP, Jennifer Greene & Andrew Stellman, O'Reilly, 2007
6. Software Engineering Project Managent, Richard H. Thayer & Edward Yourdon, 2nd edition, Wiley India, 2004.
7. The Art of Project Management, Scott Berkun, SPD, O'Reilly, 2011.
8. Applied Software Project Management, Andrew Stellman & Jennifer Greene, SPD, O'Reilly, 2011.
9. Agile Project Management, Jim Highsmith, Pearson education, 2004.

**SOFTWARE QUALITY ASSURANCE AND TESTING
(ELECTIVE-I)**

Objectives:

- Describe and determine the purpose and importance of Software Quality Assurance Framework and Standards SQA Framework.
- To study about SQA Metrics and Measurement Software Quality Metrics.
- To study about Software Testing Strategy, Environment, Methodology and Techniques.
- Learn about the Testing Specialized Systems and Applications

UNIT I

Software Quality Assurance Framework and Standards SQA Framework: What is Quality? Software Quality Assurance, Components of Software Quality Assurance – **Software Quality Assurance Plan:** Steps to develop and implement a Software Quality Assurance Plan – **Quality Standards:** ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma

UNIT II

Software Quality Assurance Metrics and Measurement Software Quality Metrics: Product Quality metrics, In-Process Quality Metrics, Metrics for Software Maintenance, Examples of Metric Programs – **Software Quality metrics methodology:** Establish quality requirements, Identify Software quality metrics, implement the software quality metrics, analyze software metrics results, and validate the software quality metrics – **Software quality indicators – Fundamentals in Measurement theory**

UNIT III

Software Testing Strategy and Environment: Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing

Software Testing Methodology: Defects hard to find, verification and validation, functional and structural testing, workbench concept, eight considerations in developing testing methodologies, testing tactics checklist

UNIT IV

Software Testing Techniques : Black-Box, Boundary value, Bottom-up, Branch coverage, Cause-Effect graphing, CRUD, Database, Exception, Gray-Box, Histograms, Inspections, JADs, Pareto Analysis, Prototyping, Random Testing, Risk-based Testing, Regression Testing, Structured Walkthroughs, Thread Testing, Performance Testing, White-Box Testing **Software Testing Tools :** Axiology of Testing tools, Methodology to evaluate automated testing tools, Load Runner, Win runner and Rational Testing Tools, Silk test, Java Testing Tools, JMetra, JUNIT and Cactus.

UNIT V

Testing Process: Eleven Step Testing Process: Assess Project Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report test results, testing software installation, Test software changes, Evaluate Test Effectiveness.

Testing Specialized Systems and Applications: Testing Client/Server–Web applications, Testing off the Shelf Components, Testing Security, Testing a Data Warehouse

TEXT BOOKS:

1. Effective Methods for Software Testing, 2nd Edition, William E. Perry, Second Edition, Wiley India, 2006.
2. Software Quality, Mordechai Ben-Menachem/Garry S. Marliss, Thomson Learning publication, 1997.

REFERENCE BOOKS:

1. Testing and Quality Assurance for Component-based Software, by Gao, Tsao and Wu, Artech House Publishers
2. Software Testing Techniques, by Borjes Beizer, Second Edition, Dreamtech Press
3. Managing the Testing Process, by Rex Black, Wiley
4. Handbook of Software Quality Assurance, by G. Gordon Schulmeyer, James I. McManus, Second Edition, International Thomson Computer Press
5. Software Testing and continuous Quality Improvement, by William E. Lewis, Gunasekaran Veerapillai, Second Edition, Auerbach Publications
6. Metrics and Models for Software Quality Engineering, by Stephen H. Kan, by Pearson Education Publication
7. Software Testing Tools, K.V.K.K. Prasad, Dream tech press, 2008.
8. Practical Software Testing, Ilene Burnstein, Springer, 2003.
9. Software Testing, Srinivasan Desikan & Gopaldaswamy Ramesh, Pearson Education, 2006.
10. Software testing techniques, Scott Loveland & Geoffrey Miller, Shroff Publishers, 2005.
11. Software Quality, Martin Wieczorek & Dirk Meyerhoff, Springer, 2001.

**SOFTWARE ARCHITECTURE AND DESIGN PATTERNS
(ELECTIVE – I)**

Objectives:

- To study the different types of Software Architectures
- To implement the various types patterns such as Creational, Structural patterns and Behavioral patterns
- A case study in utilizing architectural structures

UNIT I

Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views.

Creating Architecture: Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

UNIT II

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM.

UNIT III

Moving from one system to many: Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT IV

Patterns: Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage. **Creational and Structural patterns:** Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight, Proxy.

UNIT V

Behavioral patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

Case Studies : A-7E-A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development

TEXT BOOKS:

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

REFERENCE BOOKS:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Pattern Oriented Software Architecture, F. Buschmann & others, John Wiley & Sons.
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker & William C. Wake, Pearson education, 2006
6. J2EE Patterns, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004.

**DISTRIBUTED SYSTEMS
(ELECTIVE –II)****Objectives:**

- To explain what a distributed system is, why you would design a system as a distributed system, and what the desired properties of such systems are;
- To list the principles underlying the functioning of distributed systems, describe the problems and challenges associated with these principles, and evaluate the effectiveness and shortcomings of their solutions;
- To recognize how the principles are applied in contemporary distributed systems, explain how they affect the software design, and be able to identify features and design decisions that may cause problems;
- To design a distributed system that fulfills requirements with regards to key distributed systems properties (such as scalability, transparency, etc.), be able to recognize when this is not possible, and explain why;
- To build distributed system software using basic OS mechanisms as well as higher-level middleware and languages.

UNIT I

Characterization of Distributed Systems- Introduction, Examples of Distributed systems, Resource sharing and web, challenges, System models- Introduction, Architectural and Fundamental models, Networking and Internetworking, Interprocess Communication. Distributed objects and Remote Invocation-Introduction, Communication between distributed objects, RPC, Events and notifications, Case study-Java RMI.

UNIT II

Operating System Support- Introduction, OS layer, Protection, Processes and Threads, Communication and Invocation, Operating system architecture, Distributed File Systems-Introduction, File Service architecture, case study- SUN network file systems. Name Services-Introduction, Name Services and the Domain Name System, Case study of the Global Name Service, Case study of the X.500 Directory Service.

UNIT III

Peer to Peer Systems-Introduction, Napster and its legacy, Peer to Peer middleware, Routing overlays, Overlay case studies-Pastry, Tapestry, Application case studies-Squirrel, OceanStore. Time and Global States-Introduction, Clocks, events and Process states, Synchronizing physical clocks, logical time and logical clocks, global states, distributed debugging. Coordination and Agreement - Introduction, Distributed mutual exclusion, Elections, Multicast communication, consensus and related problems.

UNIT IV

Transactions and Concurrency control - Introduction, Transactions, Nested Transactions, Locks, Optimistic concurrency control, Timestamp ordering, Comparison of methods for concurrency controls. Distributed Transactions - Introduction, Flat and Nested Distributed Transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery, Replication-Introduction, System model and group communication, Fault tolerant services, Transactions with replicated data.

UNIT V

Security - Introduction, Overview of Security techniques, Cryptographic algorithms, Digital signatures, Case studies-Kerberos, TLS, 802.11 WiFi. Distributed shared memory, Design and Implementation issues, Sequential consistency and Ivy case study, Release consistency and Munin case study, other consistency models, CORBA case study- Introduction, CORBA RMI, CORBA Services.

TEXT BOOKS

1. Distributed Systems Concepts and Design, G Coulouris, J Dollimore and T Kindberg, Fourth Edition, Pearson Education.
2. Distributed Systems, S.Ghosh, Chapman & Hall/CRC, Taylor & Francis Group, 2010.

REFERENCE BOOKS:

1. Distributed Computing, S.Mahajan and S.Shah, Oxford University Press.
2. Distributed Operating Systems Concepts and Design, Pradeep K.Sinha, PHI.
3. Advanced Concepts in Operating Systems, M Singhal, N G Shivarathri, Tata McGraw-Hill Edition.
4. Reliable Distributed Systems, K.P.Birman, Springer.
5. Distributed Systems – Principles and Paradigms, A.S. Tanenbaum and M.V. Steen, Pearson Education.
6. Distributed Operating Systems and Algorithm Analysis, R.Chow, T.Johnson, Pearson.
7. Distributed Operating Systems, A.S.Tanenbaum, Pearson education.
8. Distributed Computing, Principles, Algorithms and Systems, Ajay D. Kshemakalyani & Mukesh Singhal, Cambridge, rp 2010

**COMPILER DESIGN
(ELECTIVE –II)**

Objectives:

- To learn about the different Phases of Compilation
- To understand the the concepts of RegularGrammar and regular expression for common programming language features
- To study about the different types of parsing techniques
- To study about the semantic analysis, code optimization and code generarion

UNIT I: Overview of Compilation: Phases of Compilation–Lexical Analysis, RegularGrammar and regular expression for common programming language features, pass and Phases of translation, interpretation, bootstrapping, data structures in compilation – LEX lexical analyzer generator.

UNIT II: Parsing: Context free grammars, Top down parsing–Backtracking, LL (1),recursive descent parsing, Predictive parsing, Preprocessing steps required for predictive parsing.

Bottom up parsing: - Shift Reduce parsing, LR and LALR parsing, Error recovery inparsing, handling ambiguous grammar, YACC – automatic parser generator.

UNIT III: Semantic analysis: Intermediate forms of source Programs–abstract syntax tree,Attributed grammars, Syntax directed translation, Conversion of popular Programming languages language Constructs into Intermediate code forms, Type checker.

Symbol Tables: Symbol table format, organization for block structured languages, hashing,tree structures representation of scope information. Block structures and non block structure storage allocation: static, Runtime stack and heap storage allocation, storage allocation for arrays, strings and records.

UNIT IV: Code Generation- Processing the intermediate Code- Interpretation, Codegeneration, Simple code generation, code generation for basic blocks, BURS Code generation and dynamic programming, Register allocation by graph coloring, Evaluation of code generation techniques Preprocessing the intermediate code, post processing the target code, machine code generation.

Code optimization: Consideration for Optimization, Machine dependent and machineindependent code optimization, Scope of Optimization, local optimization, loop optimization, frequency reduction, folding, DAG representation.

UNIT V: Data flow analysis: Dataflow Analysis, Intermediate representation for flowanalysis, Various dataflow analyses, Transformations using dataflow analysis Speeding up dataflow analysis, Alias analysis.

Loop Optimizations –Dominators, Loop-invariant computations, Induction variables, Arraybounds checks, Loop unrolling

TEXT BOOKS :

1. Principles of compiler design -A.V. Aho . J.D.Ullman; Pearson Education
1. Modern Compiler Design- Dick Grune, Henry E. Bal, Cariel T. H. Jacobs, Wiley dreamtech.

REFERENCE BOOKS:

1. Advanced Compiler Design Implementation, S.S.Muchnick, Elsevier.
2. Compilers principles, techniques and tools A.V.Aho, Ravi Sethi& J.D. Ullman; Pearson ed.,
 1. lex &yacc – John R. Levine, Tony Mason, Doug Brown, O’reilly
 2. Modern Compiler Implementation in C- Andrew N. Appel, Cambridge University Press.
 3. Engineering a Compiler-Cooper & Linda, Elsevier.
 4. Compiler Construction, Loudon, Thomson..

**NATURAL LANGUAGE PROCESSING
(ELECTIVE-I)**

Objectives:

- To acquire basic understanding of linguistic concepts and natural language complexity, variability.
- To acquire basic understanding of machine learning techniques as applied to language.
- To implement N-grams Models.

UNIT I

Introduction and Overview What is Natural Language Processing, hands-on demonstrations .Ambiguity and uncertainty in language. The Turing test. **Regular Expressions** Chomsky hierarchy, regular languages, and their limitations. Finite-state automata. Practical regular expressions for finding and counting language phenomena. A little morphology. Exploring a large corpus with regex tools. **Programming in Python** An introduction to programming in Python. Variables, numbers, strings, arrays, dictionaries, conditionals, iteration. The NLTK (Natural Language Toolkit) **String Edit Distance and Alignment** Key algorithmic tool: dynamic programming, a simple example, use in optimal alignment of sequences. String edit operations, edit distance, and examples of use in spelling correction, and machine translation.

UNIT II

Context Free Grammars Constituency, CFG definition, use and limitations. Chomsky Normal Form. Top-down parsing, bottom-up parsing, and the problems with each. The desirability of combining evidence from both directions **Non-probabilistic Parsing** Efficient CFG parsing with CYK, another dynamic programming algorithms. Early parser. Designing a little grammar, and parsing with it on some test data. **Probability** Introduction to probability theory Joint and conditional probability, marginal, independence, Bayes rule, combining evidence. Examples of applications in natural language. **Information Theory** The "Shannon game"--motivated by language! Entropy, cross entropy, information gain. Its application to some language phenomena.

UNIT III

Language modeling and Naive Bayes Probabilistic language modeling and its applications. Markov models. N-grams. Estimating the probability of a word, and smoothing. Generative models of language. Part of Speech Tagging and Hidden Markov Models, Viterbi Algorithm for Finding Most Likely HMM Path Dynamic programming with Hidden Markov Models, and its use for part-of-speech tagging, Chinese word segmentation, prosody, information extraction, etc.

UNIT IV

Probabilistic Context Free Grammars Weighted context free grammars. Weighted CYK. Pruning and beam search. **Parsing with PCFGs:** A tree bank and what it takes to create one. The probabilistic version of CYK. Also: How do humans parse? Experiments with eye-tracking. Modern parsers. **Maximum Entropy Classifiers:** The maximum entropy principle and its relation to maximum likelihood. Maximum entropy classifiers and their application to document classification, sentence segmentation, and other language tasks

UNIT V

Maximum Entropy Markov Models & Conditional Random Fields Part-of-speech tagging, noun-phrase segmentation and information extraction models that combine maximum entropy and finite-state machines. State-of-the-art models for NLP. **Lexical Semantics** Mathematics of Multinomial and Dirichlet distributions, Dirichlet as a smoothing for multinomial's **Information Extraction & Reference Resolution-** Various methods, including HMMs. Models of anaphora resolution. Machine learning methods for co reference.

TEXT BOOKS:

1. "Speech and Language Processing": Jurafsky and Martin, Prentice Hall
2. "Statistical Natural Language Processing"- Manning and Schutze, MIT Press
3. "Natural Language Understanding". James Allen. The Benajmins/Cummings Publishing Company

REFERENCES BOOKS:

1. Cover, T. M. and J. A. Thomas: Elements of Information Theory. Wiley.
2. Charniak, E.: Statistical Language Learning. The MIT Press.
3. Jelinek, F.: Statistical Methods for Speech Recognition. The MIT Press.
4. Lutz and Ascher - "Learning Python", O'Reilly

DATA STRUCTURES LAB**Objectives:**

- The fundamental design, analysis, and implementation of basic data structures.
- Basic concepts in the specification and analysis of programs.
- Principles for good program design, especially the uses of data abstraction.

Sample Problems on Data structures:

- Write Java programs that use both recursive and non-recursive functions for implementing the following searching methods:
 - Linear search
 - Binary search
- Write Java programs to implement the following using arrays and linked lists
 - List ADT
- Write Java programs to implement the following using an array.
 - Stack ADT
 - Queue ADT
- Write a Java program that reads an infix expression and converts the expression to postfix form. (Use stack ADT).
- Write a Java program to implement circular queue ADT using an array.
- Write a Java program that uses both a stack and a queue to test whether the given string is a palindrome or not.
- Write Java programs to implement the following using a singly linked list.
 - Stack ADT
 - Queue ADT
- Write Java programs to implement the deque (double ended queue) ADT using
 - Array
 - Singly linked list
 - Doubly linked list.
- Write a Java program to implement priority queue ADT.
- Write a Java program to perform the following operations:
 - Construct a binary search tree of elements.
 - Search for a key element in the above binary search tree.
 - Delete an element from the above binary search tree.
- Write a Java program to implement all the functions of a dictionary (ADT) using Hashing.
- Write a Java program to implement Dijkstra's algorithm for Single source shortest path problem.
- Write Java programs that use recursive and non-recursive functions to traverse the given binary tree in
 - Preorder
 - In order
 - Post order.
- Write Java programs for the implementation of bfs and dfs for a given graph.
- Write Java programs for implementing the following sorting methods:
 - Bubble sort
 - Insertion sort
 - Quick sort
 - Merge sort
 - Heap sort
 - Radix sort
- Write a Java program to perform the following operations:
 - Insertion into a B-tree
 - Searching in a B-tree
- Write a Java program that implements Kruskal's algorithm to generate minimum cost spanning tree.
- Write a Java program that implements KMP algorithm for pattern matching.

REFERENCE BOOKS:

- Data Structures and Algorithms in java, 3rd edition, A.Drozdek, Cengage Learning.
- Data Structures with Java, J.R.Hubbard, 2nd edition, Schaum's Outlines, TMH.
- Data Structures and algorithms in Java, 2nd Edition, R.Lafore, Pearson Education.
- Data Structures using Java, D.S.Malik and P.S. Nair, Cengage Learning.
- Data structures, Algorithms and Applications in java, 2nd Edition, S.Sahani, Universities Press.
- Design and Analysis of Algorithms, P.H.Dave and H.B.Dave, Pearson education.
- Data Structures and java collections frame work, W.J.Collins, Mc Graw Hill.
- Java: the complete reference, 7th editon, Herbert Schildt, TMH.
- Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education / Java: How to Program P.J.Deitel and H.M.Deitel, 8th edition, PHI.
- Java Programming, D.S.Malik, Cengage Learning.
- A Practical Guide to Data Structures and Algorithms using Java, S.Goldman & K.Goldman, Chapman & Hall/CRC, Taylor & Francis Group.(**Note: Use packages like java.io, java.util, etc**)

CRYPTOGRAPHY AND NETWORK SECURITY**Objectives:**

- How to apply security to networks and learn the basics of cryptography.
- Understand the symmetric and asymmetric encryption algorithms.
- Understand the message authentication and hash functions.
- Understand the PGP, SMIME and SET algorithms.

Unit-I

Introduction to Cryptography: Introduction To Security: Attacks, Services & Mechanisms, Security, Attacks, Security Services.

Conventional Encryption: Classical Techniques, Conventional Encryption Model, Steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength, Differential & Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation.

Unit-II

Conventional Encryption Algorithms: Triples DES, Blowfish, International Data Encryption Algorithm, RCS, CAST-128, RC2 Placement & Encryption Function, Key Distribution, Random Number Generation, Placement Of Encryption Function.

Unit-III

Public Key Encryption based on lattices: Homomorphic encryption (anonymous signatures), public key cryptography based on lattices (lattice crypto systems) Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm, Key Management, Fermat's & Euler's Theorem, Primality, The Chinese Remainder Theorem.

Unit-IV

Hash Functions: Message Authentication & Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Birthday Attacks, Security Of Hash Function & MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures: Digital Signatures, Authentication Protocol, Digital Signature Standard (DSS).

Unit-V

Network & System Security: Authentication Applications: Kerberos X.509, Directory Authentication Service, Electronic Mail Security, Pretty Good Privacy (PGP), S / Mime, Security: Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer & Transport Layer Security, Secure Electronic Transaction (Set), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.

TEXT BOOKS:

1. Networks~ Security Essentials (Applications and Standards) by William Stallings Pearson Education, 2008.
2. Cryptography & Network Security by Behrouz A. Forouzan, TMH 2007.

REFERENCE BOOKS:

1. Information Security by Mark Stamp, Wiley - India, 2006.
2. Cryptography and Network Security by William Stallings, Fourth Edition, Pearson Education 2007.
3. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
4. Computer Security Basics by Rick Lehtinen, Deborah Russell & G.T.Gangemi Sr., SPD O'REILLY 2006.
5. Modern Cryptography by Wenbo Mao, Pearson Education 2007.

WEB TECHNOLOGIES**Objectives:**

- To know the Web applications and how to create to web pages using HTML and java script.
- Understanding the generic markup languages such as Extensible Markup language.
- Understanding the Java Beans using BDK
- Understand how to write server side scripting using Servlets and JSP.
- Understand how to build the connectivity java and database.
- Understand the architecture of MVC using structs.

UNIT I**HTML Common tags- List, Tables, images, forms, Frames,Cascading Style sheets:**

Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script, CSS

UNIT II

XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.Review of Applets, Class, Event Handling, AWT Programming.Introduction to Swing: JApplet, Handling Swing Controls like Icons – Labels – Buttons – Text Boxes – Combo – Boxes – Tabbed Pains – Scroll Pains – Trees – Tables Differences between AWT Controls & Swing Controls Developing a Home page using Applet & Swing.

UNIT III

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API.Web servers: Tomcat Server installation & Testing.

Introduction to Servelets: Lifecycle of a Serverlet, JSDK the Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters.

UNIT IV

More on Servlets: The javax. Servlet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues.

Introduction to JSP: The Problem with Servelet. The Anatomy of a JSP Page, JSP Processing. JSP Application Design with MVC architecture. AJAX.

UNIT V

JSP Application Development: Generating Dynamic Content, Using Scripting Elements. Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations Database Access Database Programming using JDBC Studying Javax.sql.* package Accessing a Database from a JSP Page Application – Specific Database Actions Deploying JAVA Beans in a JSP Page

TEXT BOOKS:

4. Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech (UNIT 1,2)
2. The complete Reference Java 2 Fifth Edition ,Patrick Naughton and Herbert Schildt., TMH (Chapters: 25) (UNIT 2,3)
3. Java Server Pages –Hans Bergsten, SPD O'Reilly (UNITs 3,4,5)

REFERENCE BOOKS:

1. Programming world wide web-Sebesta,Pearson
2. Core SERVLETS ANDJAVASERVER PAGES VOLUME 1: CORE TECHNOLOGIES , Marty Hall and Larry Brown Pearson
3. Internet and World Wide Web – How to program, Dietel and Nieto PHI/Pearson.
4. Jakarta Struts Cookbook, Bill Siggelkow, S P D O'Reilly for chap 8.
5. Murach's beginning JAVA JDK 5, Murach, SPD
6. An Introduction to web Design and Programming –Wang-Thomson
7. Professional Java Server Programming, S.Allamaraju and othersApress (dreamtech).
8. Java Server Programming ,Ivan Bayross and others,The X Team,SPD
9. Web Warrior Guide to Web Programmimg-Bai/Ekedaw-Thomas
10. Beginning Web Programming-Jon Duckett WROX.
11. Java Server Pages, Pekowsky, Pearson.
12. Java Script, D.Flanagan, O'Reilly, SPD.

WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE**Objectives:**

- To Understand Web Services and implementation model for SOA
- To Understand the SOA, its Principles and Benefits
- To Understand XML concepts
- To Understand paradigms needed for testing Web Services
- To explore different Test Strategies for SOA-based applications
- To implement functional testing, compliance testing and load testing of Web Services
- To Identify bug-finding ideas in testing Web Services

UNIT I

Evolution and Emergence of Web Services – Evolution of distributed computing. Core distributed computing technologies – client/server, CORBA, JAVA RMI, Micro Soft DCOM, MOM, Challenges in Distributed Computing, role of J2EE and XML in distributed computing, emergence of Web Services and Service Oriented Architecture (SOA). Introduction to Web Services – The definition of web services, basic operational model of web services, tools and technologies enabling web services, benefits and challenges of using web services.

UNIT II

Web Service Architecture – Web services Architecture and its characteristics, core building blocks of web services, standards and technologies available for implementing web services, web services communication, and basic steps of implementing web services. Describing Web Services – WSDL introduction, non functional service description, WSDL 1.1 Vs WSDL 2.0, WSDL document, WSDL elements, WSDL binding, WSDL tools, WSDL port type, limitations of WSDL.

UNIT III

Brief Over View of XML – XML Document structure, XML namespaces, Defining structure in XML documents, Reuse of XML schemes, Document navigation and transformation. SOAP : Simple Object Access Protocol, Inter-application communication and wire protocols, SOAP as a messaging protocol, Structure of a SOAP message, SOAP envelope, Encoding, Service Oriented Architectures, SOAP revisited, Service roles in a SOA, Reliable messaging, The enterprise Service Bus, SOA Development Lifecycle, SOAP HTTP binding, SOAP communication model, Error handling in SOAP.

UNIT IV

Registering and Discovering Services : The role of service registries, Service discovery, Universal Description, Discovery, and Integration, UDDI Architecture, UDDI Data Model, Interfaces, UDDI Implementation, UDDI with WSDL, UDDI specification, Service Addressing and Notification, Referencing and addressing Web Services, Web Services Notification.

UNIT V

SOA and web services security considerations, Network-level security mechanisms, Application-level security topologies, XML security standards, Semantics and Web Services, The semantic interoperability problem, The role of metadata, Service metadata, Overview of .NET and J2EE, SOA and Web Service Management, Managing Distributed System, Enterprise management Framework, Standard distributed management frameworks, Web service management, Richer schema languages, WS-Metadata Exchange.

TEXT BOOKS:

1. Web Services & SOA Principles and Technology, Second Edition, Michael P. Papazoglou.
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R.P. Sriganesh, Wiley India.
3. Developing Enterprise Web Services, S. Chatterjee, J. Webber, Pearson Education.

REFERENCE BOOKS:

1. XML, Web Services, and the Data Revolution, F.P.Coyle, Pearson Education.
2. Building web Services with Java, 2nd Edition, S. Graham and others, Pearson Education.
3. Java Web Services, D.A. Chappell & T. Jewell, O'Reilly, SPD.
4. McGovern, et al., "Java web Services Architecture", Morgan Kaufmann Publishers, 2005.
5. J2EE Web Services, Richard Monson-Haefel, Pearson Education.

MACHINE LEARNING**Objectives:**

- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To understand the basic theory underlying machine learning.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To be able to read current research papers and understands the issues raised by current research.

UNIT I

INTRODUCTION - Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning.

Concept learning and the general to specific ordering – Introduction, A 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, Inductive bias.

UNIT II

Decision Tree learning – Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.

Artificial Neural Networks – Introduction, Neural network representation, Appropriate problems for neural network learning, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks

Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms

UNIT III

Bayesian learning – Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibbs algorithm, Naïve Bayes classifier, An example learning to classify text, Bayesian belief networks The EM algorithm.

Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite

Hypothesis Spaces, The mistake bound model of learning - **Instance-Based Learning**- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning.

Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

UNIT IV

Learning Sets of Rules – Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution

Analytical Learning - Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

UNIT V

Combining Inductive and Analytical Learning – Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators, **Reinforcement**

Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

TEXT BOOKS:

1. Machine Learning – Tom M. Mitchell, - MGH
2. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis (CRC)

REFERENCE BOOKS:

1. Machine Learning Methods in the Environmental Sciences, Neural Networks, William W Hsieh, Cambridge Univ Press.
2. Richard o. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc., 2001
3. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 1995

**ADVANCED DATA MINING
(ELECTIVE –III)****Objectives:**

- To develop the abilities of critical analysis to data mining systems and applications.
- To implement practical and theoretical understanding of the technologies for data mining
- To understand the strengths and limitations of various data mining models.

UNIT-I**Data mining Overview and Advanced Pattern Mining**

Data mining tasks – mining frequent patterns, associations and correlations, classification and regression for predictive analysis, cluster analysis, outlier analysis; advanced pattern mining in multilevel, multidimensional space – mining multilevel associations, mining multidimensional associations, mining quantitative association rules, mining rare patterns and negative patterns.

UNIT-II**Advance Classification**

Classification by back propagation, support vector machines, classification using frequent at terns, other classification methods – genetic algorithms, roughset approach, fuzzy set approach;

UNIT-III**Advance Clustering**

Density - based methods –DBSCAN, OPTICS, DENCLUE; Grid-Based methods – STING, CLIQUE; Exception – maximization algorithm; clustering High- Dimensional Data; Clustering Graph and Network Data.

UNIT-IV**Web and Text Mining**

Introduction, web mining, web content mining, web structure mining, we usage mining, Text mining –unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

UNIT-V**Temporal and Spatial Data Mining**

Introduction; Temporal Data Mining – Temporal Association Rules, Sequence Mining, GSP algorithm, SPADE, SPIRIT Episode Discovery, Time Series Analysis, Spatial Mining – Spatial Mining Tasks, Spatial Clustering. Data Mining Applications.

TEXT BOOKS:

1. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann.
2. Data Mining Techniques – Arun K. Pujari, Universities Press.

REFERENCE BOOKS:

1. Introduction to Data Mining – Pang-Ning Tan, Vipin kumar, Michael Steinbach, Pearson.
2. Data Mining Principles & Applications – T.V Suresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.

STORAGE AREA NETWORKS (ELECTIVE-III)

Objectives:

- To understand Storage Area Networks characteristics and components.
- To become familiar with the SAN vendors and their products
- To learn Fibre Channel protocols and how SAN components use them to communicate with each other
- To become familiar with Cisco MDS 9000 Multilayer Directors and Fabric Switches
Thoroughly learn Cisco SAN-OS features.
- To understand the use of all SAN-OS commands. Practice variations of SANOS features

UNIT I: Introduction to Storage Technology

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

UNIT II: Storage Systems Architecture

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

UNIT III: Introduction to Networked Storage

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

UNIT IV: Information Availability & Monitoring & Managing Datacenter

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

UNIT V: Securing Storage and Storage Virtualization

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

Case Studies

The technologies described in the course are reinforced with EMC examples of actual solutions. Realistic case studies enable the participant to design the most appropriate solution for given sets of criteria.

TEXT BOOK:

1. EMC Corporation, Information Storage and Management, Wiley.

REFERENCE BOOKS:

2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, sborne, 2003.
3. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne, 2001.
4. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002

GRID AND CLOUD COMPUTING**Objectives:**

- To implement Basics, techniques and tools for Grid & Cloud Computing
- To understand any kind of heterogeneous resources over a network using open standards
- To implement the Service models

UNIT-I

System models for advanced computing –clusters of cooperative computing, grid computing and cloud computing; software systems for advanced computing-service oriented software and paralleled distributed programming models with introductory details, Features of grid and cloud platform.

UNIT-II

Cloud Computing services models and features in Saas, Paas and Iaas.Service oriented architecture and web services; Features of cloud computing architectures and simple case studies.

UNIT-III

Virtualization- Characteristic features, Taxonomy Hypervisor, Virtualization and Cloud Computing, Pros and Cons of Cloud Computing, Technology Examples/Case Studies.

UNIT-IV

Cloud programming Environmental- Map Reduce Hadoop Library from Apache, Open Source Cloud Software Systems – Eucalyptus.

UNIT-V

Grid Architecture and Service modeling, Grid resource management, Grid Application trends.

TEXT BOOKS:

1. Distributed and Cloud Computing, Kaittwang Geoffrey C.Fox and Jack J Dongra, ElsevierIndia 2012.
2. Mastering Cloud Computing- Raj Kumar Buyya, Christian Vecchiola and S.Tanuraj Selvi, TMH, 2012.

REFERENCE BOOKS:

1. Cloud Computing, John W. Ritting House and James F Ramsome, CRC Press, 2012.
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2012.

**SEMANTIC WEB AND SOCIAL NETWORKS
(ELECTIVE –IV)**

Objectives:

- To learn Web Intelligence
- To learn Knowledge Representation for the Semantic Web
- To learn Ontology Engineering
- To learn Semantic Web Applications, Services and Technology
- To learn Social Network Analysis and semantic web

UNIT –I

Web Intelligence: Thinking and Intelligent Web Applications, The Information Age ,The World Wide Web, Limitations of Today's Web, The Next Generation Web, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Berners-Lee www, Semantic Road Map, Logic on the semantic Web.

UNIT –II

Knowledge Representation for the Semantic Web Ontologies and their role in the semantic web, Ontologies Languages for the Semantic Web –Resource Description framework(RDF) / RDF Schema, Ontology Web Language(OWL), UML,XML/XML Schema.

UNIT-III

Ontology Engineering Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries and Ontology Mapping, Logic, Rule and Inference Engines.

UNIT-IV

Semantic Web Applications, Services and Technology Semantic Web applications and services, Semantic Search, e-learning, Semantic Bioinformatics, Knowledge Base ,XML Based Web Services, Creating an OWL-S Ontology for Web Services, Semantic Search Technology, Web Search Agents and Semantic Methods.

UNIT-V

Social Network Analysis and semantic web What is social Networks analysis, development of the social networks analysis, Electronic Sources for Network Analysis – Electronic Discussion networks, Blogs and Online Communities, Web Based Networks. Building Semantic Web Applications with social network features.

TEXT BOOKS:

1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2008.
2. Social Networks and the Semantic Web, Peter Mika, Springer, 2007.

REFERENCE BOOKS:

1. Semantic Web Technologies, Trends and Research in Ontology Based Systems, J.Davies, R.Studer, P.Warren, John Wiley & Sons.
2. Semantic Web and Semantic Web Services -Liyang LuChapman and Hall/CRC Publishers,(Taylor & Francis Group)
3. Information Sharing on the semantic Web - Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications.
4. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly, SPD.

**WIRELESS NETWORKS AND MOBILE COMPUTING
(ELECTIVE –IV)**

Objectives:

The main objective of this course is to provide the students with the competences required for understanding and using the communications component of an universal communications environment. Students will be provided, in particular, with the knowledge required to understand

- emerging communications networks,
- their computational demands,
- the classes of distributed services and applications enabled by these networks, and
- the computational means required to create the new networks and the new applications.

UNIT I

WIRELESS NETWORKS: Wireless Network, Wireless Network Architecture, Wireless Switching Technology, Wireless Communication problem, Wireless Network Reference Model, Wireless Networking Issues & Standards.
MOBILE COMPUTING: Mobile communication, Mobile computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Mobility Management

UNIT II

WIRELESS LAN: Infra red Vs radio transmission, Infrastructure and Ad-hoc Network, IEEE 802.11: System Architecture, Protocol Architecture, 802.11b, 802.11a, Newer Developments, HIPERLAN 1, HIPERLAN 2, Bluetooth : User Scenarios, Architecture.

UNIT III

GLOBAL SYSTEM FOR MOBILE COMMUNICATIONS (GSM): Mobile Services, System Architecture, Protocols, Localization & Calling, Handover, Security. **GPRS:** GPRS System Architecture, **UMTS:** UMTS System Architecture. **LTE:** Long Term Evolution

UNIT IV

MOBILE NETWORK LAYER: Mobile IP: Goals, Assumptions, Entities and Terminology, IP Packet Delivery, Agent Discovery, Registration, Tunneling and Encapsulation, Optimizations, Dynamic Host Configuration Protocol (DHCP)

UNIT V

MOBILE TRANSPORT LAYER: Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP, TCP over 2.5G/3G Wireless Networks.

TEXT BOOKS:

1. Jochen Schiller, “Mobile Communications”, Pearson Education, Second Edition, 2008.
2. Dr. Sunilkumar, et al “Wireless and Mobile Networks: Concepts and Protocols”, Wiley India.
3. Raj Kamal, “Mobile Computing”, OXFORD UNIVERSITY PRESS.

REFERENCE BOOKS:

1. Asoke K Talukder, et al, “Mobile Computing”, Tata McGraw Hill, 2008.
2. Matthew S.Gast, “802.11 Wireless Networks”, SPD O’REILLY.
3. Ivan Stojmenovic, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2007.
4. Kumkum Garg, “Mobile Computing”, Pearson.
5. Handbook of Security of Networks, Yang Xiao, Frank H Li, Hui Chen, World Scientific, 2011.

RESEARCH METHODOLOGIES
(Elective-II)

UNIT- I :

What is Research ?, What is not Research?, Meaning, aim, nature and scope of research, Characteristics and Prerequisites of research, Research needs in Engineering, Education, Science and Management., Research benefits to Society in general.

UNIT- II :

Review of Literature: Role of Review, Search for related literature, On line search, Searching Web, Conducting a literature search, Evaluating, Organizing, and synthesizing the literature.

Research Problem Statement and Purpose of Research: Identifying and describing the research , Finding the research Problem, Sources of research problem, Criteria/ Characteristics of a Good research.

UNIT III :

Planning for Research Design: The Nature and role of Data in Research., Linking Data and Research Methodology, Validity of Method, Planning for Data collection, Choosing a Research Approach., Use of Quantitative / Qualitative Research Design, Feasibility of Research Design, Establishing Research Criteria, Justification of Research Methodology

Research Proposal preparation: Characteristics of a proposal, Formatting a research proposal. Preparation of proposal, Importance of Interpretation of data and treatment of data.

UNIT- IV:

Statistical Techniques for Quantitative Data, Exploring the data , Description and Analysis of Data. Role of Statistics for Data Analysis, Functions of Statistics, Estimates of Population Parameters, Parametric V/s Non Parametric methods, Descriptive Statistics, Points of Central tendency, Measures of Variability, Measures of relationship, Inferential Statistics- Estimation, Hypothesis Testing, Use of Statistical software.

UNIT- V :

Research Report, Format of the Research report, Style of writing report, References and Bibliography.

REFERENCES :

1. Practical Research : planning and Design(8th Edition) Paul D. Leedy and Jeanne E. Ormrod.
2. www. Prenhall.com/leedy.
3. A Hand Book of Education Research NCTE
4. Methodology of Education Research K.S. Sidhu.
5. Research Methodology. Methods & Technique : Kothari. C.R.
6. Tests, Measurements and Research methods in Behavioural Sciences- A.K. Singh.
7. Statistical Methods- Y.P. Agarwal.
8. Methods of Statistical Analysis- P.S Grewal.
9. Fundamentals of Statistics S.C. Gupta, V.K. Kapoor

SOFTWARE TECHNOLOGIES LAB

Web Technologies:**Objectives:**

- To implement the technologies like Servlets and JSP using XML and Java Beans.
- To learn how to implement and deploy web application using client and server

List of Programs:

**1. Develop static pages (using Only HTML) of an online Book store. The pages should resemble: www.amazon.com The website should consist the following pages. . Home page, Registration and user Login User Profile Page, Books catalog Shopping Cart, Payment By credit card Order Conformation

**2. Validate the Registration, user login, user profile and payment by credit card pages using JavaScript.

**3. Create and save an XML document at the server, which contains 10 users information. Write a program, which takes User Id as an input and returns the user details by taking the user information from the XML document.

****4. Bean Assignments**

1. Create a Java Bean which gives the exchange value of INR (Indian Rupees) into equivalent American/Canadian/Australian Dollar value.
2. Create a simple Bean with a label - which is the count of number of clicks. Than create a BeanInfo class such that only the "count" property is visible in the Property Window.
3. Create two Beans-a) Key Pad .b) Display Pad .After that integrate the two Beans to make it work as a Calculator.
4. Create two Beans Traffic Light(Implemented as a Label with only three background colours Red,Green,Yellow) and Automobile(Implemented as a Textbox which states its state/movement). The state of the Automobile should depend on the following Light Transition Table.

Light Transition Automobile State

Red -> Yellow	Ready
Yellow -> Green	Move
Green -> Red	Stopped

**5. Install TOMCAT web server. Convert the static web pages of assignments 2 into dynamic web pages using Servlets and cookies. Hint: Users information (user id, password, credit card number) would be stored in web.xml Each user should have a separate Shopping Cart.

**6. Redo the previous task using JSP by converting the static web pages of assignments 2 into dynamic web pages. Create a database with user information and books information. The books catalogue should be dynamically loaded from the database. Follow the MVC architecture while doing the website.

*7. Implement the "Hello World!" program using JSP Struts Framework. NOTE: * - Simple Problems.

1. - Moderate Problems.

*** - Complex Problems.

TEXT BOOKS:

1. Java Server Programming for Professionals, 2nd Edition, Bayross and others, O'reilly, SPD, 2007.
1. JOBC, Servlets, and JSP, Black Book, K. Santosh Kumar, dreamtech.
2. Core Web Programming, 2nd Edition, Volume I, M.Hall and L.Brown, PHPTR.
3. Core Web Programming, 2nd Edition, Volume 2, M.Hall and L.Brown, PHPTR.
4. Core Java, Volume 1, Horstman and Cornell, 8th Edition, Pearson Education, 2008.
5. Core Java, Volume 2, Horstman and Cornell, 8th Edition, Pearson Education, 2008.
6. Java Programming: Advanced Topics, 3rd Edition, J. Wiggles worth and PMcMillan, Thomson, 2007.

Web Services Programs:**Objectives:**

- To implement the technologies like WSDL, UDDI.
- To learn how to implement and deploy web service client and server

List of Programs:

1. Write a program to implement WSDL Service (Hello Service : WSDL File)
2. Write a program the service provider can be implement a single get price(), static bind() and get product operation.

3. Write a program to implement the operation can receive request and will return a response in two ways.
 - a) One-Way operation
 - b) Request - Response
4. Write a program to implement to create a simple web service that converts the temperature From Fahrenheit to Celsius (using HTTP Post Protocol)
5. Write a program to implement business UDDI Registry entry
6. Write a program to implement
 - a) Web based service consumer
 - b) Windows application based web service consumer