

**SGGS INSTITUTE OF ENGINEERING AND TECHNOLOGY  
VISHNUPURI- NANDED**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**SYLLABI STRUCTURE OF M. Tech (Information Technology) 2012-13**

**FIRST YEAR**

Code	Name of the course	Total credits	Lectures /week L-T-P	Practicals / week
<b>IT-501</b>	Applied Algorithms	04	03-01-00	--
<b>IT-502</b>	Software Engineering Methodologies	04	03-01-00	--
<b>IT-503</b>	Net- Centric Computing	04	03-01-00	--
<b>IT-504</b>	Mobile Computing and M Commerce	04	03-01-00	--
<b>IT-505</b>	Elective-I	04	03-01-00	--
<b>IT-506</b>	Laboratory Practice-I	03	00-00-06	06
<b>IT-507</b>	Seminar-I	01	00-00-02	02
<b>Total for Part-I</b>		<b>24</b>	<b>15-05-08</b>	<b>08</b>
<b>IT-508</b>	Advance trends in data Base Management	04	03-01-00	--
<b>IT-509</b>	Management Trends in Information Technology	04	03-01-00	--
<b>IT-510</b>	Information & Wireless Network Security	04	03-01-00	--
<b>IT-511</b>	Grid Computing	04	03-01-00	--
<b>IT-512</b>	Elective-II	04	03-01-00	--
<b>IT-513</b>	Laboratory Practice-II	03	00-00-06	06
<b>IT-514</b>	Seminar-II	01	00-00-02	02
<b>Total for Part-II</b>		<b>24</b>	<b>15-05-08</b>	<b>08</b>
<b>Total for Part-I and Part-II</b>		<b>48</b>	<b>24-08-16</b>	<b>16</b>

<b>IT- 505 : Elective-I</b>	<b>IT-512 – Elective-II</b>
Parallel Computing Fundamentals and Techniques	Parallel Processing Using Massively Parallel Processors
Real Time and Embedded Systems	Cloud Computing
User Interface Design	Image Processing and Computer Vision
Information Retrieval	Soft Computing

**SECOND YEAR**

<b>Code</b>	<b>Name of the course</b>	<b>Total credits</b>	<b>Lectures /week L-T-P</b>	<b>Practical/ week</b>
<b>IT-515</b>	Comprehensive Viva	02	00-00-04	04
<b>IT-516</b>	Seminar-III	02	00-00-04	04
<b>IT-517</b>	Project -I	08	00-00-10	10
<b>Total for Part-I</b>		<b>12</b>	<b>00-00-18</b>	<b>18</b>
<b>IT-518</b>	Project-II (Dissertation)	20	00-00-20	20
<b>Total for Part-II</b>		<b>20</b>	<b>00-00-20</b>	<b>20</b>
<b>Total for Part-I and Part-II</b>		<b>32</b>	<b>06-02-38</b>	<b>38</b>

## IT-501: Applied Algorithms

(Lectures: 3 Hrs/week Tutorials- 01 Hrs/Week  
04)

Total Credits:

1. **Introduction to Problem Solving:** Review of algorithmic strategies; proof Techniques such as implication, converse, inverse, contra positive, negation and contradiction. Structure of formal proofs, direct proofs, proof by counterexample, proof by contra position, proof by contradiction, mathematical induction, strong induction, recursive mathematical definitions, well orderings.
2. **Analysis of Algorithms:** Asymptotic analysis: upper and average complexity bounds. Identifying differences among best, average and worst Case Behaviors. Big O, little O, omega and theta notations, Standard complexity classes. Empirical measurements of performance. Time and space trade offs in algorithms. Analyzing recursive algorithms using recurrence relations.
3. **Fundamental Computing Algorithms:** Numerical algorithms. Sequential and binary search algorithms. Quadratic sorting algorithms and  $O(n \log n)$  sorting algorithms. Algorithms on graphs and their complexities.
4. **Advanced data structures:** self-adjustment, persistence and multi-dimensional trees. Randomized algorithms: Use of probabilistic inequalities in analysis.
5. **Geometric algorithms;** Point location, convex hulls and Voronoi diagrams. Arrangements applications using examples.
6. **Graph Algorithms:** Matching and Flows. Approximation algorithms. Use of Linear programming and primal dual, local search heuristics.
7. **Parallel Algorithms:** Parallel algorithms; Basic techniques for sorting, searching merging, list ranking in PRAMs, and interconnection networks. Parallel computers and models, performance measures. Parallel Complexity: The NC Class, Basic Lower and Upper Bounds. Algorithms for Parallel Computers: Pointer Jumping, CRCW algorithms and EREW algorithms.

### Reference Books:

1. Lakshmivarahan S., Dhall S., "Analysis and Design of Parallel Algorithms", McGrawHill
2. Cormen, Leiserson, Rivest, "Algorithms", PHI
3. S. Baase, S and A. Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", 3rd edition. Addison Wesley, 2000
4. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms", Addison Wesley
5. Horowitz, Sahni, "Fundamentals of Computer Algorithm", Galgotia.
6. Knuth, "Art of Programming", Addison Wesley
7. C Papadimitriou and K Steiglitz, "Combinatorial Optimization", PHI Bressard, "Fundamentals of Algorithms", PHI

## IT-502: Software Engineering Methodologies

(Lectures: 3 Hrs/week Tutorials- 01 Hrs/Week

Total Credits : 04)

1. **Software Process Models:** Software Process Framework, Process Patterns, Personal and Team Process Models, Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Iterative Development, The Unified Process, Agile process, Process Assessment, CMMI, Impact of Processes and Outcomes, Process Selection and applicability
2. **Requirements Engineering:** Requirements Engineering Tasks, Requirement Elicitation Techniques, Software Requirements: Functional, Non-Functional, Domain, Requirements Characteristics and Characterization, Requirement qualities, Requirement Specification, Requirement Traceability, System Analysis Model Generation, Requirement Prioritize
3. **UML 2.0 Concepts:** Programming In Small Versus Programming In Large, UML 2.0 History/ New Features MDA/ MOF/ XMI/ CORBA, Introduction to UML Meta model , Extensibility Mechanisms and its usage, Introduction to OCL ,Specification techniques of diagrams in UML
4. **Behavioral Model:** Use Cases, Use Case Diagram Components, Use Case Diagram , Actor Generalization, Include and Extend, Template for Use Case Narrative , Using Use Cases Data Dictionary: Finding the Objects, Responsibilities, Collaborators, and Attributes , CRC Cards
5. **Dynamic Behavior:** Sequence diagrams, object lifelines and message types, Refining sequence diagrams, Implementing memory in objects using state machines, States,events and actions, Nested machines and concurrency, Modeling methods with activity diagrams, Activity Diagrams: Decisions and Merges, Synchronization, Drilling Down, Iteration, Partitions, Parameters and Pins, Expansion Regions, Swim lanes, concurrency and synchronization, Communication Diagram, Timing Diagrams
6. **Design Engineering :** Design quality, Design Concepts, The Design Model, Introduction to Pattern-Based Software Design, Architecture styles: Main program with sub program style, Abstract data type style, Repository, Layered. Architectural Design: Software Architecture, Data Design and Architectural Design, User Interface Design: Rules, User Interface Analysis and Steps in Interface Design, Design Evaluation
7. **Object Oriented Design :** Design of Objects, Design and Factoring , Design of Software Objects ,Features and Methods, Cohesion of Objects , Coupling between Objects, Coupling and Visibility, Inheritance, Establishing The Object Model, defining classes and associations, Analysis model vs. design model classes, Categorizing classes: entity, boundary and control, Modeling associations and collections, Achieving re usability, Reuse through delegation , Identifying and using service packages
8. **Principles of Testing :** Testing Concepts: Purpose of Software Testing, Testing aspects: Requirements, Test Scenarios, Test cases, Test scripts/procedures, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures,

Testing, Debugging & Root Cause Analysis, Software Items, Component & Units, Verification & Validation, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Benefits of Formal Test Documentation  
White-Box Testing: Test Adequacy Criteria, Static Testing, Structural Testing, Code Complexity Testing, Mutation Testing Black-Box Testing: Test Case Design Criteria, Requirement Based Testing, Positive and Negative Testing, Boundary Value Analysis, Equivalence Partitioning, State Based Testing, Compatibility Testing, User Documentation Testing, Domain Testing

9. **Project Planning and Estimation** : Project Activities, Structures and Frameworks, Developing Realistic Estimates Integrating the Schedule and Critical Path, Introduction to Complex Projects, Assessing Project Viability, Managing Stakeholders, Introduction to Function Points, Empirical Estimation, COCOMO II model, Software Measurement Framework, Ishikawa's Seven tools, Process Assessment and patterns, CMMI, IPPD, Product and Process attributes

#### **Reference Books:**

1. Ian Sommerville, Software Engineering, 7th Edition, Addison-Wesley, 2004, ISBN 81-7758-530-4
2. Grady Booch, James Rumbaugh, Ivar Jacobson, "Unified Modeling Language Users Guide", 2nd Edition, Addison- Wesley, ISBN – 0321267974.
3. Jim Arlow, Ila Neustadt, "UML 2 and Unified Process: Practical Object Oriented Analysis and Design.", 2nd Edition, Addison- Wesley, ISBN – 0321321278.
4. Tom Pender, "UML Bible", John Wiley & sons, ISBN – 0764526049.
5. Desikan, Ramesh, ' Software Testing: principles and Practices', Pearson Education, ISBN 81-7758-121-X.
6. Burnstein, "Practical Software Testing", Springer International Edition, ISBN 81-8128-089-X
7. William E. Perry, " Effective Methods for Software Testing", John Wiley and Sons, ISBN 9971-51-345-5
8. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education, ISBN 81-297-0175-8

---

### **IT-503: Net-Centric Computing**

(Lectures: 3 Hrs. /week Tutorials- 01 Hrs/Week

Total Credits: 04)

1. **Network Technology** : Introduction, Media Issues, Data Link Protocols, The OSI Model, Networking topologies, Types of Networks, protocols capabilities, NetBIOS, IPX, TCP/IP, CSMA/CD, token passing, frame relay, networking devices, Repeaters, Bridges, Routers, switches, gateways, Network design issues, Data in support of Network Design, Network design tools, protocols and architecture.
2. **Network Performance, Modeling and Estimation:** Issues related with optimizing network performance, probability, stochastic processes, modeling and

- performance evaluation. Queuing theory, queuing models, estimating model parameters, throughput utilization, modeling network as graph external and internal representation, complexity issues, network traffic controls.
3. **Network Administration:** Function and responsibilities, network issues:- planning, implementation, fault diagnosis and recovery.
  4. **Network Design:** Problem definition, multipoint line layout heuristics, CMST algorithms, ESAU-William's algorithm, Sharma's algorithm, unified algorithm, Bin packing algorithm, Terminal assignments and concentrator location.
  5. **High Speed Networks :**Need, characteristics, challenges, applications, frame relay, ATM, ISDN, High speed LANs: Ethernet, fiber channel, DQDB, SMDS, B\_ISDN, STM, DSL, and DWDM, Architecture Transport, Switching and Routing in optical domain, optical network management, Internetworking.
  6. **Network Security :** Basic cryptographic techniques, security in OSI architecture, internet and networked computing, Kerberos, firewalls, proxy, etc. Security applications in commerce and banking.
  7. **IP Telephony:** VOIP system architecture, protocol hierarchy, structure of a voice endpoint, Protocols for the transport of voice media over IP networks, Providing IP quality of service for voice, signaling protocols for VOIP, PSTN gateways, VOIP applications.
  8. **Storage Networks:** Introduction, challenges, SCSI protocols and architecture: RAID, Backup and mirroring, Fiber channel attached storage. Network attached storage including NFS, CIFS, and DAFS, Management of network storage architectures. New storage protocols, architectures and enabling technologies.
  9. **Compression:** Overview of Information Theory, Lossless Compression: Run-Length Encoding, Facsimile compression, String Matching algorithms. Lossy compression: DCT, Wavelet compression.

#### **Reference Books:**

1. Stallings. W.-"High Speed Networks and Internets:Performance and Quality of service",Prentice Hall 2002
  2. Kershenbaum A.-"Telecommunications Network Design Algorithms" TataMcGraw Hill.
  3. Ramaswami R. ,Shivrajan K-"Optical Networks",Morgan Kaufmann.
  4. Douskalis B.-"IP Telephony:The Integration of Robust VOIP service",Perason Education Asia .
  5. Douglas E.Comer-"Computer NetWorks and Internet",Pearson Education Asia.
  6. Stallings W.-"High Speed Networks :TCP/IP and ATM Design principles",Prentice Hall,1998.
  7. Andrew Tanenbaum- "computer Network",PHI.
-

## **IT-504: Mobile Computing and M Commerce:**

(Lectures: 3 Hrs. /week Tutorials- 01 Hrs/Week

Total Credits: 04)

Introduction: Generations of mobile computing, Spectrum allocation, Standard Bodies, Players in the Wireless Space, three tier architecture of mobile computing, Mobile Computing through Internet, Basic cellular system, concept of frequency reuse channels, hand-off mechanism, cell splitting

**GSM & GPRS** : GSM features and Architecture , Network Aspects in GSM ,GSM Frequency Allocation, Mobility management, hand-off mechanisms, cell splitting, Security issues used in GSM, GPRS features and architecture, network operations, data services in GPRS, applications and limitations, SMS and MMS services architecture and operation details

**Emerging Telecommunication Technologies** :Introduction, bluetooth, EDGE, UMTS, Wireless Broadband (WiMAX), Mobile IP, Java Card, WLAN, Ad-hoc Networks, Sensor Networks, Spread Spectrum technology, CDMA, Third generation networks and applications, WAP: Model, architecture & protocol stack

**Security Issues in Mobile Computing** : Introduction, Information security, Security techniques and Algorithms, security Protocols, Public Key Infrastructure, Trust, Security Models, Security Frameworks for Mobile Environment

**M-Commerce: Introduction to m-commerce** :Emerging applications, different players in m-commerce, m-commerce life cycle Mobile financial services, mobile entertainment services, and proactive service management

**Management of mobile commerce services** : Content development and distribution to hand-held devices, content caching, pricing of mobile commerce services

**The emerging issues in mobile commerce** : The role of emerging wireless LANs and 3G/4G wireless networks, personalized content management, implementation challenges in m-commerce, futuristic m-commerce services

### **Text Book:**

1. Mobile Computing (Technology, Applications and Service Creation) Asoke. K Talukder and Roopa R. Yavagal. TATA McGRAW HILL
2. Mobile Communication : Jachan Schiller, Adison-Wesley.
3. Wireless and Mobile Network Architecture : Yi-Bing Lin, Wiley
4. Mobile Commerce: Technology, Theory and Applications by Brian Mennecke and Troy J. Strader, Idea Group Publishing

### **Reference Books :**

1. Mobile Commerce and Applications, Upkar Varshney, A tutorial at IEEE International Conference on Wireless Communications (WCNC)
2. Mobile Commerce: Frameworks, Applications and Networking Support, ACM/Kluwer Journal on Mobile Networks and Applications (MONET), June 2002 (Upkar Varshney and Ron Vetter)
3. Location-based Mobile Commerce Services, ACM Transactions on Internet Technology, August 2003, (Upkar Varshney)

4. Mobile Commerce: An Emerging Frontier, IEEE Computer, Oct 2000 (Varshney and others)
  5. Group-oriented Mobile Services, ACM/Kluwer Journal on Mobile Networks and Applications (MONET), 2004 (Upkar Varshney)
- 

## **IT-505: Elective-I**

(Lectures: 3 Hrs/week    Tutorials- 01 Hrs/Week

Total Credits: 04)

### **IT- 505 (a): Parallel Computing Fundamentals and Techniques**

#### **I. Fundamentals**

##### **Introduction**

**Motivation for Parallelism:** Parallel Computing, Speed Up, Moore's Law, Grand Challenge Problems, Trends;

**Parallel and Distributed Computers:** Flynn's Taxonomy, Distributed Memory Multicomputer, Shared Memory Multiprocessors, Networks of Workstations, Cluster and Grid Computing;

**Message Passing Computing:** Process Creation, Message Passing Routines, Point-to-Point, Collective Communication;

**MPI and PVM:** MPI Model of Computation, Basic Concepts, Message Passing Routines, Point-to-Point, Collective Communication, Comparison of MPI and PVM;

**Performance Measures:** Granularity, Speed Up, Efficiency, Cost, Amdahl's Law, Gustafson's Law, Isoefficiency;

**Analysis of Parallel Programs:** Parallel Computation Models, PRAM, Modeling Communication, Cluster Cost Model;

**Revision:** Fundamentals.

#### **II. Programming Techniques**

##### **Introduction**

**Embarrassingly Parallel Computations:** Low Level Image Processing, Mandelbrot Set, Monte Carlo Methods;

**Simple Data Partitioning:** Sum of Numbers, Bucket Sort, Numerical Integration, N-Body Problem;

**Divide-and-Conquer:** Sum of Numbers, Merge Sort, Adaptive Quadrature, Barnes-Hut Algorithm;

**Pipelined Computations:** Type 1, 2 and 3 Pipelines, Sum of Sequence, Insertion Sort, Prime Number Generation, Back Substitution;

**Scheduling and Load Balancing:** List Scheduling, Static Load Balancing, Dynamic Load Balancing, Moore's Algorithm;

**Synchronous Computations:** Data Parallel Programming, Global and Local Synchronization, Solving Linear Equations, Cellular Automata;

**Shared Memory Programming:** Threads, Compiler Directives, OpenMP;



**Revision:** Fundamentals;

### **III. Algorithms and Applications**

**Introduction:** Algorithms and Applications;

**Sorting Algorithms:** Rank Sort, Compare and Exchange, Bubble Sort, Quicksort,

**Numerical Algorithms:** Matrix Algorithms, Solving Linear Equations, Gaussian Elimination; Jacobi Iteration;

**Image Processing:** Low Level Image Processing, High Level Image Processing, Fourier Transform;

**Revision:** Algorithms and Applications;

### **IV. Introduction of GPU Computing and CUDA**

**GPU Computing Introduction:** GPUs as Parallel Computers, Architecture of a Modern GPU, Why More Speed or Parallelism? History of GPU Computing

**CUDA Introduction and Programming:** Data Parallelism, CUDA Program Structure, Kernel Functions and Threading, Summary Function declarations, Kernel launch

**CUDA Threads:** CUDA Thread Organization, Using blockIdx and threadIdx, Synchronization and Transparent Scalability

**CUDA Memories**

**Performance Considerations**

**Applications**

#### **Reference Books:**

1. Barry Wilkinso , Michael Allen ,”Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers (2nd Edition)” , Prentice Hall PTR (2005), ISBN 0-13-140563-2 (Home Page for Text Book).
2. Michael J. Quinn., “Parallel Programming in C with MPI and OpenMP”, McGraw Hill (2003), ISBN 0-07-282256-2.
3. A. Grama., A. Gupta., G. Karypis and V. Kumar.,”Introduction to Parallel Computing (2nd edition),” Addison Wesley (2002), ISBN 0-201-64865-2.
4. David Kirk., Wen-mei Hwu., “ Programming Massively Parallel Processors: A Hands-on Approach”, Morgan Kaufmann
5. Jason Sanders., Edward Kandrot., “CUDA by Example, An Introduction to General Purpose GPU Programming”, Addison-Wesley

---

### **IT- 505 (b): Real Time and Embedded Systems**

**Embedded Architecture** :Embedded Computers, Characteristics of Embedded Computing Applications, Challenges in Embedded Computing system design, Embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Formalism for System Design- Structural Description, Behavioral Description, Design Example: Model Train Controller

**Embedded Processor And Computing Platform** :ARM processor- processor and memory organization, Data operations, Flow of Control, SHARC processor- Memory organization, Data operations,Flow of Control, parallelism with instructions, CPU Bus configuration, ARM Bus, SHARC Bus, Memory devices, Input/output devices, Component interfacing, designing with microprocessor development and debugging, Design Example : Alarm Clock.

**Networks** : Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link ports, ethernet, Myrinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Example: Elevator Controller.

**Real-Time Characteristics** : Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-line Versus On- line scheduling.

**System Design Techniques** :Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design, Quality Assurance, Design Example:Telephone PBX- System Architecture, Ink jet printer- Hardware Design and Software Design, Personal Digital Assistants, Set-top Boxes.

**Reference Books :**

1. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Morgan Kaufman Publishers, 2001.
2. Jane.W.S. Liu Real-Time systems, Pearson Education Asia, 2000
3. C. M. Krishna and K. G. Shin , Real-Time Systems, ,McGraw-Hill, 1997
4. Frank Vahid and Tony Givargi, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons, 2000.Networking)

---

## **IT-505 (c): User Interface Design**

**Introduction to Human-Computer Interaction as an emerging field** : Disciplines contributing to HCI, Human Information Processing Psychology of everyday things, Importance of human factors in design – cultural , emotional , technological, business,Need Satisfaction curve of technology,Levels of human computer interaction

**Foundations of User Interface Design (U.I.D):** Goals of UID, Goal directed Design, User Interface Models, Understanding and Conceptualizing Interface, Psychology of users designing for collaboration and communication, Process of Interaction Design, Standards & Guidelines, Usability Testing, GIU.

**UCD Models , UCD methodology** : User centered design life cycle - cooperative , participative , contextual Understanding users , user experience levels , human

information processing - i/o channels ISO 13407, Human memory , user study techniques , user models, User research - Personas, , scenarios , story boarding Focus Groups , Card Sorting , Questionnaires , Interviews , On-site observation, Role Playing, Walkthroughs,

**User research** : O, interviews, questionnaires, social interaction & emotional design,

**Interaction Design** : Goals of interaction design , Interaction design strategies Task analysis & design , GOMS model , navigation design , screen design Defining interactivity , types of interactions , interaction models Interaction models , styles, Advancements in interaction devices Ergonomics principles in interaction design

**Types participatory** : Scenario/task based , usage centered , user centered, User interface models, Interface metaphors and conceptual models User support systems – online help, documentation Accessibility of User Interfaces Heuristics , Principles , patterns in interaction design HCI frameworks, Architectural patterns for user interface Designing for effectiveness , comprehension , satisfaction

**Evaluation criteria for UI testing** : Usability Testing , Suitability Testing , Accessibility Testing Testing methods - Think Aloud , Video taping , Customer Satisfaction questionnaires Advantages & disadvantages of user centered design Case studies in UCD

**Usable Web - Web Site Usability** : Web User Interfaces , Rich web experience design Navigations , Links , Searching , Comparisons , Readability , Collaborative systems, groupware & coordination technology

**Object Oriented User Interfaces (OOUI)** : Identifying needs and establishing requirement , Object Oriented User Interface, Migrating GUI to Object Oriented User Interfaces.

**Advanced UI – Techniques and Technology**: User Interface design, Toolkit, Help Advise, Wizard Testing and Modeling Testing, PC –Internet user Interface.

#### **Reference Books:**

1. Elements of User Interface Design - Theo Mandel, John Wiley & Sons
2. Interaction Design – Preece, Roger, Sharp, John Wiley & Sons
3. Essentials of User Interface Design – Alan Cooper – Wiley India.
4. Object Modeling & User Interface Design - Mark Hamelen ,
5. Human Computer Interaction by Alan Dix

---

### **IT-505(d): Information Retrieval**

**Introduction:** Basic Concepts – Retrieval Process – Modeling – Classic Information Retrieval – Set Theoretic, Algebraic and Probabilistic Models – Structured Text Retrieval Models – Retrieval Evaluation – Word Sense Disambiguation

**Querying:** Languages – Key Word based Querying – Pattern Matching – Structural Queries – Query Operations – User Relevance Feedback – Local and Global Analysis – Text and Multimedia languages

**Text Operations and User Interface:** Document Preprocessing – Clustering – Text Compression – Indexing and Searching – Inverted files – Boolean Queries – Sequential searching – Pattern matching – User Interface and Visualization – Human Computer Interaction – Access Process – Starting Points – Query Specification – Context – User relevance Judgment – Interface for Search

**Multimedia Information Retrieval:** Data Models – Query Languages – Spatial Access Models – Generic Approach – One Dimensional Time Series – Two Dimensional Color Images – Feature Extraction

**Applications :** Searching the Web – Challenges – Characterizing the Web – Search Engines – Browsing – Meta-searchers – Online IR systems – Online Public Access Catalogs – Digital Libraries – Architectural Issues – Document Models, Representations and Access – Prototypes and Standards

**References:**

1. Ricardo Baeza-Yate, Berthier Ribeiro-Neto, “Modern Information Retrieval”, Pearson Education Asia, 2005.
2. G.G. Chowdhury, “Introduction to Modern Information Retrieval”, Neal-Schuman Publishers; 2nd edition, 2003.
3. Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, Pearson Education, 2000
4. David A. Grossman, Ophir Frieder, “ Information Retrieval: Algorithms, and Heuristics”, Academic Press, 2000
5. Charles T. Meadow, Bert R. Boyce, Donald H. Kraft, “Text Information Retrieval Systems”, Academic Press, 2000

---

**IT-506: Laboratory Practice – I**

(Practical's: 06 Hours a week

Total Credits: 03)

Experiments/Assignments based on Subjects IT-501, IT-502, IT-503, IT-504 and IT-505 and/or small project. The lab in charge should frame minimum of five assignments/ Experiments in each of the subjects mention above.

---

**IT-507: Seminar**

(Practical: 02 Hours a week

Total Credits : 01)

The students will deliver a talk on their experience during the semester referring to at least two research papers and will deliver a seminar on topic of current interest in Information Technology, Computer Science and Engineering field. The student is expected to review and study at least four research papers from IEEE transactions based on the theory subjects.

## SEMESTER –II

### **IT-508: Advance Trends in Data Base Management.**

(Lectures: 3 Hrs/week Tutorials- 01 Hrs/Week

Total Credits : 04)

1. Distributed databases: Schemas, Architectures, Queries, Transactions, implementation aspects.
2. Data warehousing: Data preprocessing, Data Warehousing; Warehouse DBMS, multidimensional data warehouses, data warehouse architectures. Data cubes, Dashboards, BI
3. Data Mining :KDD process, Data mining applications, Data mining Techniques and Algorithms , frequent Patterns, association rules , correlation, classification, prediction
4. Introduction to Active databases syntax, semantics and applications.
5. Introduction to Object Databases .OR mapping classes and inheritance, TP Monitors and architecture of TP systems
6. Web mining introduction, crawling the web, web search and information retrieval

#### **Reference Books:**

1. Avi Silberschatz Henry F. Korth S. Sudarshan Database System Concepts Fifth Edition McGraw-Hill
2. Jiawei Han and Micheline Kamber Data Mining: Concepts and Techniques, 2nd ed.
3. Chakrabarti, S. (2002). Mining the Web: Discovering knowledge from hypertext data. Morgan-Kaufman.
4. M. Jarke, M. Lenzerini, Y. Vassiliou, P. Vassiliadis (ed.), Fundamentals of Data Warehouses, Springer-Verlag, 1999
5. Advanced Database Systems (The Morgan Kaufmann Series in Data Management Systems) (Hardcover) by Carlo Zaniolo (Author), Stefano Ceri (Author), Christos Faloutsos (Author), Richard T. Snodgrass (Author), V.S. Subrahmanian (Author), Roberto Zicari (Author)
6. Database Systems: An Application Oriented Approach, Complete Version, 2/E Michael Kifer, Arthur Bernstein, Philip M. Lewis
7. Java Persistence with Hibernate Second Edition of Hibernate in Action, Christian Bauer and Gavin King

---

### **IT-509: Management Trends in Information Technology**

(Lectures: 3 Hrs/week Tutorials- 01 Hrs/Week

Total Credits: 04)

**Managing with IT** : Applications of IT in Functions Like Finance, Accounting, Stores, Purchase,

Product Design, Quality Control, Logistics, Marketing, Customer Relationship, ERP, Health Care, Insurance, Banking, Agriculture, Railways, Defense, Road transport, Utilities, shipping, airlines. Social service organizations, Case Studies.

**Information Resources Management** :Building information model of the organization, Infrastructure status assessment Aligning IT strategy with business strategy, Developing IT strategy for the organization, Managing information resources function, Developing information systems, Database administration and housekeeping, Developing disaster recovery strategy, Auditing IT/IS systems.

**IT project management**: Defining Project Goals, Gathering Project Information, Establishing Project Priorities, Requirements Analysis, Risk Management, Project Budgeting, Creating a Work Breakdown Structure, Cost Estimation. Organizing a Project Team, Assessing Internal Scales, Creating a Team, Managing Team Issues, Resources Procurement, Preparing and Implementing Project Plan, Defining the Project Schedule, Project Network Diagram Creation and Analysis, Project Constraints, Tracking Project Progress and Financial Obligations. Revising the Project Plan, Need for Revision, Establishing Change Control, Implementing the Project Changes, coping with Project Delays.

**Software Quality Management**: Concept of Knowledge Management, Change Management, Technology Management, Supply Chain Management, Process and Project Quality Standards

Intellectual property Rights (IPR) and cyber laws, process and project quality standards - six sigma, CMM, CMMI, PCMM, Impact of IT quality management systems, learning organizations. Quality Assurance and Testing, Planning, Quality Control, Accepted Test Plan. Impact of IT on Quality Management Systems, Learning Organizations.

**Group Dynamics and Team Management**: Theory of Group Formation - Formal and Informal Groups and Their Interaction, Importance of Teams, Formation Of Teams, Term Work, Leading Team, Team Meeting, Conflict Management, Traditional Vis-À-Vis Modern View Of Conflict, Conflict Process, Strategies for Resolving Destructive Conflict, Stress Management, Employee Welfare, Energy Management and Energy Audit.

**Ethics and Corporate Social Responsibility** :Importance of Ethics and Corporate Social Responsibility, Four Forces that shape Ethical Conduct, Three Approaches to making Ethical Judgments,Managing Corporate Social Responsibility, Encouraging Ethical Conduct.

**Reference Books:**

1. IT Project Management by Joseph Phillips Tata McGraw-Hill 2003 Edition.
2. Management - Tasks, Responsibilities and Practices, Peter Drucker.
3. Management Theory and Practice - Ernst Dale.
4. Management Information System- Javadekar
5. Business Policy - Azhar Kazmi
6. Industrial Energy Conservation- D.A. Ray, Pergamon Press
7. Resisting Intellectual Property - Halbert, Taylor & Francis Ltd, 2007.
8. Cyber Law Simplified by Vivek Sood, Tata McGraw Hill.

## **IT-510: Information and Wireless Network Security**

(Lectures: 3 Hrs/week Tutorials- 01 Hrs/Week

Total Credits: 04)

### **1. Network Security Applications**

Authentication Application – Kerberos, X.509 Authentication Service, Authentication Requirements- Message Authentication codes, Hash functions, Security of Hash Functions, hash Algorithms, MD5, Digital Signatures, Digital Watermarking, PKIX Management Protocols, Overview of Public Key Infrastructure – Principles of Public key Cryptosystems, RSA Algorithm, Diffie- Hellman Key Exchange Electronic Mail Security – PGP, S/MIME, IP Security – IP Security overview, IP Security Architecture, Authentication Header, Encapsulating Security payload, Combining Security Associations, Key Management Web security – Web Security Considerations – threats, SSL and Transport Layer Security, Secure Electronic Transaction

### **2. Mobile and Wireless Network Security**

Introduction – Mobile and Wireless Devices, Wireless transmission – Multiplexing, Modulation, Spread Spectrum, Wireless LAN – IEEE 802.11, Bluetooth – security issues in Wireless LANs, Mobile IP – Security issues in GSM network, Application of MANETs – Distributed System Security, Security in Ad Hoc Networks, Key Management, Wireless Sensor Networks – WSN Security, Key Distribution and Management

### **Books**

W. Stallings, *Cryptography and Network Security*, third edition, Prentice Hall, 2003.  
R. Oppliger, *Internet and Intranet Security*, second edition, Artech House, 2002.  
A. Rubin, D. Geer and M. Ranum, *Web Security Sourcebook*, Wiley, 1997.  
W. Cheswick and S. Bellovin, *Firewalls and Internet Security*, Addison-Wesley, 1994.  
M. Pistoia *et al.*, *Java 2 Network Security*, second edition, Prentice Hall, 1999.  
Mobile Communication – Jochen Schiller – Pearson Education  
Maximum Wireless Security – Cyrus Peikari Seth Fogie

### **Web sites**

CERT web site: <http://www.cert.org/>  
Internet RFCs on-line: <http://www.faqs.org/rfcs/>  
PGP web site: <http://www.pgpi.org/>  
S/MIME charter: <http://www.ietf.org/html.charters/smime-charter.html>  
RSA Inc., S/MIME central: <http://www.rsasecurity.com/standards/smime/>  
RSA Inc., Public-Key Cryptography Standards:  
<http://www.rsasecurity.com/rsalabs/pkcs/>  
SSH charter: <http://www.ietf.org/html.charters/secsh-charter.html>  
OpenSSH: <http://www.openssh.com/>  
SSL v3 specification: <http://wp.netscape.com/eng/ssl3/index.html>

TLS charter: <http://www.ietf.org/html.charters/tls-charter.html>  
DNS security: <http://www.dnssec.net/>  
SET specifications: [http://www.setco.org/set\\_specifications.html](http://www.setco.org/set_specifications.html)  
IPSec charter: <http://www.ietf.org/html.charters/ipsec-charter.html>  
L2TP Extensions charter: <http://www.ietf.org/html.charters/l2tpext-charter.html>  
Onion routing: <http://www.onion-router.net/>  
Crowds: <http://www.research.att.com/projects/crowds/>  
IEEE 802.11 security: <http://www.drizzle.com/~aboba/IEEE/>  
Firewalls: <http://www.cerias.purdue.edu/coast/firewalls/>  
Intrusion detection: <http://www.cerias.purdue.edu/coast/intrusion-detection/welcome.html>

---

## IT-511 Grid Computing

(Lectures: 3 Hrs. /week   Tutorials- 01 Hrs/Week

Total Credits: 04)

**Concepts and Architecture** :Introduction-Parallel and Distributed Computing-Cluster Computing-Grid Computing-Anatomy and Physiology of Grid- Web and Grid Services-Grid Standards - OGSAWSRF- Trends, Challenges and applications.

**Grid Monitoring** :Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems- R-GMA -GridICE – MDS- Service Level Agreements (SLAs) - Other Monitoring Systems-Ganglia, GridMon, Hawkeye and Network Weather Service.

**Grid Security and Resource Management:** Grid Security-A Brief Security Primer-PKI-X509 Certificates-Grid Security-Grid Scheduling and Resource Management, Gridway and Gridbus Broker-principles of Local Schedulers- Overview of Condor, SGE, PBS, LSF-Grid Scheduling with QoS.

**Data Management and Grid Portals:** Data Management-Categories and Origins of Structured Data-Data Management Challenges-Architectural Approaches-Collective Data Management Services-Federation Services-Grid Portals-Generations of Grid Portals.

**Grid Middleware:** List of globally available Middlewares - Case Studies-Recent version of Globus Toolkit and gLite - Architecture, Components and Features. Features of Next generation grid.

### References

1. Ian Foster, Carl Kesselman, The Grid 2: Blueprint for a New Computing Infrastructure, Elsevier Series, 2004.
2. Vladimir Silva, Grid Computing for Developers, Charles River Media, January 2006.
3. Parvin Asadzadeh, Rajkumar Buyya, Chun Ling Kei, Deepa Nayar, and Srikumar Venugopal, Global Grids and Software Toolkits: A Study of Four Grid Middleware Technologies, High Performance Computing: Paradigm and



- Infrastructure, Laurence Yang and Minyi Guo (editors), Wiley Press, New Jersey, USA, June 2005.
4. Jarek Nabrzyski, Jennifer M. Schopf, Jan Weglarz, Grid Resource Management: State of the Art and Future Trends , (International Series in Operations Research & Management Science), Springer; First edition, 2003
  5. Srikumar Venugopal, Krishna Nadiminti, Hussein Gibbins and Rajkumar Buyya,
  6. Designing a Resource Broker for Heterogeneous Grids, Software: Practice and Experience, Wiley Press, New York, USA, 2008.
  7. Fran Berman , Geoffrey Fox, Anthony J.G. Hey, Grid Computing: Making The Global Infrastructure a Reality, Wiley, 2003
  8. Maozhen Li , Mark Baker , The Grid: Core Technologies, Wiley, 2005
  9. Joshy Joseph , Craig Fellenstein Grid Computing, IBM Press, 2004
  10. Borja Sotomayor , Lisa Childers, Globus Toolkit 4 : Programming Java Services
  11. The Elsevier Series in Grid Computing, Morgan Kaufmann, 2005
- 

### **IT-512: Elective-III**

(Lectures: 3 Hrs/week   Tutorials- 01 Hrs/Week

Total Credits: 04)

#### **IT-512(a) Parallel Processing Using Massively Parallel Processors**

##### **Subject's Contents:**

##### **1. Introduction:**

###### **Motivation for Parallelism:**

Concurrency and Parallelism, Speedup, Moore's Law,  
Grand Challenge Problems

###### **Parallel Systems:**

Parallel Computing Taxonomies, Instruction Level Parallelism, Shared  
Memory Multiprocessors Systems, Distributed Memory Multiprocessor  
Systems, Cluster and Grid Computing

###### **Performance Measures:**

Granularity, Speed-Up, Efficiency, Cost, Amdahl's Law, Gustafson's Law

##### **2. Parallel Programming Techniques:**

###### **Fundamentals of Shared Memory Programming:**

Parallel Programming Decompositions, Parallel Programming Patterns,  
Synchronization Primitives and Critical Sections, Deadlocks

###### **Shared Memory Programming API's and Environments:**

Threading API's (POSIX Threads), OpenMP

###### **Shared Memory Programming Issues:**

Data Races, Live Locks, and Deadlocks, Heavily Contended Locks, Priority

Inversion, Non-blocking Algorithms, Memory and Cache-related Issues,  
Debugging  
Techniques

**Distributed Memory Programming:**

Message Passing Computing, Message Passing Programming Patterns, MPI and PVM, Remote Procedure Calls (RPC)

**SIMD/GPGPU Computing**

Associative Computing and SIMD, ClearSpeed Programming, Cn language,  
Nvidia  
CUDA

**3. GPU Computing**

**Introduction of GPU Computing**

GPUs as Parallel Computers, Architecture of a Modern GPU, Why More Speed or Parallelism?, Parallel Programming Languages and Models, Overarching Goals

**History of GPU Computing**

Evolution of Graphics Pipelines , The Era of Fixed-Function Graphics Pipelines,  
Evolution of Programmable Real-Time Graphics , Unified Graphics and  
Computing Processors , GPGPU: An Intermediate Step, GPU Computing,  
Scalable GPUs, Recent Developments, Future Trends

**4. CUDA**

**CUDA Introduction**

Data Parallelism, CUDA Program Structure, A Matrix–Matrix Multiplication  
Example, Device Memories and Data Transfer, Kernel Functions and Threading,  
Summary, Function declarations, Kernel launch, Predefined variables, Runtime  
API

**CUDA Threads**

CUDA Thread Organization, Using blockIdx and threadIdx, Synchronization and  
Transparent Scalability

**CUDA Memories**

Importance of Memory Access Efficiency, CUDA Device Memory Types, A  
Strategy for Reducing Global Memory Traffic, Memory as a Limiting Factor to  
Parallelism, Summary, Exercises

**5. Performance Considerations**

More on Thread Execution, Global Memory Bandwidth, Dynamic Partitioning of  
SM Resources, Data Prefetching, Instruction Mix, Thread Granularity, Measured  
Performance and Summary, Exercises

**6. Application Case Studies**

**(Three Case Studies will be on practical scientific applications of CUDA)**

**Reference Books:**

1. David Kirk., Wen-mei Hwu., “ Programming Massively Parallel Processors: A Hands-on Approach”, Morgan Kaufmann
2. Jason Sanders., Edward Kandrot., “CUDA by Example, An Introduction to General-Purpose GPU Programming”, Addison-Wesley

---

## **IT-512(b) Cloud Computing**

### **Course Contents:**

- Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering & Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure, Utility Computing, Elastic Computing
- Introduction to Cloud Technologies, Study of Hypervisors Compare SOAP and REST Web services, Virtualization Technology: Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization Multitenant software: Multi-entity support, Multi-schema approach, Multitenance using cloud data stores, Data access control for enterprise applications,
- Data in the cloud: Relational databases, Cloud file systems: GFS and HDFS, Big Table, H-Base and Dynamo. Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Mapreduce, Features and comparisons among GFS, HDFS etc, Map-Reduce model
- Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud Cloud computing security architecture: Architectural Considerations- General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro-architectures; Identity Management and Access control Identity management, Access control, Autonomic Security Cloud computing security challenges: Virtualization security management virtual threats, VM Security Recommendations, VM-Specific Security techniques, Secure Execution Environments and Communications in cloud.
- Issues in cloud computing, Implementing real time application over cloud platform Issues in Intercloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

- Cloud computing platforms, Installing cloud platforms and performance evaluation Features and functions of cloud platforms: Xen Cloud Platform, Eucalyptus, OpenNebula, Nimbus, TPlatform, Apache Virtual Computing Lab (VCL), Enomaly Elastic Computing Platform,

**Text Book:**

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
2. Enterprise Cloud Computing by Gautam Shroff, Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India

**Reference Book:**

1. Google Apps by Scott Granneman, Pearson
2. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY)
3. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill,
4. Cloud Computing Bible by Barrie Sosinsky, Wiley India
5. Stefano Ferretti et.al., "QoS-aware Clouds", 2010 IEEE 3rd International Conference On Cloud Computing

### **IT-512(c) Image Processing & Computer Vision**

Overview, computer imaging systems, lenses, Image formation and sensing, CVIPlab, Image analysis, preprocessing, Binary image analysis, Edge detection, Edge detection performance, Hough transform, Segmentation ,Morphological filtering, Fourier transform, Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data preprocessing, Pattern classification

**References**

- Digital Image Processing - R.C.Gonzalez & P.Wintz  
 Robot Vision - B.K.P.Horn  
 Computer Vision - D.H.Ballard & C.M.Brown  
 Syntactic Pattern Recognition : An introduction -R.C.Gonzalez and M.G.Thomason  
 Pattern Recognition - A Statistical Approach - P.A. Devijver and J. Kittler  
 Digital Image Processing - W. K. Pratt  
 Fundamentals of Digital Image Processing - A.K. Jain  
 Digital Picture Processing - A. Rosenfeld and A.C. Kak  
 Pattern Classification and Scene Analysis - R.O. Duda and P.E. Hart  
 Object Recognition by Computer - W.E.L. Grimson  
 Digital Pictures - A.N. Netravali and B.G. Haskell  
 Vision in Man and Machine - M.D. Levine  
 Pattern Recognition Statistical, Structural and Neural Approaches, R.J Schalkoff, John

iley & Sons NY

Digital Image Processing and Computer Vision, R.J. Schalkoff, Wiley

Artificial Intelligence: An Engineering Approach, R.J. Schalkoff, McGraw-Hill

Algorithms for Graphics and Image Processing, Theo Pavlidis, Computer Science Press,  
call no.: T385.P381982

Handbook of Pattern Recognition and Image Processing, K.S. Fu and T.Y. Young,  
Academic Press

The Image Processing Handbook, John C. Russ, CRC Press SIUE Library call #:  
TA1632.R881992 (reference)

---

## **IT-512(d) Soft Computing**

**Introduction to Soft Computing and Neural Networks:** Evolution of Computing - Soft Computing Constituents from Conventional AI to Computational Intelligence Machine Learning Basics

**Genetic Algorithms:** Introduction to Genetic Algorithms (GA) ,Applications of GA in Machine Learning -Machine Learning Approach to Knowledge Acquisition.

**Neural Networks:** Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks –Supervised Learning Neural Networks – Radial Basis Function Networks -Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures – Advances in Neural networks.

**Fuzzy Logic:** Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

**Neuro-Fuzzy Modeling :**Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling –Classification and Regression Trees – Data Clustering Algorithms – Rulebase Structure Identification – Neuro-Fuzzy Control – Case studies.

### **Text Books**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”,Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Edn., 2003.

### **References**

1. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
2. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.

3. S. N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, Springer, 2007.
  4. S.N.Sivanandam · S.N.Deepa, “ Introduction to Genetic Algorithms”, Springer, 2007.
  5. Jacek M. Zurada, “Introduction to Artificial Neural Systems”, PWS Publishers, 1992.
- 

### **IT-513: Laboratory Practice – II**

(Practical: 06 Hours a week

Total Credits: 03)

Experiments/Assignments/ Tutorials based on Subjects IT-508, IT-509, IT-510, IT-511, IT-512, and/or small project. The lab in charge should frame minimum of five assignments/ Experiments based on the above syllabus

---

### **IT-514: Seminar - II**

(Practical: 02 Hours a week

Total Credits: 01)

The students will deliver a talk on their experience during the semester and will deliver a seminar on topic of current interest in Information Technology, Computer Science and Engineering field. The student is expected to review and study at least four research papers from IEEE transactions based on the theory subjects

---

## **SECOND YEAR**

### **IT-515: Comprehensive Viva**

(Practical: 04 Hours a week

Total Credits: 02)

At the end of the third semester there will be oral examination in the presence of an external examiner/ Group of examiners based on the syllabus of Part-I and Part-II. Also it will be based on the Project the candidate will undertake during second year of M.Tech.

---

### **IT-516: Seminar – III**

(Practical: 04 Hours a week

Total Credits: 02)

The students will deliver a talk on their experience during the semester and will deliver a seminar on topic of their current research project in Computer Science and Engineering field. The student is expected to review and study research papers from IEEE transactions based on their project topic.

---

### **IT-517: Project – I**

(Practical: 10 Hours a week

Total Credits: 08)

This will include students' overall performance on their respective project for 1<sup>st</sup> semester. Students must have to publish at least one research papers in national/international conferences/journals on their respective topic in an academic year. Students must be ready with details of the project undertaken in that academic year.

---

### **IT-518: Project – II (Dissertation)**

(Practical: 20 Hours a week

Total Credits: 20)

Students will have to complete their dissertation at the end of fourth semester. There will be an oral examination/ Presentation of their dissertation in presence of an external examiner on the topic the student has undertaken for the dissertation in that academic year. Students must be ready with at least one research papers published in national/international conferences/ journals relevant to the topic of their dissertation before appearing for the final dissertation.

---