

**SNDT Women's University**  
**Syllabus**  
**Syllabus Masters of Science**  
**in**  
**Computer Science (MSc-CS)**



**SNDT Women's University**  
**Sir Vithaldas Thackersey Vidyavihar,**  
**Juhu Road, Santacruz West, Mumbai 400 049.**  
**(Applicable to students taking admission in and after 2019)**

(Sem I, II, III and IV: Modified on 6<sup>th</sup> July 2019 Ad-hoc BOS)

## GENESIS

The SNDT Women's University, the pioneer Women's University in India, was founded on June 2, 1916 by Maharshi Karve with 5 students.

Today, the University has an enrolment of over 50000 students (including those from Junior Colleges) in the formal as well as the non-formal streams, 166 Colleges, 39 University Departments, 4 Faculties and 4 Campuses.

The pioneer Women's University has been in the service of Indian women from all walks of life in a variety of ways for the last nine decades. In its endeavor to give the best in science and technology, as well as to enhance research functions, the University established its computer center in 1985 with the assistance of U.G.C. for an 'O' level and higher level system and has a well-functioning computer center with adequate trained staff. The University was selected by the U.G.C. for conducting the Postgraduate Diploma in Computer Science and Applications (PGDCSA) in 1985 and for conducting the Master of Computer Applications (MCA), now AICTE approved, in 1989 and Master of Science in Computer Science [M. Sc. (CS)] from 2013. These courses follow the prescribed syllabus with a thrust for both theoretical computer science as well as applications.

The response to these courses conducted by the University is overwhelming. Thirty three batches of PGDCSA and twenty nine of MCA students have completed the course and are employed in India and abroad. The alumnae work for some of the best institutions in the world.

The SNDT Women's University is affirmative in its commitment to the empowerment of women through education and pursues excellence unstintingly. The University has obtained an A grade from the National Assessment and Accreditation Council (NAAC).

**Vision:** *Sanskrita Stree Parashakti*

An Enlightened Woman is a source of Infinite Strength

**Mission:** Empowerment of Women through Education

## **OPPORTUNITY**

In the rapidly changing area of computer science and technology there is an ever-growing shortage of trained manpower required in educational institutions as well as industry. This problem has been identified as early as 1980 by Rajaraman Committee on Computer Manpower Development and has been reiterated by various panels and study groups set up by the DoE since then. In order to enable one to cope with the ever growing and fast changing technology it is essential for one to acquire appropriate formal training. India has set up priorities, made plans and visualized grand schemes to enter the information technology era, the 21st century. It is clear that this will bring about advances in technology especially in areas such as electronics, space research, biomedical engineering, computer science, communications and genetics.

Computer science is both a pure science as well as an applied science, hence requires a large number of highly qualified personnel. The requirement of personnel can be identified to be in the following sectors viz. manufacturing and maintenance of computer, computer users such as industry and data center, government departments, educational and research organizations, national projects such as that of railways and defense and the growing area of software export.

Computer software development is also a profession particularly suitable for women. As the infra-structural facilities grow, many women will be able to work from their homes, meeting the needs of both the home and the job. This department has so far trained over 755 PGDCSA students and about 946 MCA's who are well placed around the globe. We shall not let any opportunity pass lest they may never come back. The department is proud of its students and its own performance during the last 34 years.

## **POSTGRADUATE DEPARTMENT OF COMPUTER SCIENCE**

The Shreemati Nathibai Damodar Thackersey (SNDT) Women's University Post-Graduate Department of Computer Science offers three courses at the post-graduate level, Master of Computer Applications (MCA – 3 years, full-time), Master of Science (Computer Science) (M.Sc.(CS) – 2 years, full-time) and Post Graduate Diploma in Computer Science and Applications (PGDCSA – 1 year, full time). SNDT admits candidates to MCA based on performance in the state level entrance examination conducted by Directorate of Technical Education (DTE), subject to the eligibility criteria set by DTE. Admission to the PGDCSA course is given by the P.G. Department of Computer Science directly.

### **1. Objectives**

- To provide technical education to women to catalyses their empowerment.
- To fulfill the national need for trained teachers and researchers in Computer Science.
- To promote advanced research, doctoral and postdoctoral work.
- To support the efforts of the University to promote computer awareness and utilization in the various departments.

### **2. Major Thrust Areas**

- Train highly competent computer software professionals needed by the industry.
- Strengthen teaching, research and consulting in the area of computer applications.
- Develop software for the improvement of educational testing and software for students with learning disability.
- Promote teaching materials and manpower for computer science education.
- Participate actively in professional bodies and industry to contribute to the society at large.
- Interact with some of the best in the computing profession to give exposure to students and faculty.
- Establish links with national and international organizations for advanced training and research in computer science.

### **3. Computing Facility**

There are three computer laboratories with best hardware and latest software.

### **4. Interaction with Industry and Employment**

The Department makes consistent efforts to improve the courses to make them relevant. Various industries and Computer organizations are involved in this effort. They do so by functioning on the Department's advisory bodies. The Department gets support from industries for teaching as well.

Our past students are employed in some of the finest companies in the world. Some of the students are pursuing higher studies in Computer Science, in India and abroad.

## **5. Association with Research and Development Organizations**

In addition to its linkages with industry the University had signed Memoranda of Understanding with several R&D endeavours with a view to strengthening its academic programmes, and enhancing research facilities of the Department of Computer Science. The co-signatories are:

- a. Centre for Development of Advanced Computing (CDAC), formerly NCST, Mumbai.
- b. Nuclear Power Corporation of India Limited
- c. The Tata Power Company Limited, Andheri, Mumbai
- d. Renaissance Mumbai Convention Centre Hotel & Lakeside Chalet- Mumbai, Marriott Executive Apartments.
- e. Safe Pvt. Ltd, Andheri(E), Mumbai
- f. Selec Controls Pvt. Ltd, Mumbai
- g. School of Education and Communication, Jonkoping University, Sweden The department is an institutional member of professional bodies such as Computer Society of India.

## **6. Research Activities**

The Department is actively involved in research in the following areas:

- a. Artificial Intelligence (AI)
- b. Image Processing
- c. Secure Communication
- d. Web Technologies
- e. Software Engineering and project management
- f. Geographical Information System
- g. Internet of Things
- h. Cyber Security
- i. Data Warehousing & Data Mining
- j. Machine Learning

## **7. Self-Enrichment Courses**

A series of programmes in the areas of personality development, interview techniques, communication etc. will be arranged.

**8. Faculty**

The Department has its own full time qualified and experienced faculties for lectures and practical. Several faculty members are actively involved in various areas of research and software development.

**9. Visiting Faculty**

The University has been receiving the support of research and educational institutions in Mumbai such as IIT (Mumbai), BARC, C-DAC, etc. The Department also receives support from several talented and well-experienced professionals from the Industry as visiting faculty.

**10. Library**

The University has excellent library facilities having about 2000 volumes of recent editions pure as well as applied computer science. The library subscribes to several leading Indian as well as foreign journals in computer science and related areas. In order to supplement these, the department maintains an appreciable collection of books and journals that are available to the students all the time.

**11. Service to other Departments**

This department has played a significant role in helping other departments set up computer laboratories; conduct computer related courses and computer awareness programmes.

**12. Students and Departmental Activities**

The Department makes consistent efforts to improve the quality of the courses it conducts as well as to maintain acceptable standards. In order to develop as well as to assess the individual competence there are regular tests as well as assignments. There is a continuous internal assessment for 50marks. The end of semester examination has a weightage of 50 marks. Group work and collaborative efforts are inculcated by having departmental projects as well as by attaching a group of students to a member of the faculty for discussions, etc. The problem solving capabilities are developed and reinforced by administering aptitude tests, programming assignments and even by organizing various contests. Visits to Computer Centers and Research and Development Organizations with advanced and sophisticated facilities widen the horizon and perspective of students. Experts from Industry, Consultancies and Research Institutes are invited to give lectures on specialized topics. Efforts are made to develop leadership qualities, and other desirable personality traits through extra-curricular activities as well as workshops on personality development, problem solving, etc. Interview techniques and lectures on 'job expectations' prepare them to face the challenges of job seeking. Student participation in the running of the department is achieved by having well-functioning Students Council. There are active student chapters of the Association for Computing Machinery (ACM) and Computer Society of India (CSI). Digital library access is available to the members of the ACM. Students are involved in National Service Scheme (NSS) a community service.

**13. Students Council:**

**Students Council Objectives:**

The Students council formally represents the students and endeavors to improve the department. The council shall strive to solve the problems of students being a liaison between the students and the faculty.

**Composition:**

The student's council is a body composed of

The General Secretary (GS)

Two Assistant General Secretaries (AGS)

Treasurer

Eight Council Members

**14. Extra-Curricular Activities**

The Juhu Campus of the University has excellent facilities for indoor as well as outdoor activities.

**15. Vacation**

Students normally get Diwali, Christmas, and summer vacations as per university norms.

**Fee Structure:**

**([M. Sc. (CS)] I year: Rs. 46020/-**

Fees are subject to revision.

## Master of Science (Computer Science) [M. Sc. (CS)]

### MSc-CS SEMESTER-I

Code	Subject	L	Pr.	Cr.	Int. Exam.	Ext. Exam.	Total Marks
1101	Operating Systems	4		4	50	50	100
1102	Software Engineering and Project Management	4	-	4	50	50	100
1103	Data Structures and Analysis of Algorithm	4	-	4	50	50	100
1104	Cyber Security	4	-	4	50	50	100
1105	Data Communications and Networking	4	-	4	50	50	100
1201	Operating Systems Lab	-	2	2	25	25	50
1202	Data Structures and Algorithm Lab	-	2	2	25	25	50
<b>Total</b>					<b>24</b>		<b>600</b>

### MSc-CS SEMESTER-II

Code	Subject	L	Pr.	Cr.	Int. Exam.	Ext. Exam.	Total Marks
2101	Web Technology	4		4	50	50	100
2102	Computer Organization and Architecture	4	-	4	50	50	100
2103	Database Management Systems	4	-	4	50	50	100
2104	Design & Analysis of Algorithms	4	-	4	50	50	100
2105	Elective-I	4	-	4	50	50	100
2201	Web Technology Lab	-	2	2	25	25	50
2202	Database Management Systems Lab	-	2	2	25	25	50
<b>Total</b>					<b>24</b>		<b>600</b>

### MSc-CS SEMESTER-III

Code	Subject	L	Pr.	Cr.	Int. Exam.	Ext. Exam.	Total Marks
3101	Object Oriented Programming with Java	4		4	50	50	100
3102	Dataware housing and Data Mining	4	-	4	50	50	100
3103	Research Methodology	4	-	4	50	50	100
3104	Mobile Application Development using Android Programming	4	-	4	50	50	100
3105	Elective-II	4	-	4	50	50	100
3201	Java Lab	-	2	2	25	25	50
3202	Android programming lab	-	2	2	25	25	50
<b>Total</b>					<b>24</b>		<b>600</b>



### MSc-CS SEMESTER-IV

Code	Subject	L	P/T	Cr	Ext.	Int.	Total
4101	Research Seminar	-	-	8	100	100	200
4102	Internship-Project	-	-	16	200	200	400
<b>Total</b>				<b>24</b>			<b>600</b>

Elective-I	Elective-II
1. Software Testing and Tools	1. Image Processing
2. Big Data Analytics	2. Digital Forencics
3. Computer Graphics	3. Geographical Information Systems
4. Enterprise Resource Planning	4. Internet of Things
	5. Multimedia Applications

SEMESTER				1 Credit = 25 Marks Total Credits = 96 Total Marks = 96*25 = 2400
I	II	III	IV	
24	24	24	24	

#### ASSESSMENT:

- ( I ) The final total assessment of the candidate is made in terms of an internalassessment and an external assessment for each course.
- For each theory paper, 2credit will be based on internal assessmentand 2 credits for end examination (externalassessment), where as the lab papers 1 creditis for internal and one for external.
  - It is mandatory to pass the internal exam of each Subject and hence is eligible for external exams.
  - The division of the 25marks allotted to internal assessment oftheory papers is on the basis of Attendance of 5 marks and5 assignment throughout the semester of 5 marks and two written test of 15 marks each taken during the semester(avarage of two should be taken).
  - The marks of the practical's / lab would be given on external practicaexam & oral.
  - No Theory Questions or Exams to be conducted. Only Programs will be asked. Output Questions can be asked.
  - The internal marks will be communicated to the University at theend of each semester.These marks will be considered for the declaration of the results.
- ( II ) Examination:  
Examinations shall be conducted at the end of the semester i.e. DuringDecember and in May, However supplementary examinations will also beheld in December and May.

**Students have to pass both the internal assessment and external assessment separately.**

Total marks obtained = Internal marks + External marks

## M.Sc.(C.S.) DETAILED SYLLABUS

<b>Branch: MSc-CS</b>	<b>Semester-I</b>
<b>Subject Code: 1101</b>	<b>Lecture: 04</b> <b>Credit: 04</b>
<b>Subject Title</b>	<b>OPERATING SYSTEMS</b>

Modules	Sr. No.	Topic and Details	No of Lectures Assigned	Marks Weight age %
UNIT-I	1	<p><b>Introduction to Operating Systems (OS):</b> Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Distributed Systems, Special-Purpose Systems, Computing Environments.</p> <p>Operating-System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure, Virtual Machines, Operating-System Generation.</p>	5	10
UNIT-II	2	<p><b>Processor Management:</b> Process concept, Process scheduling, Operations on Processes, Interprocess Communication, Multithreading models, threading issues, Process scheduling algorithms, Thread scheduling, Multiple processor Scheduling.</p> <p><b>Process Coordination:</b> Synchronization, Semaphores, Monitors, Deadlocks characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock Avoidance, Deadlock detection, recovery from deadlock.</p>	10	20
	3	<p><b>Memory Management:</b> Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation</p> <p><b>Virtual memory Management:</b> Demand Paging, Copy-on-Write, Page replacement, Allocation of Frames, Thrashing.</p>	10	20

UNIT-III	4	<p><b>File Management:</b> File Concept, File Access Methods, Directory Structure, File Sharing, File Protection, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management, Efficiency and Performance, Recovery, Log-Structured File Systems, NFS.</p> <p><b>I/O Management:</b> I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations, STREAMS, Performance.</p> <p><b>Disk Management:</b> Disk Structure, Disk Attachment, Disk Scheduling, Disk Management , Swap-Space Management, RAID Structure, Stable-Storage Implementation, Tertiary-Storage Structure</p>	10	20
	5	<p><b>Distributed systems:</b> Types of Distributed Operating, Network Structure, Network Topology, Communication Structure, Communication Protocols, Robustness, Design Issues.</p> <p><b>Distributed File Systems:</b> Naming and Transparency, Remote File Access, Stateful Versus Stateless Service, File Replication</p> <p><b>Distributed Coordination:</b> Event Ordering, Mutual Exclusion, Atomicity, Concurrency Control, Deadlock Handling, Election Algorithms, Reaching Agreement</p>	10	20
UNIT-IV	6	<p><b>Protection and Security:</b> Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix , Implementation of Access Matrix, Access Control, Revocation of Access Rights, Capability-Based Systems, Language-Based Protection. The Security Problem, Program Threats, System and Network Threats, Cryptography as a Security Tool, User Authentication, Implementing Security Defenses, Firewalling to Protect Systems and Networks, Computer-Security Classifications</p>	5	10

**Reference Books:**

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 7th Ed. John Wiley and Sons, Inc 2005.
2. Milan Milenkovic , "Operating Systems Concepts And Design", Second Edition, McGraw-Hill International Editions, "
3. William Stallings, "Operating Systems: Internals and design Principles", 5th Ed Prentice Hall, 2005.
4. Andrew Tanenbaum, "Modern operating systems" 3rd Ed, Pearson Education.

<b>Branch: MSc-CS</b>	<b>Semester-I</b>
<b>Subject Code: 1102</b>	<b>Lecture: 04</b> <b>Credit: 04</b>
<b>Subject Title</b>	<b>SOFTWARE ENGINEERING AND PROJECT MANAGEMENT</b>

<b>Modules</b>	<b>Sr. No.</b>	<b>Topic and Details</b>	<b>No of Lectures Assigned</b>	<b>Marks Weight age</b>
UNIT-I	1	<b>Software Processes:</b> Processes projects and products, Component software processes, characteristics of a software process, software Development Process, project management process, software configuration management process, software configuration management process, process management process.	8	15
	2	<b>Software requirement Analysis and Specification:</b> Software requirement, need for SRS, requirement process, problem analysis, analysis issues. Informal approach, structured analysis, object oriented modeling, other modeling approaches, prototyping, requirement specification, characteristics of an SRS, component of an SRS, specification languages, structure of requirement document validation requirement reviews, other method metrics, size measures, quality metrics.	8	15
UNIT-II	3	<b>Planning Software Project:</b> Cost estimation, uncertainties in cost estimation, building cost estimation models, on size estimation, COCOMO model, project scheduling, average duration estimation, project scheduling and milestones, staffing and personnel planning, rayleigh curve, personnel plan, team structure, software configuration management plans, quality assurance plans, verification and validation, project monitoring plans, risk management.	10	20
	4	<b>Coding</b> – programming practice, verification, size measures, complexity analysis, coding standards. <b>Testing</b> – fundamentals, white box testing, control structure testing, black box testing, basis path testing, code walk-throughs and inspection, testing strategies-Issues, Unit testing, integration testing, Validation testing, System testing.	08	15
UNIT-III	5	<b>Maintenance</b> -Overview of maintenance process, types of maintenance. <b>Risk management:</b> software risks - risk identification-risk monitoring and management. <b>Project Management concept:</b> People – Product-Process-Project.	8	15

UNIT-IV	6	<b>Project scheduling and tracking:</b> Basic concepts-relation between people and effort-defining task set for the software project-selecting software engineering task Software configuration management: Basics and standards User interface design - rules. Computer aided software engineering tools - CASE building blocks, taxonomy of CASE tools, integrated CASE environment.	08	20
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**Reference Books:**

1. Presman Roger, Software, Engineering: A Practitioner's Approach Tata McGraw Hill, New Delhi.
2. Jalote Pankaj, An Integrated Approach to Software Engineering Narosa, New Delhi
3. R.E. Fairly. Software Engineering Concepts. McGraw Hill, Inc 1985.
4. Poyce, Software Project Management, Addison-Wesly.
5. Sommerville , Software Engineering, Addison-Wesly.

<b>Branch: MSc-CS</b>	<b>Semester-I</b>
<b>Subject Code: 1103</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>DATA STRUCTURES AND ANALYSIS OF ALGORITHM</b>

Modules	Sr. No:	Topics and Details	No. of lectures assigne	Marks Weight age
UNIT-I	1	<b>Introduction:</b> Data types , ADT, data structure: Definition & classification Analysis of algorithms (recursive and non-recursive) with emphasis on best case, average case and worst case	4	10
UNIT-II	2	<b>Linear Data structures with applications:</b> <b>List:</b> Introduction, implementation using array & linked list (singly, doubly, circular, multi-list), Applications: Polynomial representation, Sparse matrix <b>Stack:</b> Introduction, implementation using array & linked list, Applications: Function call, Recursion, balancing of parenthesis, Polish Notation: infix to postfix conversion and evaluation of postfix expression <b>Queue:</b> Introduction (queue, circular queue, deque, priority queue), implementation using array & linked list, Applications: Job Scheduling.	12	25

UNIT-III	3	<p><b>Non Linear data structures:</b>  <b>Tree:</b> Introduction and representation, Forest, Tree traversal, Binary Tree (representation using array and links): Binary tree traversal (recursive &amp; non-recursive implementation), Expression tree  <b>Graph:</b> Introduction, representations, Traversal(BFS, DFS), Applications: Shortest path (Single source-all destinations), Minimal spanning tree (Prim's algorithm, Kruskal's algorithm)</p>	12	25
UNIT-IV	4	<p><b>Searching and Sorting:</b>  Linear Search, Binary Search, Transpose sequential search, Binary search tree, Heap tree (application in priority queue and sorting), AVL tree, Splay tree, M-way search tree, B tree (insertion), B+ tree (Definition and introduction), B* tree (Definition and introduction), Tries, Application of B tree and B+ tree in File Structures  <b>Hash Tables:</b> Introduction, hash functions and hash keys, Collisions, Resolving collisions, Rehashing  <b>Sorting with algorithm analysis</b> (best case, worst case, average): Bubble, Selection, Insertion, Shell, Merge, Quick, Heap, Radix</p>	14	30
	5	<p><b>NP-Completeness and the P &amp; NP Classes</b>  Introduction, Polynomial Time &amp; Verification, NP - Completeness and Reducibility, The Vertex Cover Problem, The Traveling Salesman Problem, The Set Covering Problem</p>	8	10

**Reference Books:**

- 1 Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2<sup>nd</sup> edition (2003)
- 2 G. A.V. PAI, "Data structures and algorithms, concepts, Techniques and Applications", 1<sup>st</sup> edition (2008)
- 3 Horowitz, Sahni, Anderson-Freed, "Fundamentals of Data Structures in C", University Press (2<sup>nd</sup> edition-2007)
- 4 Jean-Paul Tremblay, Paul G. Sorenson, "An Introduction to Data Structures with Applications", Tata McGraw-Hill, 2 Edition, (2007)
- 5 Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithm", PHI (2003),2<sup>nd</sup> Edition
- 6 Gilberg & Forouzan, "Data Structures: A Pseudo-code Approach with C", Thomson Learning
- 7 Parag Dave & Himanshu .Dave, "Design and Analysis of Algorithms", Pearson Education (2008)
- 8 Tanenbaum, "Data Structures Using C & C++", PHI.
- 9 Michel Goodrich, Roberto Tamassia, "Algorithm design-foundation, analysis &internet examples", Wiley
- 10 A V Aho, J E Hopcroft, J D Ullman, "Data Structures & Algorithms", Addison-Wesley Publishing (1983).
- 11 Michael Berman, "Data Structures Via C++: Objects by Evolution", Oxford Univ.Press (2004)

- 12 D E Knuth, "Sorting & Searching - The Art of Computer Programming",Vol. 3, Addison- Wesley Publishing (1973).
- 13 Seymour Lipschutz, "Data Structures with C" Mc Graw Hill, 2017.
- 14 Yashawant Kanetkar, Data Structures Through C,BPB publications.

<b>Branch: MSC-CS</b>	<b>Semester-I</b>
<b>Subject Code: 1104</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>Cyber Security</b>

<b>Modules</b>	<b>Sr.. No.</b>	<b>Topic and Details</b>	<b>No of Lectures Assigned</b>	<b>Marks Weight age %</b>
UNIT-I	1	<b>Introduction to Cyber Security</b> Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats:- Cyber Warfare-Cyber Crime-Cyber, terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace	4	10
	2	<b>Cyber Security Vulnerabilities and Cyber Security Safeguards</b> Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards-Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.	7	15
UNIT-II	3	<b>Securing Web Application, Services and Servers</b> Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.	7	15
	4	<b>Intrusion Detection and Prevention</b> Intrusion, Physical Theft, Abuse of Privileges, Unauthorized	8	15

		Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation		
UNIT-II11	5	<b>Cryptography and Network Security</b> Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.	8	15
	6	<b>Cyberspace and the Law</b> Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.	8	15
UNIT IV	7	<b>Cyber Forensics</b> Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.	8	15

**References:**

1. Digital Privacy and Security Using Windows: A Practical Guide By Nihad Hassan, Rami Hijazi, Apress
2. Cyber Crime Investigation, DSCI - Nasscom, 2013.
3. Information Systems Security: Security Management, Metrics, Frameworks And Best Practices (With Cd) : Nina Gobole
4. Information systems control and Audit by Ron Weber, Pearson Pub.
5. Information security policies, procedures and standards by Thomas Pettier.
6. Information security Management Hand book- 5th Edition-HAROLD F. TIPTON
7. Computer security by Alfred Basta, Wolf Halton
8. Information security policies- Thomas R.Peltier, Pel



<b>Branch: MSc-CS</b>	<b>Semester-I</b>
<b>Subject Code: 1105</b>	<b>Practical: 02 Credit: 02</b>
<b>Subject Title</b>	<b>DATA COMMUNICATIONS AND NETWORKING</b>

<b>Modules</b>	<b>Sr. No.</b>	<b>Topic and Details</b>	<b>No of Lectures Assigned</b>	<b>Marks Weight age %</b>
UNIT-I	1	<b>Introduction:</b> Computer Networks and its uses, Network categorization and Hardware : Broadcast and point-to-point networks, Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Networks (WAN), Inter networks, Topologies, Wireless Networks, Network Software : Protocols, Services, network architecture, design issues, OSI Reference model, TCP/IP Reference model, Comparison of OSI and TCP/IP Models. Introduction to Example Networks: Internet, Connection-Oriented Networks – X.25, Frame Relay, ATM	6	15
	2	<b>Data Communication Model,</b> Digital and Analog data and signals, bit rate, baud, bandwidth, Nyquist bit rate, Guided Transmission Media – Twisted Pair, Coaxial cable, Optical fiber; wireless transmission – Radio waves, microwaves, infrared waves; Satellite communication.	4	10
UNIT-II	3	<b>Switching :</b> Circuit Switching, Packet switching; Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Synchronous and Asynchronous TDM, Modems, Transmission impairments, Manchester and differential Manchester encoding.	6	15
	4	<b>Error Detection and Correction:</b> Types of errors Redundancy, Detection Versus Correction, Error Detection, Error Correction, Hamming Code, Cyclic Redundancy Check, Checksum and Its idea.	8	15
UNIT-III	5	<b>Data Link Layer Design issues:</b> Framing, error control, Flow Control, Error Detection and correction; Elementary Data Link Protocols, Sliding Windows Protocols; Medium Access Control: Aloha, CSMA protocols, Collision free protocols, Limited Contention Protocols; Wavelength division Multiple access protocol, Wireless LAN Protocol: MACA; IEEE 802.3 Ethernet, IEEE 802.4 Token Bus; IEEE 802.5 Token ring, Binary Exponential Backoff algorithm, Digital Cellular, Radio : Global System for Mobile	14	25

		Communication ( GSM), Code Division Multiple Access( CDMA)		
UNIT-IV	6	<b>Network Layer, Design issues</b> , Virtual circuit and Datagram Subnet, Routing Algorithms, Optimality principle, Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast and Multi Cast Routing, Routing for Mobile hosts, Routing in Adhoc Networks, congestion Control Algorithm, General Principals Traffic Shaping, Leaky Bucket, Token Bucket, choke packets, Load Shedding	12	20

**Reference Books:**

1. Behrouz A. Forouzan. Data Communications and Networking (4th Edition). McGraw Hill. ©2007. ISBN: 0-07-296775-7.
2. Data and Computer Communications, 10<sup>th</sup> ed., by William Stallings, Pearson
3. Computer Networks , Andrew S. Tanenbaum 5<sup>th</sup> edition.

<b>Branch: MSc-CS</b>	<b>Semester-I</b>
<b>Subject Code: 1201</b>	<b>PRACTICAL: 02 CREDIT: 02</b>
<b>Subject Title</b>	<b>DATA STRUCTURES AND ALGORITHM LAB</b>

Modules	Sr. No:	Topics and Details	No. of lectures assigned	Marks Weight age
UNIT-I	1	Implementation of linear data structure Array.	3	06
	2	Implementation of Searching and Sorting Algorithms	4	
UNIT-II	3	Implementation of linear data structure Linked List.	4	20
UNIT-III	4	Implementation of stack, queue, enqueue, dequeue.	4	
UNIT-IV	5	Implementation of Tree data structure.	6	24
	6	Graph: DFS, BFS.	4	

**Reference Books:**

1. Data Structures Using C and C++ : Langsam Y, PHI,2nd Ed.
2. Magnifying Data Structures : Arpita Gopal,PHI Learning.
3. Data Structures through C : Y.P. Kanetkar, BPB Publications, 2nd Ed

Branch: MSc-CS		Semester-I		
Subject Code: 1202		Practical: 02 Credit: 02		
Subject Title		Operating System Lab		
Modules	Sr. No:	Topics and Details	No: of lectures assigned	Marks Weight age %
UNIT-I	1	Installation of OS on Virtual Machine (VM, OracleBOX etc) <b>File Commands:</b> ls, cp, mv, rm, ln, cd, mkdir, rmdir, chown, chgrp, chmod, gzip, tar, updated, find. <b>Commands to Access File Contents:</b> cat, less, diff <b>File Systems: Mount, umount</b> <b>System Commands:</b> System Information:df, du , free, date	2	5
	2	<b>Processes:</b> top, ps, kill, killall <b>Network:</b> ping, nslookup, telnet Other: IOSTAT, SAR, Pstat, Netstat command and its parameters.	3	
UNIT-II	3	<b>The grep Family:</b> The grep Command, grep Examples with Regular Expressions, grep with Pipes, grep with Options, egrep (Extended grep), Fixed grep or Fast grep	5	20
UNIT-III	4	<b>Introduction to UNIX Shells:</b> Definition and Function, System Startup and the Login Shell, Processes and the Shell, The Environment and Inheritance, Executing Commands from Scripts. The Interactive Bourne Shell, The C Shell, The Korn Shell, The Interactive bash Shell Regular Expressions, Combining Regular Expression Metacharacters	5	5
UNIT-IV	5	<b>Programming with the bash Shell:</b> Introduction Section, Reading User Input, Arithmetic, Positional Parameters and Command Line Arguments, Conditional Constructs and Flow Control Section, Looping Commands, Functions Section , Trapping Signals, Debugging, Processing Command Line Options with getopts, The eval Command and Parsing the Command Line, bash Options, Shell Built-In Commands.	10	20

Reference Book:

1. "Unix Shell by Examples" 4th Edition, Ellie Quigley, Pearson Edition
2. "Sed&Awk", 2nd Edition, Dale Dougherty and [Arnold Robbins](#)
3. "Introduction to Unix and Shell Programming", Pearson Education, [M.G. Venkateshmurthy](#)
4. Advanced Linux Programming, Mark Mitchell, Jeffrey Oldham, and Alex Samuel, New Riders Publishing
5. Unix/Linux Programming by SumitabhaDass, PHP

## Semester-II

<b>Branch: MSc-CS</b>	<b>Semester-II</b>
<b>Subject Code:2101</b>	<b>Lecture:04 Credit:04</b>
<b>Subject Title</b>	<b>WEB TECHNOLOGY</b>

Modules	Sr. No.	Topic and Details	No of Lectures Assigned	Marks Weight age
UNIT-I	1	<p><b>Introduction to Web Technologies:</b> Concepts of Internet, Concepts of World Wide Web, Internet based Services-Email, Telnet, FTP, WWW. Web Server, Web Hosting, DNS, SMTP.</p>	2	25
	2	<p><b>HTML:</b> Introduction to HTML, Structure of HTML document, Basic HTML tags, attributes, Formatting tags, Meta Tags, Comments, Inserting Image, Image Maps, hyperlink, Tables, Lists, Frames, iframes, Marquee. HTML Form controls. Introduction to HTML5.</p> <p><b>Angular JS:</b> Environment Setup, Creating and executing angular js application, directives, controllers, expressions, filters, tables, modules, forms, views, scopes, services.</p>	8	
	3	<p><b>CSS:</b> Introduction to CSS, Types of CSS- Embedded Stylesheet, Inline Stylesheet, External StyleSheet, CSS Border, margin, Positioning, color, text, link, background, list, table, padding, image, display properties, Use of Id &amp; classes in CSS ,use of &lt;div&gt;&amp;&lt;span&gt; in CSS, Introduction of CSS3 : Gradients, Transitions, Animations, multiple columns.</p>	6	

Unit-II	4	<b>XML:</b> Introduction to XML, Valid and Well-Defined Document, Document Type Definition or DTD, uses of DTD, XML Tags, Elements, Attributes, PCDATA, CDATA, Basics of entities, XML Elements , Elements Declaration, usage of #REQUIRED , usage of #IMPLIED, usage of #FIXED, Internal Entities, External Entities, XML Schema, Defining, Accessing XML Document.	6	25
	5	<b>Client Side Scripting Language: Javascript</b> Introduction to javascript, Variables, identifiers constants in javascript, Types of Operators in javascripts, Control and looping structure, arrays in JavaScript, Event handling in javascript, JavaScript Objects-Number, Boolean, Strings, Arrays, Date, Math, Regular Expression, JavaScript Document Object Model (DOM), Window Object, Navigator Object, Location Object, History Object . <b>Validations in JavaScript.</b> <b>JQuery:</b> Introduction to JQuery, Selectors, attributes, Traversing, CSS, DOM, Events, AJAX, Effects, Interactions, Widgets, Theming.	10	
Unit-III	6	<b>Server Side Scripting Language: PHP</b> Configuration and Installation of PHP, Variables Types, Constants, Types of Operators, Arrays, Strings, Decision and Looping Statements. Processing HTML form using GET, POST, REQUEST, SESSION, COOKIE variables, Sending E-mail, Database Operations with PHP, Connecting to My-SQL, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables. CMS: Wordpress	10	25
Unit-IV	7	Introduction to CGI Programming, JSP, Servlet, AJAX. Creation of .jar project. Deployment of Java application on Appserver.	8	25

### References:

1. Beginning Web Programming with HTML, XHTML, CSS & JavaScript by JonDuckett,Wrox.
2. Webmaster in a Nutshell by Stephen Spainhour, O'Reilly andAssociates.

3. JavaScript: The Definitive Guide by David Flanagan, O'Reilly and Associates.
4. Beginning ASP 3.0 by David Buser and Others, Wrox.

Branch: MSc-CS		Semester-II		
Subject Code: 2102		Lecture: 04 Credit: 04		
Subject Title		COMPUTER ORGANIZATION AND ARCHITECTURE		
Modules	Sr. No.	Topic and Details	No of Lectures Assigned	Marks Weight age %
UNIT-I	1	<p><b>Introduction:</b> Brief history of computers, basic building blocks of computer, organization &amp; architecture, structure &amp; functions, evolution of computers, impact of VLSI on computer systems. Performance measure of Computer Architecture.</p> <p><b>Buses:</b> Concept of buses, types of buses, concept of system bus, , overview of various bus architectures used in computer, Peripheral Component Interconnect (PCI) bus, interconnection structures and bus interconnection, Bus control logic, bus arbitration techniques.</p>	8	15
UNIT-II	2	<p><b>Memory Organization:</b></p> <p><b>Internal memory:</b> Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAM and ROM, Allocation policies, Memory hierarchy and characteristics.</p> <p>Cache memory: Concept, architecture (L1, L2, L3), mapping techniques. Cache Coherency, Interleaved and Associative memory.</p> <p>Virtual Memory: Concept, Segmentation and Paging, Page replacement policies.</p> <p><b>External memory:</b> Construction and working principles of magnetic memories, magnetic disk, hard disk, magnetic tape, optical memory..</p>	8	20
UNIT-III	3	<p><b>I/O Devices:</b> Role of I/O devices in computer, overview of commonly used I/O devices such as keyboard, VDU, mouse. External devices, I/O module and its organization, various data transfer techniques – Programmed I/O, Interrupt driven I/O, Direct memory access (DMA), I/O channels and I/O Processors..</p>	8	25
	4	<p><b>Data Representation and Arithmetic Algorithms:</b></p> <p>Number representation: Binary Data representation, two's complement representation and Floating-point</p>	5	

		representation. IEEE 754 floating point number representation. Integer Data computation: Addition, Subtraction. Multiplication: Signed multiplication, Booth's algorithm. Division of integers: Restoring and non-restoring division, Floating point arithmetic: Addition, subtraction		
UNIT-IV	5	<b>Processor Organization and Architecture:</b> CPU Architecture, Register Organization, Instruction formats, basic instruction cycle. Instruction interpretation and sequencing. Control Unit: Soft wired (Micro-programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations, concepts of nano programming. Introduction to RISC and CISC architectures and design issues.	10	25
	6	<b>System Organization:</b> Use of computer in communication, serial communications and parallel communication, network topologies, LAN and WAN in brief, various ways to improve the speed of computer, concept of parallel processing, Flynn's classification of parallel computers, benefits of parallel processing, multiprocessing.	8	15

**Reference Books:**

1. William Stallings, Computer Organization and Architecture, 4<sup>th</sup> Edition, PHI, 1998
2. John P Hayes, Computer Architecture and Organization, 3<sup>rd</sup> Edition, McGraw Hill, 1998.
3. Dr. M. Usha, T. S. Srikanth, "Computer System Architecture and Organization", First Edition, Wiley- India.
4. Andrew C. Tanenbaum, Structured Computer Organization, 3<sup>rd</sup> Edition, PHI.
5. M. Morris Maw, Computer System Architecture, 3<sup>rd</sup> Edition, PHI, 1998.

**Reference Books:**

1. John P. Hayes, "Computer Architecture and Organization", Third Edition.
2. William Stallings, "Computer Organization and Architecture: Designing for Performance", Eighth Edition, Pearson.
3. B. Govindarajulu, "Computer Architecture and Organization: Design Principles and Applications", Second Edition, Tata McGraw-Hill.



<b>Branch: MSc-CS</b>	<b>Semester-II</b>
<b>Subject Code: 2103</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>DATABASE MANAGEMENT SYSTEMS</b>

<b>Modules</b>	<b>Sr. No.</b>	<b>Topic and Detail</b>	<b>No. of Lectures assigned</b>	<b>Marks Weight age %</b>
UNIT-I	1	<b>Introduction</b> : Database System Applications ,Database Systems versus File Systems, View of Data, Data Models, Database Languages, Database Users and Administrators, DBA Roles and activity, Database System Structure	2	20
	2	<b>Entity –Relational Model</b> : Basic Concepts, Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, Design of E-R Database Schema, Reduction of an E-R Schema to Tables.	2	
	3	<b>Relational Model</b> : Structure of Relational Databases, Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus	4	
UNIT-II	4	<b>SQL</b> : SQL commands, Functions, Data Constraints, Grouping Data, Subqueries, Joins, Performance Tuning, Security Management, PL/SQL, Triggers.	8	15
	5	<b>Integrity &amp; Security</b> : Domain Constraints, Referential Integrity, Assertions, Triggers, Privileges in SQL.	4	
	6	<b>Relational Database Design</b> : Functional Dependencies, Decomposition, Normalization – 1NF – 5NF , BCNF	4	
UNIT-III	7	<b>Storage &amp; File Structure</b> : RAID , Improvement of Reliability & Performance Indexing & Hashing – Basic Concepts, Ordered Indices, B+ & B Tree Index Files, Static & Dynamic Hashing , Comparison of Ordered Indexing & Hashing.	8	15
	8	<b>Transactions:</b> Transaction Concept & State, Implementation of Atomicity & Durability, Serializability, Recoverability, Testing for Serializability.	4	20
UNIT-IV	9	<b>Concurrency Control:</b> Protocols- Lock Based, Timestamp-based, Validation Based, Deadlock Handling & Concurrency	4	15

	10	<b>Recovery System</b> : Failure Classification, Storage Structure, Recovery & Atomicity, Log based Recovery, Shadow Paging, Recovery with Concurrent Transactions, Buffer management, failure with loss of nonvolatile storage, advanced recovery techniques.	4	
	11	<b>Object – Oriented Databases</b> : New Database Applications, Object – Oriented Data Model, Object-Oriented Languages, Persistent Programming Languages, Persistent C++ Systems	4	10
	12	<b>Introduction, Overview of NoSQL Databases</b> –Four Types of NoSQL (Document-oriented, Key/Value Pairs, Column-oriented and Graph).	2	5

### Reference Books:

1. Database System Concepts : Henry Korth, Silberschatz, Sudarshan 5<sup>th</sup> Edition, McGraw-Hill
2. Fundamentals of Database Systems: Elmasri&Navathe 3<sup>rd</sup> Edition , Pearson Education India, 01-Sep-2008 - 1168 pages
3. Database Management Systems; Raghu Ramakrishnan, Johannes Gehrke; McGraw-Hill International Edition, 2002 edition
4. Modern Database Management (Seventh Edition); Jeffrey A. Hoffer, Mary Prescott, Fred McFadden; Prentice Hall, 2004
5. Database systems: Design, Implementation and Management; Peter Rob, Carlos Coronel; Thomson Publication, 2004
6. Database Processing: Fundamentals, Design, Implementation (tenth Edition); D. M. Kroenke; Prentice-Hall, 2005
7. Data Base Principles Programming Performance (Second Edition); Patrick O.Neil; Morgan Kaufmann Publishers, Inc., 2000
8. Oracle 8i PL/SQL Programming : Scott Urman

<b>Branch: MSc-CS</b>	<b>Semester-II</b>
<b>Subject Code: 2104</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>DESIGN &amp; ANALYSIS OF ALGORITHMS</b>

<b>Modules</b>	<b>Sr.. No.</b>	<b>Topic and Details</b>	<b>No of Lectures Assigned</b>	<b>Marks Weight age %</b>
UNIT-I	1	Introduction : Algorithm, analysis, Time complexity and space complexity, O-notation, Omega notation and Theta notation	4	10
	2	Heaps and Heap sort , Sets and disjoint set , Union and find algorithms , Sorting in linear time, Tower of Hanoi	7	15
UNIT-II	3	Divide And Conquer, Divide and Conquer, General Strategy , Exponentiation. Binary Search, Quick Sort , Merge Sort	5	10
	4	Greedy Method , General Strategy, Knapsack problem , Job sequencing with Deadlines , Optimal merge patterns , Minimal Spanning Trees , Dijkstra's algorithm.	8	15
UNIT-III	5	Dynamic Programming , General Strategy , Multistage graphs , OBST, 0/1 Knapsack , Traveling Salesperson Problem , Flow Shop Scheduling	8	15
	6	Backtracking , Backtracking: General Strategy , N- Queen's problem , Graph Coloring	8	15
UNIT-IV	7	Branch and Bound , General Strategy, 0/1 Knapsack , Traveling Salesperson Problem ,	5	10
	8	NP-HARD AND NP-COMPLETE PROBLEMS Basic concepts, of NP-Hard And NP-Complete Problems (Only concepts should be covered)	5	10

**Reference Books:**

1. Bressard, "Fundamental of Algorithm." PHI
2. Horowitz/Sahani, "Fundamentals of computer Algorithms", Galgotia.
3. Magnifying Data Structures, ArpitaGopal : PHI Publications
4. Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithm" PHI
5. A. V. Aho and J.D. Ullman, "Design and Analysis of Algorithms", Addison Wesley

<b>Branch: MSc-CS</b>	<b>Semester-II</b>
<b>Subject Code: 2201</b>	<b>Practical: 04 Credit: 04</b>
<b>Subject Title</b>	<b>WEB TECHNOLOGY LAB</b>

<b>Modules</b>	<b>Sr. No:</b>	<b>Topics and Details</b>	<b>No.of Lectures/ Practicals assigned</b>	<b>Marks Weight age</b>
UNIT-I	1	Introduction to Web Technology, HTML, Basic Tags, CSS, Table and Forms	1	02
	2	Introduction to JavaScript, Variables, Operators, Data Type Conversions, functions, Control Structure, Date Time functions and Form Manipulation	2	08
	3	MYSQL – Introduction about Database, Data Types, DML, DDL, Aggregate functions, Data Time functions, Stored Procedure, Sub query and join	2	
	4	PHP-Introduction to PHP, History, Web Brower, Web Server, Xampp, Installation and Configuration files.	2	08
	5	Syntax, Operators, Variables, Constants, Control, Structure, Language construct and functions	2	
UNIT-II	6	Function – Syntax, Arguments, Variables, References, Returns and Variable Scope	2	12
	7	Arrays-Enumerated Arrays, Associative array, array iteration, Multi-dimensional array, Array function and SPL Date and Time functions.	2	
	8	OOP's – Instantiation, Modifiers, Inheritance, Interfaces, Exceptions, Static Methods and Properties, Auto load, Reflection, Type Hinting and Class Constance.	2	
UNIT-III	9	String and Patterns- Quoting, Matching, Extracting, Searching, Replacing and Formatting	2	4
	10	Web Features- Sessions, Forms, GET and POST data, Cookies, HTTP Headers. Database Programming.	2	4
	11	Streams and Network Programming- Files, Reading , Writing, File System functions, Streams File Uploading and File Downloading.	2	4

UNIT-IV	12	Ajax Basics, Sending data to PHP with Ajax, Prototype- Utility functions, Ajax object and Form Object. Smarty- variables, Variable Modifiers, Built-in Functions, custom functions, Config files.	2	4
	13	Introduction to Joomla	2	4
		CakePHP - MVC Overview, Naming Conventions, Model, V\view, Controller, Helpers, Scaffolding an Data Validation , Security , Web Services	1	2

<b>Branch: MSc-CS</b>	<b>Semester-II</b>
<b>Subject Code: 2202</b>	<b>Practical: 02 Credit: 02</b>
<b>Subject Title</b>	<b>DATABASE MANAGEMENT SYSTEMS LAB</b>

Modules	Sr. No:	Topics and Details	No: of lectures assigned	Marks Weight age %
UNIT-I	1	Database, Table Creation	2	05
	2	Defining Schema, Constraints, Normalisation	3	15
UNIT-II	3	SQL Basic Queries	2	10
	4	Joining, and Clauses implementation	2	
UNIT-III	5	Procedure, Function execution	4	20
	6	PL SQL Script Execution	4	
UNIT-IV	7	Stored Procedure , Function, Packages Execution	4	20
	8	Cursor, Trigger Writing	4	

References: 1. Oracle 8i The Complete Reference :Loney, Koch

<b>Branch: MSC-CS</b>	<b>Semester-II</b>
<b>Subject Code: 2111</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>Elective I SOFTWARE TESTING AND TOOLS</b>

<b>Modules</b>	<b>Sr No.</b>	<b>Topic Details</b>	<b>No. of Lectures Assigned</b>	<b>Marks Weight age</b>
UNIT-I	<b>1</b>	Software Testing Terminology and Methodology Software Testing Terminology, Software Testing Life Cycle, Writing a Policy for Software Testing, Economics of Testing, Testing – An organizational Issue, Management Support for Software Testing, Fig. of Software Testing Methodology, Risk associated with not meeting customer needs, Developing Test Strategy	4	14
	<b>2</b>	Overview of Software Testing Process Advantages of Following a Process, The Cost of Computer Testing, The Seven-Step Software Testing Process	3	
		Verification and Validation Verification and Validation (V&V) Activities, Verification, Verification of Requirements, Verification of High –level Design, Verification of Low –level Design, How to Verify Code?	3	10
	<b>3</b>	Static Testing Inspections, Structured Walkthroughs , Technical Reviews	2	
UNIT-II	<b>4</b>	Validation Activities Unit Validation Testing, Integration Testing, Function Testing, System Testing , Acceptance Testing	3	06
	<b>5</b>	Regression Testing Progressive vs. Regressive Testing, Regression Testing Produces Quality Software, Regression Testability, Objectives of Regression Testing, When is Regression Testing Done? , Regression Testing Types, Defining Regression Test Problem, Regression Testing Techniques	6	12
UNIT-III	<b>6</b>	Test Management Test Organization, Structure of Testing Group, Test Planning, Detailed Test Design and Test Specifications	4	8
	<b>7</b>	Software Metrics Need for Software Management, Definition of Software Metrics, Classification of Software Metrics, Entities to be Measured, Size Metrics	4	8

	<b>8</b>	Testing Metrics for Monitoring and Controlling the Testing Process Measurement Objectives for Testing, Attributes and Corresponding Metrics in Software Testing, Attributes, Estimation Models for Estimating Testing Efforts (include only topic Halstead Metrics), Test Point Analysis (TPA) – introduction only	5	10
UNIT-IV	<b>9</b>	Testing Process Maturity Models Need for Test Process Maturity, Measurement and Improvement of a Test Process, Test Process Maturity Models	4	8
	<b>10</b>	Automation and Testing Tools Need for Automation, Categorization of Testing Tools, Selection of Testing Tools, Cost Incurred in Testing Tools, Guidelines for Automated Testing, Overview of Some Commercial Testing Tools Testing Object Oriented Software Object- Oriented Testing	6	12
	<b>11</b>	Using Agile Methods to Improve Software Testing The importance of Agility, Building an Agile Testing Process, Agility Inhibitors, Is Improvement Necessary, Compressing Time, Challenges, Solutions , Measuring Readiness , The Seven-Step Process 4.5 Test Plan	6	12

**REFERENCE BOOKS:**

1. Software Testing Principles and Practices - By Naresh Chauhan, Oxford
2. Effective Methods of Software Testing (3rd Edition) - By William E Perry Wiley, India
3. Software Testing principles and practices- By Srinivasan Desikan, Gopalswamy Ramesh,Pearson Ed.
4. Software testing (2nd Edition) – By Ron Patton, Pearson Education
5. Effective Software Testing 50 specific ways to improve your testing- By Elfriede Dustin, Pearson Edu.

<b>Branch: MSc-CS</b>	<b>Semester-II</b>
<b>Subject Code: 2112</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>ELECTIVE I BIG DATA ANALYTICS</b>

<b>Modules</b>	<b>Sr. No.</b>	<b>Topic and Details</b>	<b>No. of lectures assigned</b>	<b>Marks Weight age</b>
UNIT-I	1	<p><b>INTRODUCTION TO BIG DATA AND HADOOP</b> Types of Digital Data, Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Echo System, IBM Big Data Strategy, Introduction to Infosphere BigInsights and Big Sheets.</p> <p><b>HDFS(Hadoop Distributed File System)</b> The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures</p>	15	25
UNIT-II	2	<p><b>Map Reduce</b> Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features</p>	10	25
UNIT-III	3	<p><b>Hadoop Eco System</b> Pig : Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive : Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. Hbase : HBasics, Concepts, Clients, Example, Hbase Versus RDBMS. Big SQL : Introduction</p>	15	25
UNIT-IV	4	<p><b>Data Analytics with R Machine Learning</b> : Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Big Data Analytics with BigR.</p>	10	25

#### Reference Books

1. Tom White "Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
2. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015. References
3. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
4. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
5. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with



- Oracle R Enterprise and Oracle R Connector for Hadoop”, McGraw-Hill/Osborne Media (2013), Oracle press.
6. Anand Rajaraman and Jeffrey David Ulman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
  7. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
  8. Glen J. Myat, “Making Sense of Data”, John Wiley & Sons, 2007
  9. Pete Warden, “Big Data Glossary”, O’Reily, 2011.
  10. Michael Mineli, Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley Publications, 2013.
  11. ArvindSathi, “BigDataAnalytics: Disruptive Technologies for Changing the Game”, MC Press, 2012
  12. Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

<b>Branch: MSC-CS</b>	<b>Semester-II</b>
<b>Subject Code: 2113</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>Elective I COMPUTER GRAPHICS</b>

Modules	Sr. No.	Topic and Details	No. of lectures assigned	Marks Weight age
UNIT-I	1	A Brief background about applications of Computer Graphics, Overview of Graphics Systems, Video display devices, Refresh cathode ray tubes, Raster and random scan displays, colour CRT monitors, Flat panel displays, LCDs. Design and architecture of raster scan and random scan display systems. A brief introduction to input devices and hardcopy devices. Output primitives, DDA and Bresenham’s 2D line drawing algorithms, Parallel line algorithms.	8	16
UNIT-II	2	Midpoint circle generating algorithm, Ellipse generating algorithm, Other curves, Filled area primitives, Scan line polygon fill algorithm, Inside outside test, Boundary fill algorithm, Flood fill algorithm, Character generation, Attributes of output primitive, line and curve attributes, Character attributes.	10	20
	3	Anti-aliasing, Two dimensional geometric transformations, Composite transformations, General Composite Transformations and Computational Efficiency, Other transformations, Affine transformation, Two dimensional viewing, Window to viewport coordinate transformation.	8	16

UNIT-III	4	Clipping operations, Cohen Sutherland line clipping, Liang Barsky line clipping, Nicholl-Lee-Nicholl line clipping, polygon clipping, Sutherland Hodgeman and Weiler Atherton Polygon clipping, Text and curve clipping. Three dimensional concepts, Display methods, polygon surfaces, quadric surfaces and super quadrics.	12	24
UNIT-IV	5	Three dimensional Geometric and Modelling Transformations, General three dimensional rotation, Three dimensional viewing pipeline, Projections, Parallel and perspective projection, View volume and general Projective transformation. Visible Surface Detection Methods, Back Face detection, Depth Buffer Method, A buffer method, Depth sorting method.	12	24

**Reference Books: -**

1. Donald Hearn and M. Pauline Baker, Second Edition, Prentice Hall of India, 1997.
2. J.D. Foley, A van Dam, S.K. Feiner, J.F. Hughes, Addison Wesley Publ. Company, 1997.
3. Jim Blinn, Jim Blinn's Corner: A trip Down the Graphics Pipeline, Morgan Kaufman, 2000.

<b>Branch: MSc-CS</b>	<b>Semester-II</b>
<b>Subject Code: 2114</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>ELECTIVE-I ENTERPRISE RESOURCE PLANNING</b>

Modules	Sr. No.	Topic and Details	No of Lectures Assigned	Marks Weight age
UNIT-I	1	<b>Introduction to Enterprise Resource Planning (ERP)</b> Information System and Its Components, Value Chain Framework, Organizational Functional Units, Evolution of ERP Systems, Role of ERP in Organization, Three-Tier Architecture of ERP system.	4	5
	2	<b>ERP and Implementation</b> ERP implementation and strategy, Implementation Life cycle, Pre implementation task, requirement definition, implementation	4	10
UNIT-II	3	<b>ERP Business Modules</b> Finance, manufacturing, human resources, quality management, material management, marketing, Sales distribution and service.	10	20

	4	Case study on Supply Chain management (SCM), Customer relationship Management (CRM)	4	10
UNIT-III	5	<b>Introduction to ERP related Technologies</b> Business Process Re-engineering (BPR) ,Data warehousing ,Data Mining, On- line Analytical Processing(OLAP), Product Life Cycle Management (PLM) Geographical Information Management ,RFID, QR Code ,Bar Coding, E-commerce and their application in Enterprise planning.	10	25
UNIT-IV	7	<b>Extended ERP and security issues</b> Enterprise application Integration (EAI), open source ERP, cloud ERP Managing ERP Securities: Types of ERP security Issues, System Access security, Data Security and related technology for managing data security	10	20
	8	<b>Case Studies and Presentations</b> – Case study to cover full enterprise layer with SCM, CRM and ERP combined with Enabled organization	8	10

**Reference Books:**

1. Alexis Leon, ERP Demystified: II Edition, Tata McGraw Hill.
2. Rajesh Ray, Enterprise Resource Planning, Text and cases, Tata McGraw Hill.
3. Sandeep Desai, Abhishek Srivastava, ERP to E2 ERP: A Case study approach, PHI.
4. Jyotindra Zaveri, Enterprise Resource Planning, Himalaya Publishing House, 2012.
5. V.K. Garg & N.K. Venkatakrishnan, Enterprise Resource Planning: concepts & practices, by ; PHI.
6. Supply Chain Management Theories & Practices: R. P. Mohanty, S. G. Deshmukh, - Dreamtech Press.
7. Enterprise wide resource planning: Theory & practice: by Rahul Altekar, PHI
8. Customer Relationship Management, Concepts and cases, Second Edition.

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3101</b>	<b>Lecture: 04</b> <b>Credit: 04</b>
<b>Subject Title</b>	<b>OBJECT ORIENTED PROGRAMMING WITH JAVA</b>

<b>Modules</b>	<b>Sr. No:</b>	<b>Topics and Details</b>	<b>No: of lectures assigned</b>	<b>Marks Weight age %</b>
UNIT-I	1	<b>Introduction to Java</b> : Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java..	8	10
	2	<b>Objects and Classes</b> : Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, StringBuffer, File, this reference.	8	20
UNIT-II	3	<b>Inheritance and Polymorphism</b> : Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.	10	20
UNIT-III	5	<b>Event and GUI programming</b> : Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing	12	25
	6	<b>I/O programming</b> : Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.	6	10
UNIT-IV	7	<b>Multithreading in java</b> : Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming.	6	15

**Reference Books:**

1. Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.
2. Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.

3. Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.
4. Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.
5. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.
6. Java Programming, D. S. Malik, Cengage Learning.

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3102</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>DATA WAREHOUSING AND DATA MINING</b>

Modules	Sr No.	Topic Details	No. of Lectures Assigned	Marks Weight age
UNIT-I	1	<b>Data Warehousing: Overview And Concepts:</b> Need for data warehousing, Basic elements of data warehousing, Trends in data warehousing.	2	08
	2	<b>Planning And Requirements:</b> Project planning and management, Collecting the requirements.	2	
	3	<b>Architecture And Infrastructure:</b> Architectural components, Infrastructure and metadata.	4	16
	4	<b>Data Design And Data Representation:</b> Principles of dimensional modeling, Dimensional modeling advanced topics, data extraction, transformation and loading, data quality.	4	
UNIT-II	5	<b>Information Access And Delivery:</b> Matching information to classes of users, OLAP in data warehouse, Data warehousing and the web.	4	16
	6	<b>Implementation And Maintenance:</b> Physical design process, data warehouse deployment, growth and maintenance.	4	
	7	<b>Data Mining: Introduction:</b> Basics of data mining, related concepts, Data mining techniques.	4	16
	8	<b>Data Mining Algorithms:</b> Classification, Clustering, Association rules.	4	
	9	<b>Knowledge Discovery : KDD Process</b> <b>Web Mining:</b> Web Content Mining, Web Structure Mining, Web Usage mining.	6	

UNIT-III	10	<b>Advanced Topics:</b> Spatial mining, Temporal mining. <b>Visualisation :</b> Data generalization and summarization-based characterization, Analytical characterization: analysis of attribute relevance, Mining class comparisons: Discriminating between different classes, Mining descriptive statistical measures in large databases	6	24
UNIT-IV	11	<b>Data Mining Primitives, Languages, and System Architectures:</b> Data mining primitives, Query language, Designing GUI based on a data mining query language, Architectures of data mining systems	6	20
	12	<b>Application and Trends in Data Mining:</b> Applications, Systems products and research prototypes, Additional themes in data mining, Trends in data mining	4	

### REFERENCE BOOKS:

1. Paulraj Ponnian, .Data Warehousing Fundamentals., John Wiley.
2. M.H. Dunham, .Data Mining Introductory and Advanced Topics., Pearson Education.
3. Han, Kamber, .Data Mining Concepts and Techniques., Morgan Kaufmann
4. Ralph Kimball, .The Data Warehouse Lifecycle toolkit., John Wiley.
5. M Berry and G. Linoff, .Mastering Data Mining., John Wiley.
6. W.H. Inmon, .Building the Data Warehouses., Wiley Dreamtech.
7. E.G. Mallach, .Decision Support and Data Warehouse systems., TMH.

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3103</b>	<b>Lecture: 04</b> <b>Credit: 04</b>
<b>Subject Title</b>	<b>RESEARCH METHODOLOGY</b>

Modules	Sr. No.	Topic and Details	No of Lectures Assigned	Marks Weight age
UNIT-I	1	Research methodology: An Introduction Objectives of Research, Types of Research, Research Methods and Methodology, Defining a Research Problem, Techniques involved in Defining a Problem.	4	08
	2	Research Design Need for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs, Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling.	6	12

UNIT-II	3	Measurement and Scaling Techniques Measurement in Research, Measurement Scales, Sources in Error, Techniques of Developing Measurement Tools, Scaling, Meaning of Scale, Scale Construction Techniques.	10	20
	4	Methods of Data Collection and Analysis Collection of Primary and Secondary Data, Selection of appropriate method Data Processing Operations, Elements of Analysis, Statistics in Research, Measures of Dispersion, Measures of skewness, Regression Analysis, Correlation.	8	18
UNIT-III	5	Techniques of Hypotheses, Parametric or Standard Tests Basic concepts, Tests for Hypotheses I and II, Important parameters limitations of the tests of Hypotheses, Chi-square Test, Comparing Variance, As a non-parametric Test, Conversion of Chi to Phi, Caution in using Chi-square test.	12	24
UNIT-IV	6	Analysis of Variance and Co-variance ANOVA, One way ANOVA, Two Way ANOVA, ANOCOVA Assumptions in ANOCOVA, Multivariate Analysis Technique Classification of Multivariate Analysis, factor Analysis, R-type Q Type factor Analysis, Path Analysis	10	20

**Reference books:**

1. "Research Methodology", C.R. Kothari, Wiley Eastern.
2. "Formulation of Hypothesis", Wilkinson K.P, L Bhandarkar, Himalaya Publication, Bombay.
3. "Research in Education", John W Best and V. Kahn, PHI Publication.
4. "Research Methodology- A step by step guide for beginners", Ranjit Kumar, Pearson
5. "Management Research Methodology-Integration of principles, methods and Techniques", K.N. Krishna swami and others, Pearson Education

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3104</b>	<b>Lecture: 04</b> <b>Credit: 04</b>
<b>Subject Title</b>	<b>MOBILE APPLICATION DEVELOPMENT USING ANDROID PROGRAMMING</b>

<b>Modules</b>	<b>Sr.No.</b>	<b>Topic and Details</b>	<b>No of Lectures Assigned</b>	<b>Marks Weight age</b>
UNIT I	1	What is Android, Android versions and its feature set The various Android devices on the market , The Android Market application store ,Android Development Environment - System Requirements, Creating Android Virtual Devices (AVDs)	5	10
UNIT II	2	Android Software Development Platform, The Directory Structure of an Android Project , Common Default Resources Folders , The Values Folder , Leveraging Android XML, Screen Sizes , Launching Your Application: The AndroidManifest.xml File ,Creating Your First Android Application	5	20
UNIT III	3	Android Application Components, Android Activities: Defining the UI, Android Services: Processing in the Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components Android Manifest XML: Declaring Your Components, Designing for Different Android Devices, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool	10	15
	4	Displaying Text with TextView, Retrieving Data from Users, Using Buttons, Check Boxes and Radio Groups, Getting Dates and Times from Users, Using Indicators to Display Data to Users, Adjusting Progress with SeekBar, Working with Menus using views, Gallery, ImageSwitcher, GridView, and	10	20



		ImageView views to display images, Creating Animation		
UNIT IV	5	Intent Overview, Implicit Intents, Creating the Implicit Intent Example Project, Explicit Intents, Creating the Explicit Intent Example Application, Intents with Activities, Intents with Broadcast Receivers, An Overview of Threads, The Application Main Thread, Thread Handlers, A Basic Threading Example, Creating a New Thread, Implementing a Thread Handler, Passing a Message to the Handler	10	20
	6	Sending SMS Messages Programmatically, Getting Feedback after Sending the Message Sending SMS Messages Using Intent Receiving, sending email, Introduction to location-based service, configuring the Android Emulator for Location-Based Services, Map-Based Activities Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures	10	15

### Reference Books

1. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, *Android Programming: The Big Nerd Ranch Guide*, Big Nerd Ranch LLC, *3rd edition*, 2017.
2. Christian Keur and Aaron Hillegass, *iOS Programming: The Big Nerd Ranch Guide*, *6th edition*, 2015.
3. Raoul-Gabriel Urma, Mario Fusco, and Alan Mycroft, *Java 8 in Action: Lambdas, Streams, and Functional-Style Programming*, Manning Publications, 2015.
4. Benjamin J. Evans and Martijn Verburg, *The Well-Founded Java Developer: Vital Techniques of Java 7 and Polyglot Programming*, Manning Publications, 2013.
5. Brian Fling, *Mobile Design and Development*, O'Reilly Media, 2009
6. Maximiliano Firtman, *Programming the Mobile Web*, 2nd ed., O'Reilly Media, 2013.
7. Christian Crumlish and Erin Malone, *Designing Social Interfaces*, O'Reilly Media, 2015.
8. Benjamin Muschko, *Gradle in Action*, Manning Publications, 2014.
9. Craig Larman, *Applying UML and Patterns: A Guide to Object-Oriented Analysis and Design and Iterative Development*, 3rd ed., Prentice Hall, 2004.

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3201</b>	<b>Practical: 02 Credit: 02</b>
<b>Subject Title</b>	<b>JAVA LAB</b>

Modules	Sr. No:	Topics and Details	No.of Lectures/ Practicals assigned	Marks Weight age
UNIT-I	1	Class	2	04
	2	Function Overloading	4	12
	3	Exceptional Handling	3	
UNIT-II	4	Multithreading	3	15
	5	Implementation of the URL, InetAddress.	3	
	6	JDBC,JSP, Servlet	2	04
UNIT-III	7	Java Beans, Implementation of JTrees, JTable	2	15
	8	Development and Deployment of Java APP on webserver, Appserver and Independent APP.	2	
UNIT-IV	9	Remote Method Invocation	2	

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3202</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>ANDROID PROGRAMMING LAB</b>

Modules	Sr. No:	Topics and Details	No.of Lectures/ Practicals assigned	Marks Weight age
UNIT-I	1	<b>Introduction to Android:</b> Basics, Setting up development environment, Dalvik Virtual Machine & .apk file extension, Fundamentals : a) Basic Building blocks – Activities,Services,Broadcast Receivers & Content providers b) UI Components- Views & notifications c) Components for communication -Intents & Intent Filters, Android API levels(versions & version names).	2	04

	2	<b>Application Structure(in detail)</b> AndroidManifest.xml, • uses-permission & uses-sdk • Activity/services/receiver declarations, Resources & R.java, Assets, Values – strings.xml Layouts & Drawable Resources, Activities and Activity lifecycle, First sample Application,Deploying sample application on a real device	3	10
UNIT-II	3	<b>Emulator-Android Virtual Device:</b> Launching emulator, Editing emulator settings, Emulator shortcuts, Logcat usage, Introduction to DDMS, File explorer,	2	
	4	Second App :- (switching between activities), Develop an app for demonstrating the communication between Intents <b>Basic UI design:</b> ,Form widgets, Text Fields, Layouts, • RelativeLayout ,TableLayout, FrameLayout, LinearLayout , Nested layouts, [dip,dp,sip,sp] versus px <b>Preferences</b> , SharedPreferences, Preferences from xml, Examples, <b>Menu</b> Option menu, Context menu, Sub menu, menu from xml, menu via code, Examples, <b>Intents (in detail)</b> , Explicit Intents, Implicit intents, Examples, <b>UI design</b> Time and Date, Images and media, Composite, AlertDialogs & Toast, Popup, Examples , <b>Tabs and TabActivity</b> , Examples, <b>Styles &amp; Themes</b> , styles.xml, colors.xml- declaring colors and drawables, Drawable resources for shapes, gradients(selectors), • Shapes drawables, • State drawables, Transition drawables, Patch drawables style attribute in layout file Applying themes via code and manifest file, Examples	4	16
UNIT-III		<b>SQLite Programming:</b> SQLite Programming, SQLiteOpenHelper, SQLiteDatabase, Cursor Content providers, • Defining and using content providers, • Example- Sharing database among two different applications using content, providers, Reading and updating Contacts, Reading bookmarks, Example : - Develop an App to demonstrate database usage. CRUD operations must be, implemented. Final details should be viewed in GridView as well as in, ListView., Do the same application with database operations in a single class(As a Model class) and do the CRUD operations with this class object	5	10

	5	<b>Android Debug Bridge(adb) tool Linkify</b> Web URLs,Email address,text,map address,phone numbers, MatchFilter & , ransformFilter, Examples <b>Adapters and Widgtes:</b> Adapters :-, a) ArrayAdapter, b) BaseAdapters, Example - Efficient Adapter , ListView and ListActivity, Custom listview, GridView using adapters, Gallery using adapters ,Examples <b>Notifications:</b> , Broadcast Receivers , Services and notifications, Toast, Alarms,Examples <b>Custom components :</b> Custom Toast, Custom dialogs, Custom Tabs, Custom animated popup , panels,Other components,Examples	3	
UNIT IV	6	<b>Threads:</b> Threads running on UI thread(runOnUiThread), Worker thread, Handlers & Runnable, AsyncTask(in detail), Examples	3	10
	7	<b>Advanced:</b> Live Folders, Using sdcards – Reading and writing, XML Parsing, JSON Parsing, Including external libraries in our application, Maps via intent and	3	

**Reference Books:**

1. Professional Android 2 Application Development Paperback, John Wiley & Sons, Inc. (10)  
Reto Meier

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3121</b>	<b>Lecture: 04</b> <b>Credit: 04</b>
<b>Subject Title</b>	<b>ELCTIVE II</b> <b>IMAGE PROCESSING</b>

Modules	Sr. No.	Topic and Details	No of Lectures Assigned	Marks Weight age
UNIT-I	1	Analog, discrete and digital signals, 1D, 2-D signals with examples. Discrete time signals: sequences, Discrete time systems LTI systems and their properties. Convolution and Correlation- need, methods and examples.	8	5
	2	<b>Introduction Digital Image Processing:</b> Introduction: Definition of digital image, generation of digital image, steps in digital image processing, 2D sampling, spatial and onal resolutions, pixel connectivity, Elements of digital image processing system.	10	10

	3	<b>Image enhancement in spatial domain</b> Point operations, Histogram Processing, Spatial Filtering, smoothing Sharpening, median, highboost.	8	10
UNIT-II	4	<b>Introduction to image in frequency domain</b> Concept of Basis Images, D.F.T. and its properties, two dimensional F.F.T. Filtering in the frequency domain: smoothening, sharpening and homomorphic filtering.	12	15
	5	<b>Image Segmentation</b> Detection of discontinuities, edge linking and Boundary detection, Hough Transform, thresholding region oriented segmentation.	12	15
	6	<b>Image representation and Description</b> Boundary descriptors: shape number, Fourier descriptors, Statistical moments, Regional descriptors	15	15
UNIT-III	7	<b>Image data compression:</b> Image data redundancies: coding, inter-pixel, psychovisual; Fundamentals of lossless compression: Arithmetic coding, Huffman coding, LZW coding, RLE, Bit plane coding, predictive coding. Lossy compression: JPEG, Subband coding, Vector Quantization, Image compression Standards. Fidelity criteria.	20	20
UNIT-IV	8	<b>Image morphology</b> Morphological operation: Dilation erosion , Opening & Closing, Hit or Miss Transform, Basic Morphological Algorithms	15	10

### Reference Books:

1. Gonzalez & Woods, Digital Image Processing, Pearson Education, Third Edition.
2. W. Pratt, Digital Image Processing, Wiley Publication, Fourth Edition, 2013.
3. J. G. Proakis and D. G. Manolakis, Digital Signal processing Principals, Algorithms and Applications, PHI publications, Third edition,
4. Milan Sonka , Digital Image Processing and Computer Vision, Thomson publication, Second Edition.2007.
5. A.K. Jain, Fundamentals of Image processing, Prentice Hall of India Publication, 1995
6. Gonzalez & Woods, Digital Image Processing using MATLAB, Pearson Education
7. S.Jayaraman, S Esakkirajan and T Veerakumar, Digital Image Processing ,McGraw Hill Education (India) Private Limited, New Delhi, 2009.
8. S.Sridhar, Digital Image Processing ,Oxford University Press, New Delhi, 2011.

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3122</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>ELCTIVE II DIGITAL FORENCICS</b>

<b>Modules</b>	<b>Sr. No.</b>	<b>Topic and Details</b>	<b>No of Lectures Assigned</b>	<b>Marks Weight age</b>
UNIT-I	01	<b>Introduction:</b> Introduction of Cybercrime: Types, The Internet spawns crime, Worms versus viruses, Computers' roles in crimes, Introduction to digital forensics, Introduction to Incident - Incident Response Methodology – Steps -Activities in Initial Response, Phase after detection of an incident.	09	10
UNIT-II	02	<b>Initial Response and forensic duplication</b> Initial Response & Volatile Data Collection from Windows system - Initial Response & Volatile Data Collection from Unix system – Forensic Duplication: Forensic duplication: Forensic Duplicates as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic.  Duplicate/Qualified Forensic Duplicate of a Hard Drive.	08	20
UNIT-III	03	<b>Preserving and Recovering Digital Evidence</b> File Systems: FAT, NTFS - Forensic Analysis of File Systems – Storage, Fundamentals: Storage Layer, Hard Drives Evidence Handling: Types of Evidence, Challenges in evidence handling, Overview of evidence handling procedure.	09	20
	04	<b>Network Forensics</b> Intrusion detection; Different Attacks in network, analysis Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing- Internet Fraud.	07	15
	05	<b>System investigation</b> Data Analysis Techniques - Investigating Live Systems (Windows & 08 Unix) Investigating	08	20

UNIT-IV		Hacker Tools - Ethical Issues – Cybercrime.		
	06	<b>Bodies of law</b> Constitutional law, Criminal law, Civil law, Administrative regulations, Levels of law: Local laws, State laws, Federal laws, International laws , Levels of culpability: Intent, Knowledge, Recklessness, Negligence Level and burden of proof : Criminal versus civil cases ,Vicarious liability, Laws related to computers: CFAA, DMCA, CAN Spam, etc.	09	15

**Reference Books:**

1. Kevin Mandia, Chris Prosise, “Incident Response and computer forensics”, Tata McGrawHill, 2006
2. Peter Stephenson, "Investigating Computer Crime: A Handbook for Corporate Investigations", Sept 1999
3. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition, 2001
4. Skoudis. E., Perlman. R. Counter Hack: A Step-by-Step Guide to Computer Attacks and Effective Defenses.Prentice Hall Professional Technical Reference. 2001
5. Norbert Zaenglein, "Disk Detective: Secret You Must Know to Recover Information From a Computer", Paladin Press, 2000
6. Bill Nelson, Amelia Philips and Christopher Steuart, “Guide to computer forensics investigation “Course technology, 4th edition

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3123</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>ELCTIVE II GEOGRAPHICAL INFORMATION SYSTEMS</b>

<b>Modules</b>	<b>Sr . No.</b>	<b>Topic Details</b>	<b>No. of Lectures Assigned</b>	<b>Marks Weightage</b>
UNIT-I	1	<b>Fundamentals of GIS:</b> Defining GIS, components of GIS, spatial data, spatial data- maps, characteristics, spatial data modeling, attribute data management-database data model, GIS applications and developments in database.	8	16
UNIT-II	2	<b>Input-Output and Data Analysis in GIS:</b> Data input and editing– methods, editing, integration, Data analysis-measurements, queries, reclassification, buffering, map overlay, interpolation, analysis of surfaces, network analysis, spatial analysis, Analytical modeling in GIS - physical, environment and human processes, output from GIS –maps, non-cartographic output, spatial multimedia, decision support.	15	30
UNIT-III	3	<b>Issues in GIS:</b> Development of computer methods for spatial data, Issues in GIS–data quality and errors, sources of errors, human and organizational issues, GIS project design and management– problem identification, designing a data model, project management, Implementation, evaluation, the future of GIS, Internet	15	30
UNIT-IV	4	<b>Remote Sensing:</b> Principles of remote sensing, remote sensing system-classification, Imaging, characteristics, extraction of information from images–metric and thematic, Integration of RS and GIS.	8	16
	5	<b>Global Positioning Systems (GPS):</b> Introduction to GPS, Accuracy of GPS, Differential GPS, Applications of GPS, Integration of GIS and GPS.	4	08

**Reference Books :**

1. An Introduction to Geographical Information Systems by Heywood, Cornelius and Carver (Person Education Asia 2000)
2. Concepts and techniques of Geographic Information Systems by C. P. Lo and Albert Yeung (PHI, New Delhi)
3. Fundamentals of Geographic information Systems 2<sup>nd</sup> Edition by Michael N. Demers (John Wiley & Sons (ASIA) Pte Ltd)



4. Kang-tsung Chang, "Introduction to Geographical Information Systems", Tata McGraw Hill, Third Edition, 2003.
5. ArcGIS Developer's Guide for Visual Basic Applications by Razvi (Onword Press, 2002).

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3124</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>ELCTIVE II INTERNET of THINGS</b>

Modules	Sr . No.	Topic Details	No. of Lectures Assigned	Marks Weightage
UNIT-I	1	Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs	6	10
	2	IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network	6	10
UNIT-II	3	Network & Communication aspects Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	16	30
	4	Challenges in IoT Design challenges, Development challenges, Security challenges, Other challenges	10	15
UNIT-III	5	Domain specific applications of IoT Home automation, Industry applications, Surveillance applications, Other IoT applications	6	10
UNIT-IV	6	Developing IoTs Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python	16	25

**Reference Books:**

1. Vijay Madiseti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Walteneus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

<b>Branch: MSC-CS</b>	<b>Semester-III</b>
<b>Subject Code: 3125</b>	<b>Lecture: 04 Credit: 04</b>
<b>Subject Title</b>	<b>ELCTIVE II MULTIMEDIA APPLICATIONS</b>

<b>Modules</b>	<b>Sr . No.</b>	<b>Topics and Details</b>	<b>No. of Lectures Assigned</b>	<b>Marks Weightage</b>
UNIT-I	1	Introduction to Multimedia What is multimedia, Hypermedia, Multimedia tools, Multimedia Authoring & its Tools, VERML, File Formats.	5	10
	2	Color in Images & Video Colour Models for Images & Videos, Video Signals, Digital Video, MIDI, Quantization, Transmission of Audio	5	10
UNIT-II	3	Compression Algorithms Lossless Compression , Introduction, Basics, RLC ,VLC, lossless Image Compression, Lossy Compression, introduction, Distortion, Rate Distortion Theory, Quantization	5	10
	4	Image Compression Standards JPEG standards, JPEG 2000 standards, JPEG –LS, standards, Bi-Level Image Compression Standards	5	10
	5	Video Compression Techniques Introduction, Motion Compensation ,Motion vectors, H.261& H.263,MPEG-1&MEPEG-2MPEG_4,MPEG-7,MPEG21	5	10
	6	Audio Compression ADPCM, Vocoders, Psychoacoustics, MPEG audio.	5	10
UNIT-III	7	Multimedia Network Applications Quality of Multimedia Data transmission, Multimedia over IP, Multimedia over ATM, Media on Demand, Multimedia over Wireless Network	6	10

		Multimedia Data bases		
	8	Design and Architecture of Multimedia Data base, Types, Organization, Medias Abstraction, Query Language.	7	10
	9	Frame Work for Multimedia Standards Introduction, Standard Activates, Standard to built a news Global Information Infrastructure, Standardization process on Multimedia Communication, ITU-I Mediacom 2004 Framework, ISO/MPEG -21, Framework, IETF Multimedia Internet Standards.	6	10
UNIT-IV	10	Application layer: Introduction, ITU applications, MPEG Application , Digital Broadcasting Applications, Universal multimedia access.	7	10

**Reference Books:**

1. Fundamentals of Multimedia by Ze-Nian Li& Mark.S.Drew
2. Introduction to Multimedia Communication, Application, Middleware, Networking by K.R.Roa, Zoran S,Bojkovic & Dragorad A. Milovanovic.
3. Multimedia systems by Thakker