

1.0 Nomenclature

- 1.1 *Academic Term*: Extent of time during which academic instructions are initiated and completed
- 1.2 *Academic Year*: Academic Term of, approximately, one year duration that usually starts in June/July and ends in April/May next
- 1.3 *Semester*: Either of two Academic Terms that make up an Academic Year
- 1.4 *Major*: A specific field of study
- 1.5 *Minor*: An area outside of, or complementary to, a Major
- 1.6 *Subject*: An area of knowledge that is studied as part of a Course
- 1.7 *Core*: A subject that is mandatory for a Major course of study
- 1.8 *Elective*: A subject that is selected for study to suit one's individual needs
- 1.9 *Audit Subject*: A subject that is studied to meet certain requirements but has no credits assigned to it
- 1.10 *Self-Study Subject*: A subject that is learnt by a student on own under the guidance of a Faculty member
- 1.11 *Humanities*: Subjects that describe and interpret human achievements, problems and historical changes at individual and societal levels covering the disciplines of literature, history, and philosophy
- 1.12 *Social Sciences*: Subjects that describe the mental and behavioural activities of individuals, groups, organizations, institutions, and nations covering the disciplines of anthropology, economics, linguistics, political science, and psychology
- 1.13 *Exam*: A test to measure one's progress, knowledge, or ability in a subject
- 1.14 *Credit*: A numerical weight given to a subject
- 1.15 *Grade*: A numerical or alphabetic designation measuring the level of achievement in an exam
- 1.16 *Attendance*: Physical presence of oneself in a classroom/laboratory for purpose of a scheduled academic instruction
- 1.17 *Course*: A series of subjects that constitute a Major field of study
- 1.18 *Branch*: Same as Course
- 1.19 *Program*: Same as Course
- 1.20 *Specialization*: Same as branch
- 1.21 *Degree*: An academic title conferred to honour distinguished achievement

2.0 Short Title and Application

- 2.1 These rules and regulations may be called as R14PG and come into force from Academic Year 2014-15 and exist until superseded by new regulations
- 2.2 These rules and regulations are applicable to all post graduate courses in engineering and technology leading to Master's Degree in Technology (M. Tech)
- 2.3 The Specializations offered, at present, are:
 - 2.3.1 Geotechnical Engineering
 - 2.3.2 Electrical Power Systems
 - 2.3.3 CAD & CAM
 - 2.3.4 Digital Electronics and Communication Systems
 - 2.3.5 Computer Science and Engineering
- 2.4 The Institute may offer new Specializations in future to which these rules and regulations will be applicable

3.0 Suspension and Amendment of Rules

- 3.1 Academic Council has the authority to suspend a rule temporarily
- 3.2 Academic Council has the authority to amend a rule
- 3.3 For affirmative action on any suspension or amendment of a rule, an affirmative vote of three-fifths of the members present and voting shall be required in Academic Council

4.0 Requirements for Admission

- 4.1 At present, admissions into first semester of various Specializations are governed by Government and the Affiliating University. The eligibility criteria and procedure for admission are prescribed by Government and Affiliating University
- 4.2 A student is not allowed change of Specialization after admission
- 4.3 A student must fulfil medical standards required for admission
- 4.4 The selected students are admitted into first semester after payment of the prescribed fees

5.0 Structure of the M. Tech course

- 5.1 Duration: The duration of M. Tech degree course is four semesters
- 5.2 Working Days: Calendar for any semester shall be announced at least four weeks before its commencement. Minimum number of working days is 90 per semester
- 5.3 Curriculum: Each Specialization shall have core, elective and audit subjects. The curriculum for each Specialization shall be approved by its corresponding Board of Studies and then by the Academic Council
- 5.4 Credits: All subjects that are assessed for marks have credits assigned to them. The credits assigned to subjects shall be given in curriculum. The total number of credits for entire course is 90 for all Specialization. The distribution of total credits semester-wise is given in Table 1

Table 1 Academic Term-wise Total Credits

Semester	Total Credits
First Semester	26
Second Semester	26

Third Semester	2
Fourth Semester	16
Total for entire course	70

- 5.5 The curriculum and syllabus is given in Annexure-1 and Annexure-2 respectively
- 5.6 Responsibility and Advising: It is the responsibility of the student to understand and know the regulations and requirements to earn the degree. Each student admitted in to the degree programs is assigned to a Faculty Advisor who assists the student in designing an effective program of study. Students should consult their Faculty Advisors for selection of electives and for general advice on academic program

6.0 Registration and Enrolment

- 6.1 Prior to opening of each semester, every student shall register for all the credit-bearing and audit subjects listed in curriculum of the term. Excepting first semester, the registration for a semester shall be done during a specified week after end examinations of previous semester. In first semester, the registration shall be done within six working days from date of opening. Recommendation of Faculty Advisor is needed for registration
- 6.2 A student can also register optionally for one self-study subject per semester that does not carry any credits. A student can take any subject of any specialization as self-study subject on the recommendation of concerned Faculty Advisor
- 6.3 Late registration will be permitted with a fine, decided from time to time, up to six working days from the last date specified for registration
- 6.4 A student will be eligible for registration for a semester if she or he i) is promoted to that semester, ii) has cleared all fees to the Institute, library and hostel of previous term, and iii) is not disqualified for registration by a disciplinary action of the Institute
- 6.5 A student will be enrolled and allowed to attend the classes on successful registration and payment of necessary fees to Institution, library, and hostel
- 6.6 Registration and enrolment will be controlled by the Office of the Controller of Examinations

7.0 Assessment Procedure – Internal Tests and End Examinations

- 7.1 Performance of students in all subjects is assessed continuously through internal assessment tests and an End examination
- 7.2 Allocation of internal assessment and End examination marks
- 7.2.1 For theory subjects, the allocation is 40 marks for internal assessment and 60 marks for End examination totalling 100 marks
- 7.2.2 For laboratory/drawing/project work subjects, the allocation is 50 marks for internal assessment and 50 marks for End examination totalling 100 marks
- 7.2.3 For seminar/viva voce/industrial training subjects' total 100 marks are allocated for internal assessment. There shall be no end examination for these subjects
- 7.2.4 For all audit subjects the allocation is 40 marks for internal assessment and no allocation for End examination
- 7.3 Internal Assessment Examinations

- 7.3.1 Internal assessment means performance evaluation of students by faculty members who teach the subjects
- 7.3.2 For theory subjects, including audit subjects, the internal assessment shall be done by midterm tests. For each subject, two midterm tests will be conducted for 40 marks each and the internal assessment mark is the better of two marks. If any student abstains for any midterm test, she or he will be awarded zero marks for that midterm test.
- 7.3.3 For laboratory/practical/drawing subjects, the internal assessment will be based on regular laboratory work over full term. The assessment will be done by the faculty concerned. The students shall be informed sufficiently early of the procedure to be followed for internal assessment
- 7.3.4 For self-study subjects, the assessment is through assignments, quizzes, seminars and viva-voce. The students shall be informed sufficiently early of the procedure to be followed for assessment
- 7.3.5 For subjects like seminar, project-work, industrial training, and comprehensive viva-voce, the internal assessment will be done by a concerned Department Committee consisting of two senior faculty members and faculty guide of concerned student. The assessment procedure will be informed sufficiently early to the students
- 7.4 End examinations
 - 7.4.1 End examinations shall be conducted after completion of coursework in each term
 - 7.4.2 The question papers for theory subjects shall be set by faculty members outside of the Institute. The external faculty members for question paper setting will be selected by the Principal
 - 7.4.3 Evaluation of answer scripts shall be done by faculty members from outside of the Institute selected by the Principal
 - 7.4.4 For laboratory subjects, end examination shall be conducted by a committee consisting of two internal examiners. One examiner shall be recommended by Head of Department of concerned Major, and the other examiner shall be appointed by the Principal
 - 7.4.5 For project work viva-voce, End examination shall be conducted by a committee consisting of one internal examiner, one external examiner, and the concerned guide of the student. Internal examiner shall be appointed by Head of Department of concerned Major, and the external examiner shall be appointed by the Principal
 - 7.4.6 If a student abstains from End examination of any subject, for any reason, she or he shall be awarded zero marks in that subject
 - 7.4.7 There is no end examination for self-study and audit subjects

8.0 Method of Assigning Letter Grades and Grade Points

- 8.1 For all credit-bearing subjects, performance of a student in a subject is indicated by a letter grade that corresponds to absolute marks earned in that subject. Each letter grade is assigned a numeric Grade Point that is used to compute Grade Point Average on a scale of 0 to 10
- 8.2 Performance of a student in both internal assessment and End examination will be considered for awarding grades for credit bearing subjects. Total marks earned in a subject is the sum of marks obtained in internal and End examinations in that subject

- 8.3 Pass grade A+ to D- is assigned to a subject based on total marks earned in that subject provided that a student earns at least i) 35% of marks in End examination marks and ii) 40% of marks in internal and End examination marks put together; otherwise fail grade F will be assigned to that subject
- 8.4 Grade I will be assigned to a subject if a disciplinary action is pending and is not resolved before publication of results. Office of Controller of Examinations shall resolve the pending disciplinary action within six working days from the date of publication of results and change the grade to any of A+ to D- or F
- 8.5 Grade X will be assigned to a subject if a student abstains for End examination of that subject
- 8.6 The absolute marks and corresponding letter grade and grade points are given in Table 2

Table 2 Letter Grades and Grade Points

Absolute Marks	Letter Grade	Grade Points	Remark
95-100	A+	10.0	Pass
90-94	A	9.5	Pass
85-89	A-	9.0	Pass
80-84	B+	8.5	Pass
75-79	B	8.0	Pass
70-74	B-	7.5	Pass
65-69	C+	7.0	Pass
60-64	C	6.5	Pass
55-59	C-	6.0	Pass
50-54	D+	5.5	Pass
45-49	D	5.0	Pass
40-44	D-	4.5	Pass
0-39	F	0.0	Fail
-	I	0.0	Result Withheld
-	X	0.0	Absent for End Exam

- 8.7 SGPA: Semester Grade Point Average indicates the performance of a student in all credit-bearing subjects of a term. SGPA is calculated as the weighted average of Grade Points of all subjects of the term with corresponding credits of subjects as weights. Audit and self-study subjects are not considered for SGPA calculation
- 8.8 CGPA: Cumulative Grade Point Average indicates the performance of a student in all terms up to and including the current term under consideration. CGPA is calculated as the weighted average of SGPAs with total credits in each term as the weights
- 8.9 Grade Card: All students shall be issued Grade Cards after the publication of results of a term. Grade Card is a statement of performance of a student in a term. It

contains information about each registered subject: type of subject, allocated credits, and letter grade earned. SGPA and CGPA will also be indicated

9.0 Requirements for Completing Subjects

- 9.1 A student shall complete all credit-bearing and audit subjects successfully to be eligible for award of degree
- 9.2 Credit-bearing subjects: A student is considered to have completed a credit-bearing subject successfully and earned credits if she or he obtains a pass grade from A+ to D- in that subject. If a student receives fail grade F or X in any subject, she or he must register for supplementary End examination for that subject as and when opportunity arises and improve grade to pass grade
- 9.3 Audit subjects: A student is considered to have successfully completed an audit subject if she or he earns at least 40% of marks in internal assessment marks. A student may request for makeup tests to satisfy this requirement by paying requisite fee
- 9.4 Self-study subjects: Based on internal assessment, the faculty guide concerned will certify whether a student has successfully completed the subject or not. Grade card will list successfully completed self-study subjects

10.0 Requirements for taking End Examinations

- 10.1 A student is eligible to take regular End Examinations of current semester if she or he full fills the attendance requirement
- 10.2 A student shall be promoted from current term to succeeding term on satisfying the attendance requirement
- 10.3 A student shall complete all credit-bearing and audit subjects successfully before taking End examination for project viva-voce
- 10.4 Attendance Requirement
 - 10.4.1 Attendance of students shall be recorded for credit-bearing and audit subjects as per the workload indicated in curriculum
 - 10.4.2 Total class-periods conducted shall be reckoned from beginning to end of a term as published in academic calendar
 - 10.4.3 Aggregate Percentage of Attendance is calculated using total number of class-periods attended as numerator and total number of class-periods conducted for the concerned class as the denominator
 - 10.4.4 A minimum aggregate attendance of 75% is required for promotion to succeeding term
 - 10.4.5 A student can appeal to Academic Council for condoning deficiency in aggregate attendance if she or he gets 65% or more aggregate attendance presenting a valid reason for deficiency. Such a student will be granted promotion if Academic Council pardons the deficiency. Academic Council has the right to reject the appeal if it is not satisfied with the performance of the student or the reason cited for deficiency of the attendance
 - 10.4.6 A student earning less than 65% aggregate attendance will be denied promotion. A student who is not promoted on basis of attendance shall be removed from the rolls and shall register for the same term when opportunity arises. The current term record of the student is cancelled automatically
- 10.5 A student can forego promotion and opt to repeat the current term on written request. Recommendation of the concerned Faculty Advisor is required for

cancellation of promotion. This option shall be exercised before the commencement of the End examinations of the current term^s

11.0 Revaluation of End Examination Scripts

- 11.1 Revaluation of End Examination scripts is allowed for theory subjects only by paying requisite fee
- 11.2 A Procedure for Revaluation: The current valuation is annulled and the script will be sent for revaluation by an external examiner appointed by the Principal. Marks obtained in the revaluation will be awarded for that subject
- 11.3 A student can apply for revaluation in a subject only once

12.0 Supplementary End Examinations

- 12.1 Students are eligible to take Supplementary examinations in subjects with fail grade F or X only
- 12.2 Supplementary examinations for even semester subjects will be conducted with regular examinations of odd semester subjects and vice versa
- 12.3 A student will be allowed to improve grade in any theory subject provided she or he has completed coursework of all terms but before award of provisional/final degree^s

13.0 Requirements for Award of M. Tech degree

- 13.1 Time Limit for completion of requirements for award of degree is four calendar years from the date of admission. A student who could not complete all the requirements in this time limit shall forego admission and will be removed from the rolls of the Institute
- 13.2 A student shall be eligible for award of degree provided she or he has:
 - 13.2.1 Registered and successfully completed all required credit-bearing and audit subjects with a total of 70 credits
 - 13.2.2 Secured a CGPA of 4.5 or more
 - 13.2.3 Cleared all dues to the Institute, library and hostel
 - 13.2.4 No disciplinary action is pending against her or him
 - 13.2.5 Satisfied any other stipulation of the affiliating University
- 13.3 Award of Class: Each student will be given class in degree based on CGPA as given in Table 3

Table 3 Class of Degree

Class of Degree	Range of CGPA
Pass Class	≥ 4.5 but < 5.5
Second Class	≥ 5.5 but < 6.5
First Class	≥ 6.5 but < 7.5
First Class with Distinction	≥ 7.5

- 13.4 Consolidated Grade Card and Degree will issued under the seal of affiliating University

14.0 Transitory Regulations

- 14.1 A student who initially joins the Institute in a previous Regulation and has to rejoin in an academic-term of the present Regulations, due to any reason, shall be bound by the rules of the current Regulations. Board of Studies of the concerned Major will specify, extra or otherwise, academic coursework to be undertaken by such students who rejoin the current Regulations

^s Decision is pending on this clause

Course Structure for M.Tech.**COMPUTER SCIENCE & ENGINEERING****I Year I Semester**

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1.	14551101	Advanced Data Structures	PJ	4	0	0	40	60	4
2.	14551102	Advanced Software Engineering	PJ	4	0	0	40	60	4
3.	14551103	Advanced Computer Architecture	PJ	4	0	0	40	60	4
4.	14551104	Cloud Computing	PJ	4	0	0	40	60	4
5.	14551105	Advanced Computer Networks	PJ	4	0	0	40	60	4
6.		Elective -1	PJ	4	0	0	40	60	4
	14551106	1. Pythan Programming							
	14551107	2. Java & Web Technologies							
	14551108	3. Image Processing							
7.	14551109	Software Lab-1	PJ	0	0	3	50	50	2
		Total:		24	0	3	290	410	26

COMPUTER SCIENCE & ENGINEERING

I Year II Semester

S.No.	Subject Code	SUBJECT	SC	L	T	P	IM	EM	CR
1.	14551201	Advanced Database Management Systems	PJ	4	0	0	40	60	4
2.	14551202	Distributed Systems	PJ	4	0	0	40	60	4
3.	14551203	Data Warehousing & Data Mining	PJ	4	0	0	40	60	4
4.	14551204	Object Oriented Analysis and Design	PJ	4	0	0	40	60	4
5.	14551205	Big Data Analytics	PJ	4	0	0	40	60	4
6.		Elective-2	PJ	4	0	0	40	60	4
	14551206	1. Software Quality Assurance and Testing							
	14551207	2. Network Security & Cryptography							
	14551208	3. Wireless Sensor Networks							
7.	14551209	Software Lab-2	PJ	0	0	3	50	50	2
		Total:		24	0	3	290	410	26

II Year (III & IV SEMESTERS)

S.No.	Course Code	Subject	Internal Marks	External Marks	Credits
1.	14552101	Seminar	100	--	2
2.	14552201	Project Work	50	50	16

(14551101) ADVANCED DATA STRUCTURES

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UNIT I

Overview of Data Structures: Review of Arrays, Stacks, Queues, linked lists, Linked stacks and Linked queues, Applications

Algorithm Analysis: Efficiency of algorithms, Apriori Analysis, Asymptotic Notations, Time complexity of an algorithm using O notation, Polynomial Vs Exponential Algorithms, Average, Best, and Worst Case Complexities

UNIT II

Trees and Graphs: Introduction, Definition and Basic terminologies of trees and binary trees, Representation of trees and Binary trees, Binary tree Traversals, Graphs-basic concepts, representation and traversals.

Binary Search Trees, AVL Trees and B Trees: Introduction, Binary Search Trees: Definition, Operations and applications. AVL Trees: Definition, Operations and applications. B Trees: Definition, Operations and applications.

UNIT III

Red – Black Trees, Splay Trees and Hash Tables: Red–Black Trees, Splay Trees and its applications.

Hash Tables: Introduction, Hash Tables, Hash Functions and its applications.

UNIT IV

Fundamental File Structure Concepts: Field and Record organization, Using Classes to manipulate Buffers, Record Access, More about Record Structures, File Access and File organization.

UNIT V

Managing Files of Records: Record Access, More about Record Structures, Encapsulating Record I/O Operations in a Single Class, File Access and File Organization, **Indexing:** Introduction, A simple Index for entry sequenced Files, Object oriented support for Indexed, Entry sequenced Files of data objects, Indexing to provide access by multiple keys.

TEXT BOOKS:

1. Data Structures and Algorithms by G.A.V. Pai, 2009, TMH.
2. File Structures- An Object Oriented Approach with C++, Michael J. Folk, Greg Riccordi, Bill Zoellick, Third Edition, Pearson.

REFERENCE BOOKS:

1. Data Structures and Algorithms in C++ by Drozdek 2nd Edition, Thomson

(14551102) ADVANCED SOFTWARE ENGINEERING

L T C
4 0 4

UNIT I

Software, Software Engineering, and Process: The nature of Software, Software engineering- A layered technology, Generic process model (framework), Process patterns, Process assessment and improvement, CMMI, Software myths.

Process Models: Prescriptive process models: The waterfall model, Incremental process models, Evolutionary process models. The Unified process, Aspect oriented software development, Agile development: Agile process, Extreme programming.

UNIT II

Software Requirements: Introduction to functional and non-functional requirements, Requirements engineering activities, Eliciting requirements, *Requirements modeling*, Requirements validation, Software requirements specification(SRS), Requirements management.

Design Concepts: Software design quality guidelines and attributes, Design concepts.

UNIT III

Software Architecture: Architecture and its importance, Architectural Styles, Data design, Architectural design.

Design: Structured view (Traditional view): Architectural mapping using data flow (Call and return architecture), Interface design, Function based component design.

Object oriented view: OO Architecture, Class hierarchies, Message design, Class based component design.

UNIT IV

Performing User Interface Design: Golden rules, User interface analysis and design, interface analysis, interface design steps.

Pattern Based Design: Design patterns, Pattern based software design, Architectural patterns, Component level design patterns, User interface design patterns.

UNIT V

Testing: Software testing strategies: A strategic approach to software testing, Test strategies (Unit testing and integration testing) for conventional and object oriented software, Validation testing, System testing, the art of debugging.

Testing Conventional Applications: Software testing fundamentals, White-Box testing: basis path testing, condition (predicate) testing, data flow testing, loop testing, Black box testing: Equivalence partitioning, Boundary value analysis, Graph based testing methods.

Testing Object Oriented Applications: OO testing methods, Testing methods applicable at class level, Interclass test case design.

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 7th edition. McGraw Hill International Edition.
2. Software Engineering- Sommerville , 7th edition, Pearson education.

REFERENCES:

1. Software Engineering- K.K. Agarwal & Yogesh Singh, New Age International .Pub.
2. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiely.
3. Systems Analysis and Design- Shely Cashman Rosenblatt, Thomson Publications.
4. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.

(14551103)ADVANCED COMPUTER ARCHITECTURE

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UNIT I

Register Transfer and Micro Operations: Register Transfer language. Register Transfer, Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro operations, Arithmetic Logic Shift Unit.

UNIT II

Microprogrammed Control: Control Memory, Address Sequencing, Microprogram example, Design of Control Unit.

Central Processing Unit: STACK organization. Instruction formats, Addressing modes, Program Control.

UNIT III

Pipelining and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipelining, Instruction Pipelining, RISC Pipelining, Vector Processing, Array Processors.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory, Virtual Memory.

UNIT IV

Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, SIMD Computer Organizations, The Connection Machine CM-5.

UNIT V

Scalable, Multithreaded, and Dataflow Architectures: Latency-Hiding Techniques, Principles of Multithreading, Fine-Grain Multi computers, Scalable and Multithreaded Architectures, Dataflow and Hybrid Architectures

TEXT BOOKS:

1. Computer Systems Architecture – M.Moris Mano, IIIrd Edition, Pearson/PHI
2. Advanced computer architectures- parallelism, scalability, programmability – Kai Hwang, Tata McGraw-Hill Edition-2001

(14551104) CLOUD COMPUTING

L T C
4 0 4

UNIT I

UNDERSTANDING CLOUD COMPUTING: Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services.

UNIT II

DEVELOPING CLOUD SERVICES: Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds

UNIT III

CLOUD COMPUTING FOR EVERYONE: Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.

UNIT IV

USING CLOUD SERVICES: Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files.

UNIT V

OTHER WAYS TO COLLABORATE ONLINE: Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

TEXT BOOKS:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.
2. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

(14551105) ADVANCED COMPUTER NETWORKS

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UNIT I

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

Networking Devices: Multiplexers, Modems and 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.

Routing and Internetworking :- Network-Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intradomain Routing Protocols, Interdomain Routing Protocols, Congestion Control at Network Layer. Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intradomain Multicast Protocols, Interdomain Multicast Protocols, Node-Level Multicast algorithms.

UNIT III

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)

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

UNIT IV

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.

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

UNIT V

Mobile A-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, *Nader F. Mir*, Pearson Education, 2007

REFERENCES:

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.

(14551106) PYTHON PROGRAMMING

(Elective-1)

L	T	C
4	0	4

UNIT I

Introduction, Features, Input/output, Operators, Variables and Assignment, Statements and Syntax, Identifiers, Basic Style Guidelines, Memory Management.

UNIT II

Python Objects: Python Objects, Built-in Types, Standard type operators, Standard type Built-in functions, **Sequences:** Introduction to sequences, Strings, Lists, Tuples.

UNIT III

Mapping Type: Dictionaries: Operators, Built-in functions, Built-in methods, Dictionary keys, Set Types: Operators, Built-in functions, Built-in methods, **Conditional and Loops:** If statement, Else statement, Elif statement, For statement, Break statement, Continue statement, Pass statement, Else statement...Take Two, Iterators.

UNIT IV

Files and Input/Output: File Objects: File Built-in functions, File Built-in methods, File Built-in attributes. Standand Files, Command Line Arguments, File System, File Execution.

Errors and Exceptions: Exceptions in Python, Detecting & Handling Exceptions, Context Management, Raising Exceptions, Assertions, Standard Exceptions, Creating Exceptions.

UNIT V

Functions and Functional Programming: Calling Functions, Creating Functions, Passing Functions, Formal Arguments, Variable Length Arguments, Functional Programming, Variable Scope, Recursion, Generators. **Modules:** Modules and Files, Name Spaces, Importing Modules, Importing Module Attributes, Module Built-in functions, Packages.

TEXT BOOKS:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.

REFERENCE BOOKS:

1. Programming with PYTHON, Michael Dawson, India Edition.
2. Programming PYTHON, Mark Lutz, SPD O'REILLY.

(14551107) JAVA AND WEB TECHNOLOGIES

(Elective-1)

L	T	C
4	0	4

UNIT I

HTML Common tags- Introduction, HTML Basics: Text, Colors, Links, Images, Forms: Text Area, Check Box, Radio Button, Button, Menus, Frames, List, Tables

UNIT II

JAVA Script: Introduction, Basics of Java Script, Control Structures, Pop up Boxes, Functions, Arrays, Events, Objects , Dynamic HTML: Introduction, Cascading Style Sheets (CSS).

UNIT III

Review of Applets, Class, Event Handling, AWT Programming, Introduction to Swings: JApplet, Handling Swing controls like icons, Labels, Buttons, Text Boxes, Combo Boxes

UNIT IV

Web Servers and Servlets: Tomcat Server Installation & Testing, Introduction to Servlets, Deployment of Servlets, Life cycle of a servlet, HTTP-GET and POST Requests, Session Tracking, Cookies.

UNIT V

JDBC: Database Access, JDBC Architecture, Introduction to JSP: Introduction, Advantages of JSP, The problem with Servlet, The anatomy of JSP page, JSP Processing.

TEXT BOOKS:

1. Web Technologies, A.A Puntambekar, Technical Publications
2. Java The Complete Reference, Herbert Schildt, TMH

REFERENCE BOOK:

1. Web Technology , N.P. Gopalan, J. Akilandeswari, PHI

(14551108) IMAGE PROCESSING
(ELECTIVE-I)

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UNIT I

Elements of visual perception:

Image sampling and quantization Basic relationship between pixels –Basic geometric transformations-Introduction to Fourier Transform and DFT – Properties of 2D Fourier Transform – FFT – Separable Image Transforms -Walsh – Hadamard – Discrete Cosine Transform.

UNIT II

Spatial Domain methods:

Basic gray level transformation – Histogram equalization – Image subtraction – Image averaging –Spatial filtering: Smoothing, sharpening filters – Laplacian filters – Frequency domain filters: Smoothing –Sharpening filters – Homomorphic filtering Model of Image Degradation/restoration process – Noise models – Inverse filtering -Least mean square filtering – Blind image restoration.

UNIT III

Lossless compression:

Variable length coding – LZW coding – Bit plane coding. Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG.Edge detection – Thresholding- Region Based segmentation – Boundary representation: chain codes-Polygonal approximation – Boundary segments. Ref. Books

UNIT IV

Introduction:

Machine perception , pattern recognition example, pattern recognition systems, the design cycle.

Bayesian Decision Theory: Introduction, continuous features – two categories classification , minimum error rate classification, zero-one loss function, classifiers, discriminate functions.

UNIT V

Normal density:

Univariate and multivariate density, discriminant functions for the normal density, Bayes decision theory – discrete features, compound Bayesian decision theory and context. **Maximum likelihood and Bayesian parameter estimation:** Introduction, maximum likelihood estimation, Bayesian Estimation, Bayesian parameter estimation –Gaussian Case.

TEXT BOOKS :

1. Digital Image Processing, Rafael C Gonzalez, Richard E Woods 2nd Edition,. Pearson Education 2003
2. Pattern classification, Richard O. Duda , Peter E.Hart , David G.Stroke. Wiley student edition. Second Edition

REFERENCE BOOKS :

1. Image Processing Analysis and Machine Vision – Millman Sonka, Vaclav hlavac, Roger Boyle, Thompson Learning (1999).
2. Fundamentals of Digital Image Processing, A.K. Jain, PHI
3. Digital Image Processing and Applications, Chanda Dutta Majumdar, Prentice Hall of India, 2000.
4. Pattern Recognition and Image Analysis – Earl Gose, Richard John baugh. Steve Jost PHI 2004.

(14551201) ADVANCED DATABASE MANAGEMENT SYSTEMS

L T C
4 0 4

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 Application 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 – Lock Conversions, Dealing with deadlocks, 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 Indexing, 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 Recovery.

TEXT BOOKS:

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TMH, 3rd Edition, 2003.
2. Introduction to Database Systems, C.J.Date, Pearson Education.

REFERENCE BOOKS:

1. Data base System Concepts, A.Silberschatz, H.F.Korth, S.Sudarshan, McGraw hill, VI edition, 2006.
2. Fundamentals of Database Systems 5th edition. Ramez Elmasri, Shamkant B.Navathe, Pearson Education, 2008.
3. Database Management System Oracle SQL and PL/SQL, P.K.Das Gupta, PHI.
4. Database System Concepts, Peter Rob & Carlos Coronel, Cengage Learning, 2008.
5. Database Systems, A Practical approach to Design Implementation and Management Fourth Edition, Thomas Connolly, Carolyn Begg, Pearson education.
6. Database - Principles, Programming, and Performance, P.O'Neil&E.O'Neil, 2nd ed., ELSEVIER.

(14551202) DISTRIBUTED SYSTEMS

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UNIT I

Introduction of Distributed System: Goals, Hardware Concepts, Software Concepts, the Client-Server Model.

Communication: Remote Procedure Call, Remote Object Invocation, Message Oriented Communication, Stream-Oriented Communication.

UNIT II

Processes: Threads, Clients, Servers, Code Migration, Software Agents.

NAMING: Naming Entities, Locating Mobile Entities.

UNIT III

Synchronization: Clock Synchronization, Logical Clocks, Global State, Election Algorithms, Mutual Exclusion, Distributed Transactions.

Consistency And Replication: Introduction, Data-Centric Consistency Models, Client Centric Consistency Models, Distribution Protocols, Consistency Protocols, Examples.

UNIT IV

Fault Tolerance: Introduction to Fault Tolerance, Process Resilience, Reliable Client-Server Communication, Reliable Group Communication, Distributed commit, Recovery.

UNIT V

Distributed Object-Based Systems: CORBA, Distributed COM.

Distributed File Systems: SUN Network File System, The CODA File System, Other Distributed File Systems, Comparison of Distributed File Systems.

TEXT BOOKS:

1. Andrew S. Tanenbaum, Maarten Van Steen. Distributed Systems- Principles and Paradigms 2/e, Pearson.

REFERENCES:

1. Pradeep K. Sinha, "Distributed Operating Systems Concepts and Design", PHI 2002.
2. Randy Chow Theodore Johnson, "Distributed Operating Systems and Algorithm Analysis", PEA, 2009.
3. George Couloris, Jean Dollimore, Tim Kind berg, "Distributed Systems Concepts and Design", 3/e, PEA, 2002.

(14551203) DATA WAREHOUSING AND DATA MINING

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4 0 4

UNIT I

Introduction - What Is Data Mining?, What Kinds of Data Can Be Mined?, What Kinds of Patterns Can Be Mined?, Which Technologies Are Used?, Major Issues in Data Mining. .

Getting to Know Your Data - Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.

UNIT II

Data Preprocessing - An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data Warehousing and Online Analytical Processing - Data Warehouse: Basic Concepts, Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

UNIT III

Data Cube Technology - Data Cube Computation: Preliminary Concepts, Data Cube Computation Methods .

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods - Basic Concepts , Frequent Itemset Mining Methods , Which Patterns Are Interesting?—Pattern Evaluation Methods.

UNIT IV

Classification: Basic Concepts – Basic Concepts, Decision Tree Induction, Bayes Classification Methods , Rule-Based Classification .

Classification: Advanced Methods - Bayesian Belief Networks, Classification by Back propagation, Support Vector Machines, Classification Using Frequent Patterns, Lazy Learners.

UNIT V

Cluster Analysis: Basic Concepts and Methods - Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods.

Data Mining Trends and Research Frontiers: Mining Complex Data Types, Other Methodologies of Data Mining

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei, “**Data Mining: Concepts and Techniques**”, **Third Edition**, Morgan Kauffman Publishers.

REFERENCE BOOKS:

1. Margaret H.Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education 2004.
2. Sam Anahory, Dennis Murry, "Data Warehousing in the real world", Pearson Education 2003.
3. David Hand, Heikki Manila, Padhraic Symth, "Principles of Data Mining", PHI 2004.
4. W.H.Inmon, "Building the Data Warehouse", 3rd Edition, Wiley, 2003.
5. Alex Bezon, Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", McGraw-Hill Edition, 2001.
6. Paulraj Ponniah, "Data Warehousing Fundamentals", Wiley-Interscience Publication, 2003.

(14551204) OBJECT ORIENTED ANALYSIS AND DESIGN

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UNIT I

Introduction to UML: The meaning of Object Orientation, importance of modeling, principles of modeling, conceptual model of the UML, Architecture.

Basic Structural Modeling: Classes, Relationships, common Mechanisms, Class & Object diagrams.

UNIT II

Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration diagrams, iterated messages, use of self in messages.

Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, callback mechanism, broadcast messages.

Basic Behavioral Modeling: Use cases, Use case Diagrams, Activity Diagrams.

UNIT III

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

The Unified process: use case driven, architecture centric, iterative, and incremental

The Four Ps: people, project, product, and process

UNIT IV

Use case driven process: why use case, capturing use cases, analysis, design, and implementation to realize the use cases, testing the use cases.

Architecture-centric process: architecture in brief, why we need architecture, use cases and architecture, the steps to architecture, an architecture description.

UNIT V

Iterative incremental process: iterative incremental in brief, why iterative incremental development? The iterative approach is risk driven, the generic iteration.

The Generic Iteration workflow: phases are the first division workflow, planning proceeds doing, risks affect project planning, use case prioritization, resource needed, assess the iteration and phases.

Case Studies: Automation of a Library, Software Simulator application

TEXT BOOKS :

1. The Unified Modeling Language User Guide By Grady Booch, James Rumbaugh, Ivar Jacobson 2nd Edition, Pearson Education.
2. UML 2 Toolkit By Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado WILEYDreamtech India Pvt. Ltd.

3. The Unified Software Development Process By Ivar Jacobson, Grady Booch, James Rumbaugh, Pearson Education

REFERENCE BOOKS:

1. Fundamentals of Object Oriented Design in UML By Meilir Page-Jones, Pearson Education
2. Object Oriented Analysis & Design By Atul Kahate, The McGraw-Hill.
3. Practical Object-Oriented Design with UML By Mark Priestley, TATA McGrawHill
4. Object Oriented Analysis & Design By Brett D McLaughlin, Gary Pollice and David West, O'REILY .
5. Object-Oriented Analysis and Design using UML By Simon Bennet, Steve McRobb and Ray Farmer, 2nd Edition, TATA McGrawHill.
6. Object-Oriented Analysis and Design with the Unified Process By John W. Satzinger, Robert B Jackson and Stephen D Burd, THOMSON Course Technology.
7. UML and C++ R.C.Lee, and W.M.Tepfenhart,PHI.

(14551205) BIG DATA ANALYTICS

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UNIT I

Big Data in the Enterprise: Sentiment analysis, Exploratory analytics, Operational analytics, Opportunities from big data, Taming the big data.

The New Information Management Paradigm: Enterprise information system, New approach to management of big data, Implications of big data to enterprise IT.

UNIT II

Big Data Implementations for Industry: Big data analytics for telecom, Big data analytics for banking.

Emerging Database Landscape: Database evolution, Scale-out architecture, Database workloads, Database technologies for managing the workloads, Columnar databases, Requirements for next generation data warehouses, Polyglot Persistence – The next generation database architecture.

UNIT III

Application Architecture for Big Data and Analytics: Big data warehouse and analytics, Big data warehouse requirements, Hybrid architectures, Enterprise data platform ecosystem – BDW and EDW, Introduction to Hadoop – Technical components, merits and demerits, Hadoop suitability test, Additional considerations for Big Data Warehouse, Big data and Master Data Management, Data quality implications for big data, A conceptual BDW architecture.

Data Modeling – Map-Reduce Patterns, Algorithms, and Use Cases: Basic map-reduce patterns, Distributed task execution, Advanced map-reduce patterns.

UNIT IV

Data Modeling – NoSQL Data Modeling Techniques: Types of NoSQL stores, Choice of database system, JSON, Column family databases, Operations on column family databases, Understanding Cassandra data model, Designing Cassandra data structures, Schema migration approach using ETL.

Big Data Analytics Methodology: Challenges in big data analysis, Big data analytics methodology, Analysis and evaluation of business use case, Development of business hypotheses.

UNIT V

Extracting Value from Big Data: In-memory computing technology, Real-time analytics, CAP theorem, Use of in-memory data grid, Map-reduce and real-time processing, Real-time analysis of machine generated data, Building a recommendation system.

Data Scientist: Definition, Big data flow, Design principles for contextualizing big data, Nature of work of a data scientist.

TEXT BOOK:

1. Mohanthy S, Jagadeesh M, Srivatsa H, Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics, Apress/Springer(India), 2013.

REFERENCE BOOKS:

1. Berman J J, Principles of Big Data: Preparing, Sharing, and Analyzing Complex Information, Morgan Kaufmann, 2013.
2. Manoochehri M, Data Just Right: Introduction to Large Scale Data & Analytics, Pearson Education, 2014.
3. Fung K, Numbersense: How to Use Big Data to Your Advantage, McGraw-Hill, 2013.
4. Srinivasa S, Bhatnagar V (Eds.), Big Data Analytics: First International Conference Proceedings, Bda 2012, New Delhi, India, Springer, 2012.
5. Runkler T A, Data Analytics - Models and Algorithms for Intelligent Data Analysis, Vieweg+teubner Verlag, 2012.
6. Minelli M, Chambers M, Dhiraj A, Big Data Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley, 2013.
7. Akerkar R (Ed.), Big Data Computing, CRC Press, 2014.
8. Liebowitz J (ed.), Big Data and Business Analytics, CRC Press, 2013.
9. Sheikh N, Implementing Analytics: A Blueprint for Design, Development, and Adoption, Morgan Kaufmann, 2013.
10. Craig T, Ludloff M E, Privacy and Big Data, Shroff/O'Reilly, 2013.
11. Davis K, Ethics of Big Data, Shroff/O'Reilly, 2012.
12. O'Reilly Media Inc., Big Data Now: 2012 Edition, Shroff/O'Reilly, 2013.
13. Warden P, Big Data Glossary, Shroff/O'Reilly, 2011.

Web Resources:

1. <http://lntool.github.com/MapReduceAlgorithms/>
2. <http://infolab.stanford.edu/~ullman/mmds/book.pdf>
3. <http://netlab.ulsofona.pt/cp/HadoopinAction.pdf>
4. http://research.microsoft.com/en-us/collaboration/fourthparadigm/4thparadigm_science.pdf
5. http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_f or_innovation

(14551206) SOFTWARE QUALITY ASSURANCE AND TESTING

(Elective-2)

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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, 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:

Taxonomy of Testing tools, Methodology to evaluate automated testing tools, Load Runner, Win runner and Rational Testing Tools, 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 by *William E. Perry* , Second Edition, published by Wiley.
2. Software Quality, by *Mordechai Ben-Menachem / Garry S. Marliss*, by Thomson Learning Publication

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.

**(14551207) NETWORK SECURITY & CRYPTOGRAPHY
(ELECTIVE-2)**

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UNIT I

Fundamentals - Introduction: OSI security architecture, Security Attacks, Services and Mechanisms, Model for network Security.

Conventional Encryption: Conventional Encryption model, Steganography, Classical Encryption Techniques, Placement of Encryption function, Traffic Confidentiality.

Modern Techniques: Cipher Principles, Feistel Cipher structure, Data Encryption Standard, Strength of DES, triple DES, Block Cipher design, principles and Modes of Operations, AES-Evaluation criteria for AES.

UNIT II

Public Key Cryptography: Key management & Distribution, Diffie- Hellman key exchange, Elliptic curve Cryptography, Public key cryptography and RSA.

Number theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Test for primality, Euclid's Algorithm, Chinese remainder theorem, Discrete logarithms.

UNIT III

Authentication and Hash Function: Authentication requirements, Authentication functions, Message authentication Code, Hash functions, Security of hash functions and MACs, MD5 Message Digest algorithm, Secure hash algorithm, HMAC, Digital signatures, Authentication protocols, Digital signature standard.

UNIT IV

Network Security: Authentication applications, Kerberos, X.509 Authentication service, Electronic mail security, PGP, S/MIME.

IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations.

Web Security: Web Security requirements, Secure socket layer and Transport layer security, Secure Electronic Transaction.

UNIT V

System Level Security: Intruders, Intrusion detection, Password management, Malicious Software: Viruses and related threats, Virus counter measures.

Firewall: Need for Firewall & Characteristics, Types of Firewalls, Firewall design principles, Firewall Configuration, Trusted systems.

TEXT BOOKS:

1. Cryptography and Network Security: Principles and Practice-William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings, Pearson Education.

**(14551208) WIRELESS SENSOR NETWORKS
(Elective-2)**

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UNIT I

OVERVIEW OF WIRELESS SENSOR NETWORKS

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II

ARCHITECTURES

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

UNIT III

NETWORKING SENSORS

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

UNIT IV

INFRASTRUCTURE ESTABLISHMENT

Topology Control, Clustering, Localization and Positioning.

UNIT V

SENSOR NETWORK PLATFORMS AND TOOLS

Sensor Node Hardware–Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TEXT BOOK:

1. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2007.

REFERENCE BOOKS

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks - Technology, Protocols,And Applications", John Wiley, 2007.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.