Annexure B
Proposed Structure of M.Tech Computer Engineering
CBCS Pattern (2015-16)
STRUCTURE & EXAMINATION PATTERN

Semester I									**Total Duration: 20 hrs/week** **Total Marks :500** **Total Credits: 18**		
Subjects	**Teaching Scheme (Hrs) Hrs./Week**		**Examination Scheme (Marks)**						**Examination Scheme (Credits)**		**Total Credits**
	L	**P**	**Theory**	**Unit Test**	**Attendance**	**Tutorial/assignments**	**TW**	**Pract/ Oral**	**TH**	**TW/PR/OR**	
Advanced Database Management System	04	02	60	20	10	10	25	25	04	01	05
Advanced Software Engineering	04	02	60	20	10	10	25	25	04	01	05
Mobile Operating System	04	--	60	20	10	10	-	-	04	-	04
Distributed Computing	04	--	60	20	10	10	--	--	04	-	04
Total	**16**	**04**	**240**	**80**	**40**	**40**	**50**	**50**	**16**	**02**	**18**

Semester II									**Total Duration: 20 hrs/week** **Total Marks :500** **Total Credits: 18**		
Subjects	**Teaching Scheme (Hrs) Hrs./Week**		**Examination Scheme (Marks)**						**Examination Scheme (Credits)**		**Total Credits**
	L	**P**	**Theory**	**Unit Test**	**Attendance**	**Tutorial/assignments**	**TW**	**Pract/ Oral**	**TH**	**TW/PR/OR**	
High Performance Computing	04	02	60	20	10	10	25	25	04	01	05
Advanced Computer Algorithms	04	02	60	20	10	10	25	25	04	01	05
Web Technologies	04	--	60	20	10	10	--	--	04	--	04
Wireless Communication and Security	04	--	60	20	10	10	--	--	04	--	04
Total	**16**	**04**	**240**	**80**	**40**	**40**	**50**	**50**	**16**	**02**	**18**

Semester III									**Total Duration: 28 hrs/week** **Total Marks : 500** **Total Credits: 40**		
Subject	**Teaching Scheme (Hrs) Hrs./Week**		**Examination Scheme**						**Examination Scheme (Credits)**		**Total Credits**
	L	**P**	**Theory**	**Unit Test**	**Attendance**	**Tutorial/assignments**	**TW**	**Pract/ Oral**	**TH**	**TW/PR /OR**	
Elective I	04	02	60	20	10	10	25	25	04	01	05
Elective II	04	02	60	20	10	10	25	25	04	01	05
Self Study Paper I	04	--	60	20	10	10	-	-	04	-	04
Seminar	-	05	-	-	--	--	25	25		05	05
Dissertation Stage I	-	07	-	-	**--**	**--**	25	-	-	21	21
Total	**12**	**16**	**180**	**60**	**30**	**30**	**100**	**75**	**12**	**28**	**40**

Elective – I	**Elective - II**
a) E-Commerce and ERP	a) Cryptography and Network Security
b) Information Storage Management	b)Parallel computing
c) Cyber Security	c)Wireless Sensor Network
d) Big Data & Analytics	d)Storage Area Network

Semester IV									**Total Duration: 14 hrs/week** **Total Marks : 325** **Total Credits: 34**		
Subject	**Teaching Scheme (Hrs) Hrs./Week**		**Examination Scheme**						**Examination Scheme (Credits)**		**Total Credits**
	L	**P**	**Theory**	**Unit Test**	**Attendance**	**Tutorial/assignments**	**TW**	**Pract/ Oral**	**TH**	**TW/PR/OR**	
Self-Study Paper-II	04	--	60	20	10	10	-	-	**04**	**-**	**04**
Dissertation Stage –II	-	10	-	-	--	-	150	75		30	30
Total	**04**	**10**	**60**	**20**	**10**	**10**	**150**	**75**	**04**	**30**	**34**

List of Self Study paper I & II

Self Study Paper I	**Self Study Paper II**
Enterprise Resource Planning	Grid Computing
Bioinformatics	Research Methods in Computer Science
Information Retrieval and Web Search	Middle ware Technologies
Speech Processing	Agile Systems
Sensor Network and Embedded Systems	Soft Computing
Computer Graphics and Visualization	E-Commerce and Payment Systems
Cloud Computing	Knowledge Representation and Reasoning
Pervasive computing	Computational Intelligence
Data Warehousing and Data Mining	High Performance Information systems
Software Security	Advanced Web Technologies

Advanced Database Management System

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	TW&OR : 50 Marks	01 Credits

UNIT - I	**Parallel and Distributed Databases :**	**(08 Hours)**
	Architectures for parallel database, Parallel query Evaluation, Parallelizing individual operation, Parallel Query Optimization, Distributed DBMS Architecture, Storing data in distributed DBMS, Distributed Catalog Management, Distributed query processing, Updating distributed data, Distributed concurrence control, Distributed recovery.	
UNIT - II	**Web databases :**	**(08 Hours)**
	Web search engines, web search architecture, Inverted indexes the IR way, Inverted indexes for web search engines, web crawling, web search statistics.	
UNIT - III	**Data Warehousing and Data Mining:**	**(08Hours)**
	Data Warehousing: Introduction Data Warehousing OLAP, Implementation Techniques for OLAP, Views and decision support. **Data Mining:** Introduction, Counting Co-occurrences, Mining for rules, Tree structured rules, Clustering, Similarity search over sequences, Additional data mining tasks.	
UNIT - IV	**Object Database Systems and XML:**	**(08 Hours)**
	Object Database Systems: User defined abstract data types, Structured types, Objects, Objects Identity and Reference types, Inheritance, database design for an ORDBMS, Comparing RDBMS with OODBMS and ORDBMS. **XML:** Introduction, Structure of XML Data, XML Document Schema, Querying and Transformation, API to XML, Storage of XML Data, XML Applications.	
UNIT - V	**Spatial Data Management:**	**(08 Hours)**
	Types of Spatial Data and Queries Application involving Spatial data, Introduction to spatial Indexes, Indexing based on space filling Curves, Grid files, R trees, High command Indexing.	
UNIT - VI	**Deductive Databases AND Advanced Transaction Processing:**	**(08 Hours)**
	Deductive Databases: Recursive Queries, Theoretical foundation, Recursive Queries with Negation, Efficient evaluation of Recursive Queries, Additional Transaction Processing, Advance transaction processing Integrated access to Multiply data sources, Mobile database, multiplying database, Geographic Information systems, Temporal and Sequence database, Information Visualization. **Advanced Transaction Processing:** Transact ion-Processing Monitors, Transactional Workflows, Main- Memory Databases, Real-Time Transaction Systems, Long-Duration Transactions and Transaction Management in Multi-databases.	

Reference Books:

1. Rob & Colonel, “Database System Design Implementation & Management”, Thomson Learning
2. Date, “An Introduction to database system”, Addison Wesley Pub
3. Desai “Principles of Repagination database”, Galgotia Publications
4. Mallach, “Decision Support and Data Warehouse Systems”, TMH
5. Raghu Ram Krishnan, “Database Management Systems”, IInd edition
6. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, 5th Edition , McGraw Hill International Edition.
7. Jiawei Han, Micheline Kamber, “Data Mining: Concepts and Systems”,Morgan Kaufmann publishers

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Advanced Software Engineering

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	TW&OR : 50 Marks	01 Credits

UNIT - I	**Software Development Process:**	**(08 Hours)**
	Software Processes, SDLC Models, Waterfall Model, The V Model, Prototyping Model, Iterative Model, Spiral Model. Agile Development, Agile Principles, XP, Scrum, AUP, Kanban, ASD, DSDM, FDD, Agile practices, Empirical Model in Software engineering	
UNIT - II	**Requirement Engineering and Black Box Testing:**	**(08 Hours)**
	Requirement Engineering: Requirements phase and its importance, Requirement Elicitation and Analysis, Process models (DFD), Data models (ERD), Software, Requirement Specification Standard and Preparation, Characteristics of good SRS Documents, traceability matrix and its importance, CASE tool, and its basic features. Black box testing: Test case design and implementation, Automated testing and limitations, debugging methods, Black box testing methods.	
UNIT - III	**Process Improvement and Verification:**	[08 Hrs]
	Process and product quality, Process classification, Process Measurement, Process Analysis and Modelling, Process change, The CMMI process improvement framework, Configuration Management Planning, Change management, Version and release management, System building, CASE tools for configuration management.	
UNIT - IV	**User interface Design, Maintenance and reengineering:**	**(08 Hours)**
	User interface design issues: The UI design process, User analysis, User interface prototyping, Interface Evaluation. Software Maintenance: Reengineering, Business process reengineering, software reengineering, reverse engineering, restructuring, Forward engineering, The economics of reengineering.	
UNIT - V	**Software Reuse, CBSE:**	**(08 Hours)**
	The reuse landscape, Design patterns, Frameworks, Generator based reuse, Application frameworks, Application system reuse, components and component models, The CBSE process, component composition, service oriented software engineering - services as reusable components, service engineering, software development with services.	
UNIT - VI	**Quality Management and SAQ:**	**(08 Hours)**
	Quality Management - Quality Concepts, Software Quality, The review technique, cost impact of software defects, defect amplification and removal, Review metrics and their use, Reviews: A formal spectrum, Informal spectrum, Formal technical reviews, SQA: Background issues, Elements of SQA: SQA tasks, goals and metrics, Formal approaches to SQA: statistical SQA, Software reliability. The ISO 9126 quality factors, Mc Call's quality factors, The SQA plan	

References

1. Ian Sommerville, "Software Engineering: Update", 8th Edition

2. Roger S. Pressman and Roger, “Software Engineering: A Practitioner's Approach”
3. Shari Lawrence Pfleeger and Joanne M Atlee, “Software Engineering”, 3rd Edition

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Mobile Operating System

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
	Continuous Assessment: 40 Marks	

UNIT - I	**Introduction to Mobile Operating Systems:**	**(08 Hours)**
	Brief History of Mobile Operating Systems, OS-Interfaces, Multilevel Views of OS, Categories, Small and Specialized OS, 64-Bit OS, Processes and Threads, System Performance and Models: Performance of Computer Systems, Performance Metrics, Workload and System Parameters, Simulation Models: Types, Discrete-Event Model, Stochastic Model.	
UNIT - II	**Multiprogramming:**	**(08 Hours)**
	System with Multiprogramming, Processor Scheduling, Synchronization, Deadlocks, File Management, Memory Management: Process Address Space, Contiguous Memory Allocation, Non Contiguous Memory Allocation, Virtual Memory, Paging with Virtual Memory.	
UNIT - III	**Security and Protection:**	**(08 Hours)**
	Components for Security and Protection, Physical Security, User Authentication, Protection, Secure Communications, Digital Certificates, System Vulnerabilities, Invasive and Malicious Software, Defending the System and User, Intrusion Detection Management.	
UNIT - IV	**Mobile Ecosystems:**	**(08 Hours)**
	Application Framework, Developing a Mobile Strategy, Mobile Information Architecture, Mobile Design: Elements of Mobile Design, Ubiquity in the Mobile Web, Mobile Web Development	
UNIT - V	**Introduction to Linux:**	**(08 Hours)**
	Command Line Interface, Files and Directories, Shell Variables, Script Files, Connecting a Remote Linux Server. Java Modeling Framework, Java and Posix Threads.	
UNIT - VI	**Case Study:**	**(08 Hours)**
	Android SDK, iOS, Windows, Mobile Web Apps vs. Mobile Applications	

Reference Books:

[1] Jose M Garrido, Richard Schlesinger, Kenneth Hoganson, Principles of Modern Operating Systems.

[2] By Brian Fling, Mobile Design and Development: Practical concepts and techniques for Creating Mobile Sites and Web Apps, O'Reilly Publications

[3] Brian Fling, Mobile Design and Development, O'Reilly Publications.

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Distributed Computing

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04Hours / Week	End Semester Examination: 60 Marks	04 Credits
	Continuous Assessment: 40 Marks	

UNIT – I	**Distributed System Concepts:**	**(08 Hours)**
	Distributed Computing Models, Software Concepts, Issues in Designing Distributed Systems Client-Server Model. Case Studies. Network Communication: LAN and WAN Technologies, Protocols for Network Systems, Asynchronous Transfer Mode, Protocols for Distributed Systems.	
UNIT – II	**Interprocess Communication:**	**(08 Hours)**
	Message Passing, Advantages and Features of Message Passing Systems, IPC Message Format, IPC Synchronization, Message Buffering Strategies, Multidatagram Messaging, Process Addressing Techniques, Failure Handling Mechanism. Case Study: IPC in Mach	
UNIT – III	**Remote Communication:**	**(08 Hours)**
	Introduction, Remote Procedural Call, RPC Implementation, RPC Implementation, Parameter Passing Semantics, Server Management, RPC Call Semantics, Communication Protocols, Client Server Binding, Exception Handling and Security, RPC in Heterogeneous Environment, Failure Handling, RPC Optimization, Case Study: Sun RPC, Java RMI.	
UNIT – IV	**Synchronization:**	**(08 Hours)**
	Clock Synchronization, Physical Clocks, Clock Synchronization Algorithms, Logical Clocks, Global State, Mutual Exclusion, Election Algorithms, Deadlocks: Prevention, Detection Recovery, Deadlocks in Message Communication.	
UNIT – V	**Distributed System Management:**	
	Resource Management, Task Assignment Approach, Load Balancing Approach, Load Sharing Approach, Process Management in Distributed Environment, Process Migration, Threads, Fault Tolerance, Component Faults, System Failures and Use of Redundancy	**(08 Hours)**
UNIT – VI	**Distributed Shared Memory:**	
	Architecture, Types of DSM, Hardware DSM, and Design Issues in DSM Systems. Distributed File Systems, Naming, Security in Distributed Systems, Real Time Distributed Operating System, Distributed Database Management System, Emerging Trends in Distributed Computing.	**(08 Hours)**

Reference Books:

1. H. Attiya, J. Welch Distributed Computing - Fundamentals, Simulation and Advanced Topics, Wiley Publications.
2. Vijay Garg, Elements of Distributed Computing, Wiley Publications.
3. S. Mahajan, S. Shan, Distributed Computing, Oxford Publications.

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II
Unit Test -2	UNIT – III, UNIT – IV
Unit Test-3	UNIT –V, UNIT-VI

High Performance Computing

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	PR & OR : 50 Marks	01 Credits

UNIT - I	**Computer organization:**	**(08 Hours)**
	Memory, Registers, Instruction set architecture, Instruction processing, Pipelined processors: Pipelining, Structural, data and control hazards, Impact on programming. Cache memory: Organization, impact on programming, virtual caches, Operating systems: Processes and system calls, Process management, Program profiling.	
UNIT - II	**Modern Computer Architectures :**	**(08 Hours)**
	Memory, Floating-Point Numbers, Programming and Tuning Software - What a Compiler Does, Timing and Profiling, Eliminating Clutter, Loop Optimizations, Program execution, Program, Compilation, Object files, Function call and return, Address space, Data and its representation. Parallel Processing Concepts - Levels of parallelism instruction, transaction, task, thread, memory, and function, Models SIMD, MIMD, SIMT, SPMD, Dataflow Models, and Demand-driven Computation etc. Case Study: Cluster Computing network.	
UNIT - III	**Parallel Algorithms:**	**(08 Hours)**
	Parallel models: ideal and real frameworks, Basic Techniques: Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra, Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel Pseudo-Random Number Generators, Sorting, Monte Carlo techniques	
UNIT - IV	**Parallel Programming:**	**(08 Hours)**
	Revealing concurrency in applications, Task and Functional Parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, Star-P, Matlab MPI), Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays).	
UNIT - V	**High-End Computer Systems:**	**(08 Hours)**
	Memory Hierarchies, Multi-core Processors: Homogeneous and Heterogeneous, Shared-memory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Supercomputers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purpose-built, Architectures: N-wide superscalar architectures, multi-core, multi-threaded	
UNIT - VI	**Achieving Performance:**	**(08 Hours)**
	Performance metrics and measurements, Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, Using existing libraries, tools, and frameworks, CASE tools.	

Reference Books:

1. Highly Parallel Computing", by George S. Almasi and Alan Gottlieb
2. "Advanced Computer Architecture: Parallelism, Scalability, Programmability", by Kai Hwang, McGraw Hill 1993
3. "Parallel Computer Architecture: A hardware/Software Approach", by David Culler Jaswinder Pal Singh, Morgan Kaufmann, 1999.
4. "Scalable Parallel Computing", by Kai Hwang, McGraw Hill 1998.

5. "Principles and Practices on Interconnection Networks", by William James Dally and BrianTowles, Morgan Kauffman 2004.	
6. GPU Gems 3 --- by Hubert Nguyen (Chapter 29 to Chapter 41)	
7. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, © 2003.	
8. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, © 2007.	
9. J. L. Hennessy and D. A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.	
10. Silberschatz, P. B. Galvin, G. Gagne, Operating System Concepts, John Wiley.	
11. R. E. Bryant and D. R. O'Hallaron, Computer Systems: A Programmer's Perspective, Prentice Hall.	
12. John Levesque (Author), Gene Wagenbreth (Author), High Performance Computing: Programming and Applications (Chapman & Hall/CRC Computational Science)	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Advanced Computer Algorithms

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 04Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	TW & OR : 50 Marks	01 Credit

UNIT – I	**Introduction:**	**(08 Hours)**
	Asymptotic notation, Models of Computation, Algorithm & their complexity, Random Analysis machines, Computational complexity of RAM programs, A stored program model, Abstractions of the RAM, A primitive model of computation(Turing Machines),Relational between Turing machine & RAM model ,Pidgin ALGOL A high level lang.	
UNIT - II	**Algorithm Analysis and Algorithm Design techniques:**	**(08 Hours)**
	Algorithm Analysis: Analyzing Algorithm, Designing Algorithm, Time & Space Complexity, Average & Worst case analysis, Lower Bounds. **Algorithm Design techniques:** Divide & Conquer, Search Traversals, Dynamic Programming, Backtracking, Branch & Bound, Greedy Algorithm	
UNIT - III	**Sorting and Searching Algorithm :**	**(08 Hours)**
	The Sorting problem, Radix Sorting, Sorting by comparison, Heap sort-an O(n logn) comparison sort, Quick Sort-an O(n log n) expected time sort, Expected time for Order statistics, Binary Search, binary search trees, optimal binary search tree, B-Trees Algorithms on graph: Elementary graph Algorithm, Minimum spanning tree, Single Source shortest Path, All pairs shortest path	
UNIT – IV	**String Processing Algorithm and Divide and conquer method and Greedy method:**	**(08 Hours)**
	String Processing Algorithm: The naïve string matching, The Robin-Karp algorithm, String matching with Finite Automata, Knuth Morris Pratt Algorithm **Divide and conquer method:** Binary search, Mergesort, Quick sort, Strasen's matrix multiplication. **The Greedy method:** Knapsack problem, job sequencing, optical merge patterns, minimal spanning trees.	
UNIT – V	**Dynamic Programming, Back Tracking, Branch & Bound:**	**(08 Hours)**
	Dynamic Programming: Multistage graphs, OBST, 0/1 Knapsack, traveling sales man problem. **Back Tracking:** Eight Queens problem, graph coloring, Hamiltonian cycles, Knapsack problem, Maze problem. **Branch & Bound:** 0/1 Knapsack, Traveling salesman problem lower bound theory-comparisons trees for sorting/searching, lower bound on parallel computation.	
UNIT – VI	**NP-hard and NP-complete problems:**	**(08 Hours)**
	Algorithms, Complexity- intractability, Non-Deterministic Polynomial time (NP) Decision problems, cooks Theorem, NP-Complete problems- statisfiability problem, vertex cover problem. NP-Hard problems-graph, scheduling, code generation problems, Simplified NP Hard Problems, Approximation Algorithm for NP Hard Problem.	

Reference Books:

1. Bressard, “Fundamental of Algorithm”
2. Horowitz, Sahani, “Fundamentals of Computer Algorithms”, Galgotia
3. Thomas H. Cormen and Charles E. L. Leiserson, “Introduction to Algorithm”, PHI
4. V. Aho and J. D. Ullman, “Design and Analysis of Algorithms”, Addison Wesley

5. E. V. Krishna Murthy, “Introduction to Theory of Computer”	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Web Technologies

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
	Continuous Assessment: 40 Marks	

UNIT – I	**Web Environment:**	**(08 Hours)**
	WWW, HTTP, Web Server and its deployment, N-Tier Arch., Services of Web Server – Mail server, News server, Proxy server, Multimedia server. **XML Primer :** Mark-up languages, XML, Uses of XML. WELL-FORMED XML: Parsing XML, Tags, text, elements, attributes, comments and empty elements. XML Declaration, Processing, Instructions, Errors in XML XML NAMESPACES: Need for namespaces, How XML namespaces work, URIs, When to use, namespace. **VALIDATION:** Document type definitions (DTD), Sharing vocabularies, Anatomy of DTD, Developing DTDs, DTD Limitations. **XML SCHEMAS:** Benefit of XML schemas, Elements of XML Schema Definition, Creating a Schema from multiple documents. XPATH, XSLT, Xquery	
UNIT – II	**JSP :**	**(08 Hours)**
	JSP overview, JSP language basics, JSP translation and compilation directives, Standard java objects from JSP, JSP configuration and deployment, actions and tags of JSP; Java servlets – Arch, servlet interface, applications of servlets.	
UNIT – III	**ASP :**	**(08 Hours)**
	Objects and Components, Handling databases, Data Retrieval from Databases, applications of ASP, session management, ASP with .NET	
UNIT – IV	**Web Technologies :**	**(08 Hours)**
	Server side programs. CGI programs. Client side scripts. The Applet Concept. Search Engine Optimization: Strategies, Optimizing Search strategies, Robots, Spiders and Crawlers, Mobile Search Engine Optimization.	
UNIT – V	**The Web as an example of client server computing :**	**(08 Hours)**
	Characteristics of web servers: handling permissions. File Management Capabilities of common server architectures , Role of client Computer. Nature of Client server relationship. Web protocols Support tools for website creation and management. Developing Internet Information servers. Publishing information and application.	

UNIT – VI	**Building Web applications :**	**(08 Hours)**
	Protocols at the application layer. Principles of Web engineering. Database driven websites. RPC. Lightweight distributed objects. The role of the middleware. Support tools. Security issues in Distributed object systems. Enterprise- wide web base.	

Reference Books:

1. Information Architecture for the World Wide Web, Peter Morville and Louis Rosenfied, O'REILLY, 2007
2. Internet and World Wide Web: How to Program, Deitel and Deitel, 4th Edition, Prentice Hall, 2009
3. Beginning XML, David Hunter et al, 4th Edition, Wrox/John Wiley, 2007
4. Herbert Schildt, "Complete Reference JAVA 2", TMH
5. Jerri L. Ledford, "Search Engine Optimization",2nd Edition, Wiley Publication

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Wireless Communication And Security

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
	Continuous Assessment: 40 Marks	

UNIT - I	**Introduction :**	**(08 Hours)**
	A Short history of wireless communication. A market for mobile communication. Some research topics. A simplified reference model. Wireless Transmission. **Frequencies for Radio Transmission:** Signal antennas, signal propagation. Multiplicity, modulation, spread spectrum, cellular systems.	
UNIT - II	**Medium Access Control:**	**(08 Hours)**
	Motivation for a specialized MAC. SDMA, FDMA, TDMA, CDMA, Comparison of S/T/F/CDMA. **Telecommunication Systems:** GSM, DECT, TETRA, UMTS.	
UNIT - III	**Satellite Systems :**	**(08 Hours)**
	Basics, Routing, Localization, Handover. **Broadcast Systems :** Cyclic repetition of data, digital audio broadcasting, digital video broadcasting	
UNIT - IV	**Wireless LAN:** Infrared vs. radio transmission, Ad-Hoc networks, IEEE802.11, Bluetooth, Case Study on WLAN. **Wireless ATM :** Motivation for WATM, WATM services reference model, functions, radio access layer, handover, location management, addressing, mobile quality of service, access point control protocol, Case Study on WATM.	**(08 Hours)**
UNIT - V	**Mobile Network Layer:**	**(08 Hours)**
	Mobile IP, Dynamic host configuration protocol, Ad-hoc Networks. **Mobile Transport Layer :** Traditional TCP, Indirect TCP, Mobile TCP.	
UNIT - VI	**Performance Issues :**	
	QOS issues, Security issues, Non line of sight issues, Power control issues. **Security** Encryption and Authentication, Key pre-distribution and management, Secure Ad-Hoc Networks, Denial-of-Service Attacks, Energy-aware Security Mechanisms	**(08 Hours)**

References:

[1] Jochen Schiller, “Mobile Communication”, Pearson Education, Asia

[2] Mallick, “Mobile and Wireless Design Essentials”, Wiley computer publication

[3] Andy Dornan, “The Essential Guide of Wireless Communications Applications”, Pearson Education Asia

[4] Weisman, “The Essential guide to RF and wireless”, Pearson Education Asia

[5] Lee, “Mobile Cellular Telecommunications”, MGH

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

E-Commerce and ERP

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 50 Marks	01 Credit

UNIT - I	**Ecommerce business models and concepts, EC infrastructure, Ecommerce:**	**(06 Hours)**
	Ecommerce business models and concepts, EC infrastructure, Ecommerce -Frame work, anatomy of E-Commerce applications E-Commerce Consumer applications, E-Commerce organization. Applications. Consumer Oriented Electronic commerce - Mercantile Process models	
UNIT - II	**E-Security and payment systems, Electronic payment systems :**	**(06 Hours)**
	ESecurity and payment systems, Electronic payment systems - Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems. Inter Organizational Commerce - EDI, EDI Implementation, Value added networks.	
UNIT - III	**Concepts and communications, ethical, social and political EC issues, Intra Organizational Commerce:**	**(06 Hours)**
	Concepts and communications, ethical, social and political EC issues, Intra Organizational Commerce - work Flow, Automation Customization and internal Commerce, Supply chain Management. Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research. Marketing, online retailing, services, content and media, social networks.	
UNIT - IV	**Introduction To ERP:**	
	Introduction To ERP: Evolution of ERP, What is ERP? Reasons for the growth of ERP, Scenario and Justification of ERP in India, Evaluation of ERP, Various Modules of ERP, Advantage of ERP.	
UNIT - V	**Overview of Enterprise:**	
	An overview of Enterprise, Integrated Management Information, Business Modeling, ERP for Small Business, ERP for make to order companies, business Process Mapping for ERP Module Design, Customized ERP, Hardware Environment and its Selection for ERP Implementation.	**(06 Hours)**
UNIT - VI	**ERP Market:**	**(06 Hours)**
	ERP Market: Introduction, SAP AG, Baan Company, Oracle Corporation, People Soft, JD Edwards World Solutions Company, System Software Associates, Inc. (SSA) QAD, A Comparative Assessment and Selection of ERP Packages and Modules.ERP implementation lifecycle, issues in implementing Vendors, Consultants and users, In-House Implementation - pros and cons, vendors, consultants, end user.	

Reference Books:

1. Laudon K., C. G. Traver, E-Commerce Prentice Hall, 2010
2. William S. Davis, John Benamati, E-Commerce Basics: Technology Foundations and E-Business Applications, Prentice Hall.
3. Enterprise Resource Planning – Alexis Leon
4. ERP Ware: ERP Implementation Framework – V.K. Garg & N.K. Venkitakrishnan

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Information Storage and Management

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04Hours / Week	End Semester Examination: 60 Marks	04Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	PR & OR : 50 Marks	01 Credits

UNIT - I	**Introduction to Storage Technology:**	**[8Hrs]**
	Data proliferation and the varying value of data with time & usage, Sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, Traditional file storage and it's pitfalls. The five pillars of technology, Overview of 12 storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations.	
UNIT - II	**Storage Systems Architecture:**	**[8Hrs]**
	Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols.	
UNIT - III	**Introduction to Networked Storage:**	**[8Hrs]**
	JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fibre Channel principles, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity protocols (NFS, CIFS, ftp), & management principles IP SAN elements, standards (SCSI, FCIP, FCP), connectivity principles, security, and managementprinciples, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage solutions overview including technologies like virtualization & appliances.	
UNIT - IV	**Introduction to Information Availability:**	**[8Hrs]**
	Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques. Case study: Storage Network for Business Continuity.	
UNIT - V	**Managing &Monitoring**:	**[8Hrs]**
	Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and pro-active management best practices, Provisioning & configuration change , Problem reporting, prioritization, and handling techniques, Management tools overvie	
UNIT - VI	**Information storage on cloud:**	**[8Hrs]**
	Concept of Cloud, Cloud Computing, storage on Cloud, ClouVocabulary, Architectural Framework, Cloud benefits, Cloud computing Evolution, Applications & services on cloud, Cloud service providers and Models, Essential characteristics of cloud computing, Cloud Security and integration.	

References:

1) Information Storage and Management Storing, Managing, and Protecting Digital Information , by EMC, Hopkinton and Massachusetts, Wiley, ISBN:9788126521470
2) G. Somasundaram & Alok Shrivastava (EMC Education Services) editors; Information Storage and Management: Storing, Managing, and Protecting Digital Information; Wiley India.

3) Ulf Troppens, Wolfgang Mueller-Friedt, Rainer Erkens, Rainer Wolafka, Nils Haustein; Storage Network explained: Basic and application of fiber channels, SAN, NAS, iSESI, INFINIBAND and FCOE, Wiley India.
4) John W. Rittinghouse and James F. Ransome; Cloud Computing : Implementation , Management and Security, CRC Press, Taylor Frances Pub.

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Cyber Security

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04Hours / Week	End Semester Examination: 60 Marks	04Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	PR & OR : 50 Marks	01 Credits

UNIT - I	**Cyber Security Fundamentals:**	**(08 Hours)**
	Network and Security Concepts, Authentication, Authorization, Non repudiation, Confidentiality, Integrity, Availability, Basic Cryptography, Symmetric Encryption, Public Key Encryption, The Domain Name System, Firewalls, Virtualization, Microsoft Windows Security Principles	
UNIT - II	**Attacker's Techniques:**	**(08 Hours)**
	Types of Proxies, Tunneling Techniques, Phishing, Smishing, Vishing, and Mobile Malici Threat Infrastructure.	
UNIT - III	**Exploitation:**	**(08 Hours)**
	Shell code, Stack-Based Buffer Overflows, Format String Vulnerabilities, Malicious PDF Web Exploit Tools, Brute Force and Dictionary Attacks, Misdirection, Reconnaissance, a Cross-Site Scripting, DNS Amplification Attacks.	
UNIT - IV	**Malicious Code:**	**(08 Hours)**
	Self-Replicating Malicious Code, Virtual Machine Obfuscation, Persistent Software Tech Privileged User Accounts and Escalation of Privileges, Token Kidnapping, Man-in-the-Middle Attack.	
UNIT - V	**Defense and Analysis Techniques:**	**(08 Hours)**
	Memory Forensics, Capabilities of Memory Forensics ,Memory Analysis Frameworks, In and Using Volatility, Honey pots, Malicious Code Naming, Automated Malicious Code Analysis Systems	
UNIT - VI	**Cyber Security Real World Impact:**	**(08 hours)**
	Cyber security and internal political security, International conflict in cyberspace, Nation-state cyber attack mitigation strategies, IP V6 address space, Improved security, privacy concerns, uneven world wide deployment. Case study	

Reference Books:

1. Cyber security essentials by James Graham, Richard Howard,Ryan Olson
2. Strategic Cyber Security by Kenneth Geers

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

Big Data Analytics

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04Hours / Week	End Semester Examination: 60 Marks	04Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	PR & OR : 50 Marks	01 Credits

UNIT - I	**Introduction:**	**(08 Hours)**
	Introduction to Big data, Data Exposition, Types of data, Need for big data, Big data & its sources, Three Characteristics of big data, Challenges of Conventional Systems – Big data Problem, Traditional IT Analytics Approach, Big data use cases, Handling limitations of Big data, big data platform. Evolution of Analytic Scalability.	
UNIT - II	**Big Data Storage and Computing Platforms:**	**(08 Hours)**
	Big Data Storage and Computing Platforms: Traditional RDBMS, NoSQL, NewSQL, and Hadoop, Parallel computing systems, Programming models for batch, interactive, and streaming applications, Trade-offs between programming models, Survey of new emerging database and storage systems for Big Data, Tradeoffs between reduced consistency, performance, and availability, MangoDB: Introduction, overview, Design Goals for MangoDB, MangoDB shell, MangoDB applications, Multimedia database application.	
UNIT - III	**Regression Modeling - Multivariate Analysis:**	**(08 Hours)**
	Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Neural Networks: Learning And Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods	
UNIT - IV	**Introduction To Streams Concepts:**	**(08 Hours)**
	Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.	
UNIT - V	**Mining Frequent Itemsets:**	**(08 Hours)**
	Market Based Model – Apriori Algorithm – Handling Large Data Sets in Main Memory – Limited Pass Algorithm – Counting Frequent Itemsets in a Stream – Clustering Techniques – Hierarchical – K-Means – Clustering High Dimensional Data – CLIQUE And PROCLUS – Frequent Pattern based Clustering Methods – Clustering in Non-Euclidean Space – Clustering for Streams and Parallelism	
UNIT - VI	**MapReduce:**	**(08 Hours)**
	MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques; Systems and Analytics Applications - Analytics using Statistical packages-Approaches to modeling in Analytics – correlation, regression, decision trees, classification, association-Intelligence from unstructured information-Text analytics-Understanding of emerging trends and technologies-Industry challenges and application of Analytics.	

Text Books:

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Ohlhorst, Frank J. Big Data Analytics: Turning Big Data into Big Money. Copyright © 2012 SAS Institute Inc., Cary, North Carolina, USA.
3. AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced

Analytics", John Wiley & sons, 2012.	
5. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007	
6. Pete Warden, "Big Data Glossary", O'Reilly, 2011	
7. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Cryptography and Network Security

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04Hours / Week	End Semester Examination: 60 Marks	04Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	PR & OR : 50 Marks	01 Credits

UNIT - I	**Introduction:**	**(08 Hours)**
	Services, Mechanisms and Attacks, The OSI Security Architecture, A Model for Network Security. Symmetric Ciphers: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. Block Ciphers and the Data Encryption Standard: Simplified DES, Block Cipher Principles, The Data Encryption Standard, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operation.	
UNIT - II	**Introduction to Finite Fields:**	**(08 Hours)**
	Introduction to Finite Fields: Groups, Rings, Fields, Modular Arithmetic, Euclid's Algorithm, Finite Fields of the Form GF, Polynomial Arithmetic, Finite Fields of the Form GF. Advanced Encryption Standard: Evaluation Criteria for AES, The AES Cipher. Contemporary Symmetric Ciphers: Triple DES, Blowfish, RC5, Characteristics of Advanced Symmetric Block Ciphers, RC4 Stream Cipher. Confidentiality Using Symmetric Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation	
UNIT - III	**Public-Key Encryption and Hash Functions:**	**(08 Hours)**
	Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms. Public-Key Cryptography and RSA, Principles, The RSA Algorithm, Key Management, Diffie Hellman Key Exchange, Elliptic Curve Arithmetic, Elliptic Curve Cryptography	
UNIT - IV	**Message Authentication and Hash Functions:**	**(08 Hours)**
	Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, Security of Hash Functions. Hash Algorithms: MD5 Message Digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC, Digital Signatures, Authentication Protocols, Digital Signature Standard.	
UNIT - V	**Authentication Applications:**	**(08 Hours)**
	Kerbos, X.509 Authentication Service, E-mail Security, Preety Good Privacy, S/MIME, IP Security, Architecture, Authentication Header, Encapsulation Security Payload, Combining Security Associations, Key Management Web Security: Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.	
UNIT - VI	**System Security:**	**(08 Hours)**
	Intruders, Intrusion Detection, Password Management. Malicious Software, Firewalls: Firewall Design Principles, Trusted Systems.	

1. William Stallings, "Cryptography and Network Security", Principles and Practices, Pearson Education, Sixth Edition.
2. Behrouz A. Forouzan, "Cryptography and Network Security", McGraw Hill Publication
3. Atul Kahate, "Cryptography and Network Security", McGraw Hill(India)Publication, Third Edition.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Parallel Computing

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 50 Marks	01 Credit

UNIT - I	**Introduction to Parallel Programming Paradigms:**	**(08 Hours)**
	Types of Parallelism , Parallel Computation Models, Memory less Parallel Computers, Parallel Computers with Memory, Flynn's Taxonomy, The Data-Parallel Model, Networked Computers, The Performance of Parallel Algorithms, Amdahl's Law, Gustaf son Barsis's Law, Karp-Flatt Metric, Multidimensional Meshes, Hypercube-Based Machines, Routing in Networks, The PRAM Model.	
UNIT - II	**Convergence of Parallel Architecture:**	**(08 Hours)**
	Communication Architecture, Shared Address Space, Message Passing, Convergence, Data parallel processing, Other Parallel Architectures, A Generic parallel architectures, shared memory systems and cache coherence, distributed-memory systems, interconnection networks and routing, Architectural Trends, Application Trends, Technology Trends, Supercomputers case study: Param.	
UNIT - III	**Programming scalable systems:**	**(08 Hours)**
	The message-passing model, the message-passing interface, MPI standard basic concepts of MPI: MPI_Init, MPI_Comm_size, MPI_Comm_rank, MPI_Send, MPI_Recv, MPI_Finalize, timing the MPI programs: MPI_Wtime, MPI_Wtick, collective communication: MPI_Reduce, MPI_Barrier, MPI_Bcast, MPI_Gather, MPI_Scatter, case studies: the sieve of Eratosthenes, Floyd's algorithm, Matrix-vector multiplication.	
UNIT - IV	**Shared-Memory Programming:**	**(08 Hours)**
	Shared-memory model, OpenMP standard, Parallel for loops, Parallel for pragma, private variables, critical sections, reductions, parallel loop optimizations, general data parallelism, functional parallelism, case studies: the sieve of Eratosthenes, Floyd's algorithm, matrixvector multiplication – distributed shared-memory programming, DSM primitives.	
UNIT - V	**Implications for Programming Models and Case Study:**	**(08 Hours)**
	Naming, Replication, Overhead and granularity of communication, Block Data transfer, Synchronization, Hardware Cost and Design Complexity, Case Study: Ocean, Ray trace, Data mining.	
UNIT - VI	**Fundamental Design issues:**	**(08 Hours)**
	Partitioning of data, Mapping of data onto the processors, Reproducibility of results, Synchronization, Scalability and Predictability of performance, Performance & Scalability, Performance Requirements, Types of performance requirements, Performance Metrics of Parallel Systems, Communication Abstraction, Programming model requirements, Communication and Replication, Starssen's Matrix multiplication to compute complexity less than O(n3).	

References:

1. Parallel Programming – Techniques and applications Using Networked Workstations and Parallel Computers, Barry Wilkinson and Michael Allen, Prentice Hall, 1999

2. Multi-Core Programming - Increasing Performance through Software MultiThreading, Shameem Akhter and Jason Roberts, Intel Press 2006.
3. Parallel Programming in C with MPI and OpenMP, Michael J. Quinn, McGraw Hill 2003.
4. Introduction to Parallel Computing by AnanthGrama, George Karypis, Vipin Kumar, and Anshul Gupta.
5. Programming Massively Parallel Processors by D.Kirk and W. Hwu

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Wireless Sensor Networks

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 50 Marks	01 Credit

UNIT - I	**Introduction & Characteristics of Wireless Sensor Networks :**	**(08 Hours)**
	Introduction, Brief Historical Survey of Sensor Networks. Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.	
UNIT - II	**Medium Access Control Protocols:**	**(08 Hours)**
	Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol, **Case Study:** IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling, ZigBee.	
UNIT - III	**Routing And Data Gathering Protocols:**	**(08 Hours)**
	Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Point-to-Point VPN Tunneling Protocol and Challenges- Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GAF, GPSR – Real Time routing Protocols – APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB,	
UNIT - IV	**Embedded Operating Systems:**	**(08 Hours)**
	Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS –OSPM - EYES OS. Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.	
UNIT - V	**Transport Control Protocols and Middlewares for Wireless Sensor Networks :**	**(08 Hours)**
	Traditional Transport Control Protocols: TCP (RFC 793), UDP (RFC 768), MobileIP, Introduction, WSN Middleware Principles, Middleware Architecture: Existing Middleware: MiLAN (Middleware Linking Applications and Networks), IrisNet (Internet-Scale Resource-Intensive Sensor Networks Services)	
UNIT - VI	**Applications of WSN:**	**(08 Hours)**
	WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications.	

References:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, " Wireless Sensor Networks Technology, Protocols, and Applications", John Wiley & Sons, 2007.
2. Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.
3. K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349.

4. Philip Levis, " TinyOS Programming".
5. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd.
6. Wireless sensor networks Edited by C. S. Raghavendra Pub: Springer.
7. Fundamentals of Sensor Network Programming: Applications and Technology By Sridhar S. Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, Wiley.
8. Ad Hoc Wireless Networks: Architectures And Protocols By Murthy Pub: Pearson Education

Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

Storage Area Network

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 04 Hours / Week	End Semester Examination: 60 Marks	04 Credits
Practical: 02 Hours / Week	Continuous Assessment: 40 Marks	
	Term Work: 50 Marks	01 Credit

UNIT - I	**Information Storage and Data Centre Environment:**	**(08 Hours)**
	Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing, Application, Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Disk I/O Controller Utilization, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application Requirements and Disk Performance, Data Protection: RAID.	
UNIT - II	**Data and Information in SAN**:	**(08 Hours)**
	Data organization: File vs. Block, Object, Data store, Searchable models, File Systems, Volume Managers, Caches, Prefetching, Storage Networking Technologies, What Storage Networking Is, What to Expect from SANs, Leading up to SANs, Killer Apps for SANs	
UNIT - III	**SAN Hardware Ecosystem:**	**(08 Hours)**
	Components of an Intelligent Storage System, Front End, Cache, Back End, Physical Disk, Storage Provisioning, Virtual Storage Provisioning,Types of Intelligent Storage Systems – DAS, SAN, NAS, Comparing DAS, SAN & NAS, Host Bus Adapters, SFPs, FC Cables and Connectors, SCSI/SATA/SAS Cables and Connectors, JBODs, RAID Arrays, RAID Controllers, External Storage Boxes, Tape Drive, Tape Library, NAS Device, NAS Head, Fiber Channel Switches, Bridges, FC Appliances.	
UNIT - IV	**Storage Virtualization:**	**(08 Hours)**
	Storage Virtualization, Disk Virtualization, Block Virtualization, File Virtualization, File system Virtualization, Tape Virtualization, Tape Library Virtualization, Host Based Virtualization, Network Based Virtualization, Storage Device Virtualization.	
UNIT - V	**Protocols in SAN:**	**(08 Hours)**
	ATA and SATA, SPI – Parallel SCSI, SAS – Serial Attached SCSI, SAS Topology, SAS Devices, FC Topologies, FC Ports, FC Protocol Layers, FC WWNs, FC Addresses, FC Frame, FC Flow Control, Zoning, Lun Masking, iSCSI Topology, iSCSI Initiators and Targets, iSCSI Namesand Addresses, Speeding Up iSCSI, iSCSI Advantages, iSCSI Limitation, Comparing Storage Protocols.	
UNIT - VI	**SAN Managements and Storage Systems:**	**(08 Hours)**
	Storage Management, Storage Vs. Data Classification, Information Lifecycle Management, Hierarchical Storage Management, RTO and RPO, Backup and Restore, Snapshot & CDP, De-duplication, Storage Provisioning, Storage Migration, SRM, Case study - Google FS/BigTable, Programming models: Hadoop, NAS.	

References:

[1] Storage Area Network Essentials:A complete Guide to Understanding and Implementing SANs(HardCover) By Richard Barker, Paul Massigliar By Wiley 2001.

[2] Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS iSCSI and InfiniBandBy Ulf Troppens, Rainer Erkens, Wolfgang Miiller Wiley 2004.

[3] Using SANs and NAS By W.Curtis Preston, Mike Loukides.

[4] Information Storage and Management, 2nd Edition, Edited by Somasundaram Gnanasundaram, Alok

Shrivastava	
Syllabus for Unit Test:	
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI