PONDICHERRY ENGINEERING COLLEGE, PUDUCHERRY – 605 014

CURRICULUM AND SYLLABI FOR AUTONOMOUS STREAM

M.TECH. (INFORMATION TECHNOLOGY) COURSES

(FOR STUDENTS ADMITTED FROM ACADEMIC YEAR 2015-16 ONWARDS)

CURRICULUM[a]

I SEMESTER

Subject Code	Subjects	Category	Periods			Marks #			Credits
			L	T	P	CA	SE	TM	
IT151	Advanced Data Structures and Algorithms	TY	3	1	0	40	60	100	4
IT152	Advanced Computer Architecture	TY	3	1	0	40	60	100	4
IT153	Advanced Operating System	TY	3	1	0	40	60	100	4
IT154	Advanced Databases	TY	3	1	0	40	60	100	4
	Elective-I	TY	3	1	0	40	60	100	4
	Elective-II	TY	3	1	0	40	60	100	4
IT155	Advanced Software Laboratory-I	LB	-	-	3	60	40	100	2
Total Credits									**26**

SEMESTER-II

Subject Code	Subjects	Category	Periods			Marks #			Credits
			L	T	P	CA	SE	TM	
IT156	Network Security	TY	3	1	0	40	60	100	4
IT157	Design of Web Services	TCM	3	0	2	50	50	100	4
	Elective –III	TY	3	1	0	40	60	100	4
	Elective –IV	TY	3	1	0	40	60	100	4
	Elective –V	TY	3	1	0	40	60	100	4
	Elective –VI	TY	3	1	0	40	60	100	4
IT158	Advanced Software Laboratory-II	LB	-	-	3	60	40	100	2
IT159	Research Methodology	PR	-	-	3	100	-	100	1
Total Credits									**27**

[a] ***Approved in 3rd Academic Council Meeting***

SEMESTER-III

Subject Code	Subjects	Category	Periods			Marks #			Credits
			L	T	P	CA	SE	TM	
IT160	Project Phase I	PR	-	-	-	150	150	300	9
Total Credits									**9**

SEMESTER-IV

Subject Code	Subjects	Category	Periods			Marks #			Credits
			L	T	P	CA	SE	TM	
IT161	Project Phase II	PR				200	200	400	14
	Professional Development Courses	PR				200	-	200	2
Total Credits									**16**

A representative list of *Professional Development Courses* is given below:

a. Industrial Training (*Limited to one credit*)
b. Specific Field Knowledge Training
c. Seminar related with directed study
d. Paper Publication in SCI Journals (*Limited to one credit*)
e. Paper Publication in reputed Conference.

CA – Continuous Assessment, **SE** – Semester Examination, **TM** – Total Marks
*** TY** – Theory, **TCM** – Theory with a Mini Project, **LB** – Laboratory, **PR** - Practice

LIST OF ELECTIVES

Sl. No.	Subject Code	Subjects	Category
1	**ITE51**	Soft Computing	TY
2	**ITE52**	Wireless Sensor Networks	TY
3	**ITE53**	Software Quality Management	TY
4	**ITE54**	Meta Heuristic Optimization	TY
5	**ITE55**	Ontology and Semantic Web	TY
6	**ITE56**	Knowledge Engineering	TY
7	**ITE57**	Biometrics	TY
8	**ITE58**	Image and Video Coding	TY
9	**ITE59**	Compiler Construction and Optimization	TY
10	**ITE60**	Software Project Management	TY
11	**ITE61**	Speech Processing	TY
12	**ITE62**	Multimedia Systems	TY
13	**ITE63**	Pervasive Computing	TY
14	**ITE64**	Big Data Analytics	TY
15	**ITE65**	Business Intelligence	TY
16	**ITE66**	Software Requirements Engineering	TY
17	**ITE67**	Machine Learning Techniques	TY
18	**ITE68**	Information Retrieval Techniques	TY
19	**ITE69**	Ad hoc and Sensor Networks	TY
20	**ITE70**	Web Data Mining	TY
21	**ITE71**	Network Engineering and Management	TY

SYLLABUS (Core Subjects)

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester : One				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT151	Advanced Data Structures and Algorithms	3	1	0	4	40	60	100

Prerequisite	-
Objective	• To extend the students' knowledge in data structures and algorithms with advanced topics • To develop students to select and design appropriate data structures and algorithms to solve complex problems
Outcome	• Ability to analyze algorithms and to determine algorithm correctness • Mastering a variety of advanced data structures and their implementations • Apply suitable design strategies for problem solving

UNIT – I	**Algorithm Analysis**	**Hours: 12**
Mathematical Proof Techniques: Induction, Proof By Contradiction, Direct Proofs – Asymptotic Notations – Properties Of Big O Notation – Conditional Asymptotic Notation – Algorithm Analysis – Amortized Analysis – Introduction To NP Hard, NP Completeness – Recurrence Equations – Solving Recurrence Equations – Time / Space Trade Off.		
UNIT – II	**Heap structures**	**Hours: 12**
Min / Max Heaps – DEPQ – Liftist Trees – Binomial Heaps – Fibonacci Heaps – Skew Heaps – Pairing Heaps – Interval Heaps		
UNIT – III	**Advanced Tree structures**	**Hours: 12**
Binary Search Trees – AVL Trees – Red Black Trees – Multi Way Search Trees – B Trees – Splay Trees – Tries		
UNIT – IV	**Multi-Dimensional Data Structures**	**Hours: 12**
Segment Trees – K-D Trees – Point Quad Trees – MX Quad Trees – R Trees – TV Trees		
UNIT – V	**Geometric Structures**	**Hours: 12**
1-Dimensional Range Searching – Line Segment Intersection – Convex Hulls – Computing Overlay of Two Subdivisions – Range Trees – Voronoi Diagram		

Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**	**Total Hours: 60**

Text Books:

1. Mark de Berg, Otfried Cheong, Marc Van Kreveld and Mark Overmars, Computational Geometry Algorithms and Applications, Springer-Verlang, 3rd Edition, 2008.
2. S.Sahni, Data Structures, Algorithms and Applications in C++, 2nd Edition, Universities Press, 2005.

Reference Books:

1. E.Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data Structures in C++, Universities Press, 2nd Edition, 2007.
2. G. Brassard and P.Bratley, Algorithmics: Theory and Practice, Prentice Hall of India, 1988

Web sites:

1. http://en.wikibooks.org/wiki/Advanced_Data_Structures_and_Algorithms
2. http://www.cs.ox.ac.uk/teaching/courses/adsa/
3. http://theory.stanford.edu/~rajeev/cs361.html

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester : One				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT152	Advanced Computer Architecture	3	1	0	4	40	60	100
Prerequisite	--							
Objective	• To understand the advances in Computer Architecture • To understand the Parallel Programming Platforms							
Outcome	On completion of the course, the students are able to • To exploit the parallel programming platforms. • To write efficient programs							
UNIT – I	**Introduction**						**Hours: 12**	
Need of High Speed Computing – Increase the Speed of Computers – History of Parallel Computers and Recent Parallel Computers; Solving Problems in Parallel – Temporal Parallelism – Data Parallelism – Comparison of Temporal and Data Parallel Processing – Data Parallel Processing with Specialized Processors – Inter-Task Dependency. The Need for Parallel Computers - Models of Computation - Analyzing Algorithms –Expressing Algorithms.								
UNIT – II							**Hours: 12**	
Parallel Programming Platforms: Trends in Microprocessor Architectures - Limitations of Memory System Performance – Parallel Computing Platforms – Communication Costs in Parallel Machines – Routing Mechanisms for Interconnection Networks. **Principles of Parallel Algorithm Design**: Preliminaries – Decomposition Techniques – Characteristics of Tasks and Interactions – Mapping Techniques for Load Balancing – Methods for Containing Interaction Overheads – Parallel Algorithm Models. **Basic Communication Operations**: One-to-All Broadcast and All-to-One Reduction – All-to-All Broadcast Reduction – All-Reduce and Prefix-Sum Operations – Scatter and Gather – All-to-All Personalized Communication – Circular Shift – Improving the Speed of Some Communication Operations.								
UNIT – III	**Analytical Modeling of Parallel Programs**:						**Hours: 12**	
Sources of Overhead In Parallel Programs – Performance Metrics For Parallel Systems – Scalability Of Parallel Systems – Minimum Execution-Time and Minimum Cost-Optimal Execution Time - Programming Using the Message-Passing Paradigm: Principles of Message-Passing Programming – Building Blocks – MPI – Topologies and Embedding – Overlapping Communication with Computation – Collective Communication and Computation Operations – Groups and Communicators-Programming Shared Address Space Platforms: Thread Basics – Synchronization Primitives in threads – Controlling Thread and Synchronization Attributes – Composite Synchronization Constructs – Tips for Designing Asynchronous Programs – Open MP.								
UNIT – IV							**Hours: 12**	
Dense Matrix Algorithms: Matrix-Vector Multiplication – Matrix-Matrix Multiplication – Solving A System of Linear Equations – FFT. **Sorting**: Issues in Sorting on Parallel Computers – Sorting Networks – Bubble Sort and Its Variants – Quick sort – Bucket and Sample Sort – Other Sorting Algorithms. **Graph Algorithms**: Definitions and Representation – Minimum Spanning Tree – Single-Source Shortest Paths – All-Pairs Shortest Paths.								
UNIT – V							**Hours: 12**	
Search Algorithms for Discrete Optimization Problems: Definitions and Examples, Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies In Parallel Search Algorithms-**Dynamic Programming**: Overview.								
Total Contact Hours: 45	**Total Tutorials: 15**			**Total Practical Classes:**			**Total Hours: 60**	
Text Books:								
1. V. Rajaraman and C. Siva Ram Murthy, Parallel Computers – Architecture and Programming, Prentice-Hall of India, 2003. 2. Ananth Grama, Anshul gupta, George Karypis and Vipin Kumar, Introduction to Parallel Computing, Pearson Education, Second Edition, 2004.								

Reference Books:

1. Selim G. Akl, The Design and Analysis of Parallel Algorithms, Prentice-Hall of India, 1999.
2. M. J. Quinn, Parallel Computing – Theory and Practice, McGraw-Hill, 1994.
3. M. J. Quinn, Parallel Programming in C with MPI and Open MP, McGraw-Hill, 2003

Department : IT		Programme : M.Tech.						
Semester: One		Category: TY						
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
IT153	Advanced Operating System	3	1	0	4	40	60	100
Prerequisite:	----							
Objective:	• To understand main components of Distributed Operating System, Network Operating System, Real-time Operating system and Mobile Operating System. • To study the operations performed by different OS as a resource manager. • To understand the scheduling policies of RTOS, DOS and Mobile OS.							
Outcome:	• Able to list the requirements and features of different type of OS • Able to design a specific type of Operating System							
UNIT – I	Distributed Operating System (DOS)					Hours: 12		
DOS Definition - Issues in designing a DOS - Message Passing - Remote procedure calls - Distributed shared memory (DSM) – Synchronization - Resource and Process Management - Case Study: Amoeba								
UNIT – II	Network Operating System (NOS)					Hours: 12		
NOS Definition – Differences between DOS and NOS - Characteristics of NOS - Issues in design and implementation of a NOS - Case study: Unix - Windows NT - Novel Netware								
UNIT – III	Real-time operating System (RTOS)					Hours: 12		
Real-time system definition and types - Real-time task scheduling - Types of real-time tasks and their characteristics - Classification of real-time scheduling algorithms - Clock-driven scheduling - Event driven scheduling - Resource sharing and Dependencies among real-time tasks – RTOS - Case Study: PSOS – RT Linux – Windows CE								
UNIT – VI	Mobile Operating System (MOS)					Hours: 12		
Features of MOS - Mobile OS Kernel structure - Process Scheduling in mobile OS - Memory in mobile OS - File systems on mobile phones - I/O in mobile OS - Mobile OS messaging model - Security on smart phones - Case study: Android and Symbian OS								
UNIT – V	OS Security					Hours:		
Threats, Attacks and Assets - Intruders, Malicious software - Viruses, worms and bots - System call attacks - Security Techniques								
Total Contact Hours: 45	Total Tutorials: 15	Total Practical Classes: 0				Total Hours: 60		

Reference Books:

1. Pradeep K.Sinha, Distributed Operating System-Concepts and Design, PHI, 2012
2. Andrew S Tanenbaum, Modern Operating Systems, 4/e, Pearson Prentice Hall, 2015.
3. Abraham Silberchatz, Peter B. Galvin and Greg Gagne, Operating System Principles, 9th edition, John Wiley
4. Rajib Mall, Real-time Systems: Theory and Practice, 1/e, Pearson Education, 2008
5. Arash Habibi Lashkari and Mohammadreza Moradhaseli, Mobile Operating Systems and Programming: Mobile Communications, Paperback, 2015.
6. William Stallings, Operating Systems: Internal and Design Principles, 8th edition, Pearson Education, 2014.

Web sites:

1. https://www.udacity.com/wiki/ud156

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester : One				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT154	Advanced Databases	3	1	0	4	40	60	100
Prerequisite	--							
Objective	• To understand the needs of different databases. • To make the students familiarize with transaction management of the database • To make the students gain knowledge about web and intelligent database.							
Outcome	• Students will be able to implement computer applications with multiple kinds of data models. • The students have understood the benefits and the uses of the Parallel Databases, Object-oriented Databases and Web Databases.							
UNIT – I	**Parallel Databases**							**Hours: 12**
Database System Architectures: Centralized and Client-Server Architectures –Server System Architectures – Parallel Systems- Distributed Systems – Parallel-Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra-Operation Parallelism – Case Studies.								
UNIT – II	**Object Oriented Databases**							**Hours: 12**
Object Oriented Databases– Demerits of RDBMS – Object Oriented Concepts- Storing Objects in Relational Databases – Next Generation Database Systems – Object Oriented Data models – OODBMS Perspectives – Persistence – Issues in OODBMS – Advantages and Disadvantages of OODBMS – Object Oriented Database Design – OODBMS Standards and Systems – Object Management Group – Object Database Standard ODMG – Object Relational DBMS –Postgres - Comparison of ORDBMS and OODBMS.								
UNIT – III	**Web Databases**							**Hours: 12**
Web Technology and DBMS – Introduction – The Web – The Web as a Database-Application Platform – Scripting languages – Common Gateway Interface – HTTP-Cookies – Extending the Web Server – Java – Microsoft's Web Solution Platform- Oracle Internet Platform – Semi structured Data and XML – XML Related Technologies – XML Query Languages.								
UNIT – IV	**Intelligent Databases**							**Hours: 12**
Advanced Data Models for Innovative Applications – Active Database Concepts and Triggers – Temporal Database Concepts – Deductive Databases – Knowledge Databases.								
UNIT – V	**Current Trends**							**Hours: 12**
Mobile Database – Geographic Information Systems – Genome Data Management– Multimedia Database – Parallel Database – Spatial Databases – Database Administration – Data Warehousing and Data Mining.								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**				**Total Contact Hours: 60**		

Text Books:

1. Thomas M. Connolly, Carolyn E. Begg, Database Systems - A Practical Approach to Design, Implementation, and Management, 6th Edition , Pearson Education, 2014.
2. Ramez Elmasri & Shamkant B. Navathe, Fundamentals of Database Systems, 6th Edition, Pearson Education, 2010.

Reference Books:

1. Tamer Ozsu M., Patrick alduriel, Principles of Distributed Database Systems, 3rd Edition, Pearson Education, 2011.
2. Prabhu C.S.R., Object Oriented Database Systems: Approaches and Architectures, 3rd Edition, Kindle 2010.

Web sites:

1. http://www.cs.bu.edu/fac/gkollios/ada05/
2. http://ece.ut.ac.ir/classpages/F85/AdvancedDatabase/lectures.html

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester : One				**Category :** LB				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT155	Advanced Software Laboratory - I	0	0	3	2	60	40	100
Prerequisite								
Objective	• To develop implementation skills in Advanced Structures like Heap, tree and multimedia structures • To make the students to implement computer applications with multiple kinds of data models							
Outcome	• Design and implement efficient algorithms with minimum complexity • Design and implement Advanced Data Structures • Design the storage system necessary for real-time applications.							
Exercises	1) Implementation of all of the multi dimensional structures into one dimensional array.- 2) Implementation of the Heap structures(DEPQ, Leftist, Skew, Finonacci heaps) with insertion, deletion and search 3) Implementation of the search tree structures (AVL, splay, Tries, B - Tees)with insertion, deletion and search 4) Implementation of the multimedia structures (2-D trees, quad trees, segment trees) with insertion, deletion and range queries 5) Stimulation of Database Access from a Programming Language. 6) Given multiple sample application problems, the student is to develop a logical and physical database design for the problem and develop Forms, Menu design and Reports. 7) The logical design is to perform the following tasks: a. Map the ER/EER diagrams to a relational schema. b. Identify the functional dependencies in each relation c. Normalize to the highest normal form possible . 8) The physical design is to be done based on the above logical design using Oracle/MSSQL . 9) Simulation of Distributed Operating System concepts like shared memory and distributed file system. 10) Implementation of Network Operating System features. 11) Implementation of real-time scheduling applications. 12) Implementation of Mobile Operating System utilities. 13) Simulation of Operating System Security algorithms.							**Hours: 45**
Total Contact Hours:	**Total Tutorials:**	**Total Practical Classes: 45**						**Total Hours: 45**

Department : Information Technology			**Programme :** M.Tech. (Information Technology)					
Semester : One			**Category :** TY					
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT156	Network Security	3	1	0	4	40	60	100
Prerequisite	--							
Objective	• To understand the network security, services, attacks, mechanisms, types of attacks on TCP/IP protocol suite. • To comprehend and apply authentication services, authentication algorithms • To comprehend and apply network layer security protocols, Transport layer security protocols, Web security protocols. • To understand the wireless network security threats.							
Outcome	• Be able to determine appropriate mechanisms for protecting the network. • Design a security solution for a given application system with respect to security of the system							
UNIT – I							**Hours: 12**	
Overview Of Network Security, Security Services, Attacks, Security Issues in TCP/IP Suite - Sniffing, Spoofing, Buffer Overflow, ARP Poisoning, ICMP Exploits, IP Address Spoofing, IP Fragment Attack, Routing Exploits, UDP Exploits, TCP Exploits.								
UNIT – II							**Hours: 12**	
Authentication Requirements, Authentication Functions - Message Authentication Codes – Hash Functions - Security of Hash Functions And Macs - MD5 Message Digest Algorithm – Secure Hash Algorithm - RIPEMD - HMAC Digital Signatures, Authentication Protocols-Kerberos, X.509.								
UNIT – III							**Hours: 12**	
IP Security-AH and ESP, SSL/TLS, SSH, Web Security-HTTPS, DNS Security, Electronic Mail Security (PGP, S/MIME).								
UNIT – IV							**Hours: 12**	
Intruders, Viruses, Worms, Trojan Horses, Distributed Denial-of-Service (DDoS), Firewalls, IDS, Honey Nets, Honey Pots								
UNIT – V							**Hours: 12**	
Introduction to Wireless Network Security, Risks and Threats of Wireless Networks, Wireless LAN Security (WEP, WPA).								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**					**Total Hours: 60**	
Text Books:								
1. Yang Xiao and Yi Pan, Security in Distributed and Networking Systems, World Scientific, 2007 2. W. Stallings, Cryptography and Network Security: Principles and Practice, 5/E, Prentice Hall, 2013.								
Reference Books:								
1. AtulKahate, Cryptography and Network Security, Tata McGraw-Hill, 2003 2. Aaron E. Earle, Wireless Security Handbook, Auerbach publications, Taylor & Francis Group, 2006								
Web sites:								
1. http://www.cisco.com/cisco/web/solutions/small_business/resource_center/articles/secure_my_business/what_is_network_security/index.html?referring_site=smartnavRD 2. http://www.webopedia.com/TERM/N/network_security.html								

Department : Information Technology			**Programme :** M.Tech. (Information Technology)					
Semester : Two			**Category :** TCM					
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT157	Design of Web Services	3	0	2	4	50	50	100
Prerequisite								
Objective	To understand and write well-formed XML documents To write the schema for the given XML documents in both DTD and XML Schema languages To format XML data to the desired format							
Outcome	On successful completion of this course, the students will be able to: Understand and describe the principles of Service Oriented Architecture Compare Service Oriented Architecture with other kinds of design principles							
UNIT – I	**XML Technology Family**							**Hours: 9**
XML – Benefits – EDI – Databases – XML Based Standards – Presentation Technologies – Search Technologies- Storage Technologies								
UNIT – II	**Web Services Building Block**							**Hours: 9**
Web services framework, Services (Web services: Definition, Architecture and standards), Service descriptions with WSDL, Messaging with SOAP, UDDI.								
UNIT – III	**Web Services**							**Hours: 9**
Transport Protocols for Web Services – Messaging with Web Services – Protocols – SOAP – Describing Web Services – WSDL – Anatomy of WSDL – Manipulating WSDL – Web Service Policy – Discovering Web Services – UDDI – Anatomy of UDDI – Web Service Inspection – Ad Hoc Discovery – Securing Web Services.								
UNIT – IV	**Web Services – Activity Management and Composition**							**Hours: 9**
Message exchange patterns, Coordination, Atomic transactions, Business activities, Orchestration, Choreography.								
UNIT – V	**Web Services - Advanced Messaging, Metadata, Security, and RESTful Services**							**Hours: 9**
Addressing, Reliable messaging, Correlation, Policies, Metadata exchange, Security, Notification and eventing. RESTful services. Motivations, principles, strengths and weaknesses of REST, WS-* vs. REST								
Mini Project								**Hours: 30**
Design and implement a mini project in web services for security, choreography, semantics design (any one)								
Total Contact Hours: 45	**Total Tutorials:**	**Total Practical Classes: 30**						**Total Hours: 75**

Text Books:

1. Ron Schmelzer et al, XML and Web Services, Pearson Education, 2002.
2. Sandeep Chatterjee and James Webber, Developing Enterprise Web Services: An Architect's Guide, Prentice Hall, 2004.

Reference Books:

1. Frank P.Coyle, XML, Web Services and the Data Revolution, Pearson Education, 2002.
2. Keith Ballinger, .NET Web Services Architecture and Implementation, Pearson Education, 2003.
3. Henry Bequet and MeerajKunnumpurath, Beginning Java Web Services, Apress, 2004.
4. Russ Basiura and Mike Batongbacal, Professional ASP .NET Web Services, Apress, 2003.

Web sites:

1. https://msdn.microsoft.com/en-us/library/ms996507.aspx

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester : Two				**Category :** LB				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT158	Advanced Software Laboratory - II	0	0	3	2	60	40	100
Prerequisite								
Objective	To give the students a hands on training in Web Services and Network security							
Outcome	The Student can able to create a distributed application							
Exercises	1. Design and storage of XML document using XML technologies. 2. Web Service creation using JAX-WS 3. Web Service creation using JAX-RS 4. Web Service creation using .NET 5. Marshaling and Unmarshaling 6. Design a distributed application using web services and XML 7. Eavesdropping, DoS, Phishing and Password attacks and its prevention using SSH. 8. WEP Key Cracking and Decryption 9. MAC Spoofing and Defense 10. Managing Security in a Small business Network 11. Demonstration of Intrusion Detection System (IDS) using any tool					**Hours: 45**		
Total Contact Hours:		**Total Tutorials:**		**Total Practical Classes: 45**		**Total Hours: 45**		

Department : Information Technology		**Programme :** M.Tech. (Information Technology)						
Semester : Two		**Category :** PR						
Subject code	**Subject**	**Hours/week**			**Credit**	**Maximum marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT159	Research Methodology	-	-	3	1	100	0	100
Prerequisite	-							
Objectives	• To educate students to methods of selection of research problems • To expose students to different research methods							
Outcomes	• Students will be capable to identify and narrow down to the area of research on the basis the requirements of industrial and global requirements • Students will exhibit the domain skill to choose suitable research methods to execute research effectively • Students will possess knowledge to further their academic program, namely, Ph.D program.							

- **Definition of research:** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Definition and Dimension of a Theory, Functions and Characteristics; Types of Theory: General Theory and Particular/ Empirical Theory. Cases and their Limitations; Causal Relations. Philosophy and validity of research. Objective of research.
- **Characteristics of research:** Various functions that describe characteristics of research such as systematic, valid, verifiable, empirical and critical approach.
- **Types of research:** Pure and applied research. Descriptive and explanatory research. Qualitative and quantitative approaches.
- **Research procedure:** Formulating the Research Problem, Literature Review, Developing the objectives, Preparing the research design including sample. Design, Sample size.
- **Considerations in selecting research problem:** Relevance, interest, available data, choice of data, Analysis of data, Generalization and interpretation of analysis.
- **Outcome of research:** Significance of report writing – Layouts of the research report – Types of reports – Oral presentation – Mechanics of writing research report – Precautions for writing research reports – Plagiarism and copy right violation – Patent writing and filing.

Total contact hours:	**Total tutorials:**	**Total practical classes: 15**	**Total hours: 15**

Reference books:

1. Dawson, Catherine, Practical Research Methods, UBS Publishers and Distributors, New Delhi, 2002
2. Kothari, C.R., Research Methodology-Methods and Techniques, Wiley Eastern Limited, New Delhi, 1985.
3. Kumar, Ranjit, Research Methodology, A Step-by-Step Guide for Beginners, (2nd.ed), Pearson Education, Singapore, 2005.

Department : Information Technology		**Programme :** M.Tech. (Information Technology)						
Semester : Three		**Category :** PR						
Subject code	**Subject**	**Hours/week**			**Credit**	**Maximum marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT160	Project work (Phase I)	-	-	-	9	150	150	300
Prerequisite	Computer Science and Engineering Core Subjects							
Objectives	To facilitate the students to design a Project.							
Outcomes	To make the students to carry out a detailed literatures.							

- To identify the solution to a problem, the students are to take up a literature survey, identify the problem space and to arrive at the solution for a specific problem with detailed standard specification.

Department : Information Technology					**Programme :** M.Tech. (Information Technology)			
Semester : Four					**Category :** PR			
Subject code	**Subject**	**Hours/week**			**Credit**	**Maximum marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT161	Project work (Phase II)	-	-	-	14	200	200	400
Prerequisite	Project work (Phase I)							
Objectives	• To enable the student to implement and document his project. • The student is to implement his designed project, to test it and to submit a project report in the specified format. • The student is to publish his project design in a reputed journal or a Conference.							
Outcomes	• The student is to acquire the skill of standard documentation, testing and reporting.							

SYLLABUS (Elective Subjects)

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE51	Soft Computing	3	1	0	4	40	60	100
Prerequisite								
Objective	• To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience • To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems • To provide the mathematical background for carrying out the optimization associated with neural network learning							
Outcome	On successful completion of this course, the students will be able to: • Identify and describe soft computing techniques and their roles in building intelligent machines • Recognize the feasibility of applying a soft computing methodology for a particular problem and Apply fuzzy to handle uncertainty and solve engineering problems							
UNIT – I	**Introduction to Soft Computing and Neural Networks**							**Hours: 12**
Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics								
UNIT – II	**Genetic Algorithms**							**Hours: 12**
Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition								
UNIT – III	**Neural Networks**							**Hours: 12**
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								
UNIT – IV	**Fuzzy Logic**							**Hours: 12**
Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems- – Fuzzy Expert Systems – Fuzzy Decision Making								
UNIT – V	**Neuro-Fuzzy Modeling**							**Hours: 12**
Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rulebase Structure Identification – Neuro-Fuzzy Control – Case studies.								
Total Contact Hours: 45	**Total Tutorials: 15**			**Total Practical Classes:**				**Total Hours: 60**
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.								
Reference Books: 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.								
Web sites: 1. http://www.springer.com/engineering/computational+intelligence+and+complexity/journal/500 2. http://www.journals.elsevier.com/applied-soft-computing/								

Department : IT		Programme :M.Tech.						
Semester:ELECTIVE								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
ITE52	Wireless Sensor Networks	3	1		3	40	60	100
Prerequisite:	Computer Networks							
Objective:	1. To understand the fundamentals of wireless sensor networks and its application to critical real time scenarios. 2. To study the various protocols at various layers and its differences with traditional protocols. 3. To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network.							
Outcome:	1. Technically knowing in building a WSN network. 2. Analysis of various critical parameters in deploying a WSN							
UNIT – I	**Wireless LANs and PANs**: fundamentals of WLANs, IEEE 802.11 standard, HIPERLAN standard, Bluetooth. Wireless WANs and MANs: Wireless in Local Loop, Wireless ATM, IEEE 802.16 standard, Wireless Internet: Mobile IP , TCP in wireless domain.							**Hours: 12**
UNIT – II	**Wireless Sensor Networks:** Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, Location Discovery, Quality of a Sensor Network , Evolving standards, Other Issues							**Hours: 12**
UNIT – III	**Networking Sensors**: Key Assumptions, Medium Access Control, Geographic Energy Routing, Attribute-based routing. Infrastructure Establishment: Topology control, clustering, Time synchronization, Localization and Localization services.							**Hours: 12**
UNIT – IV	**Ad hoc wireless Networks:** Introduction, Issues in ad hoc wireless networks**,** Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.							**Hours: 12**
UNIT – V	**QoS and Energy Management** : Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.							**Hours: 12**
Total Contact Hours: 45	Total Tutorials: 15	Total Practical Classes: 0			Total Hours: 60			

Reference Books:

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.

2. Holger Karl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, John Wiley & Sons, Inc.,

2005.

3. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.

4. Erdal Çayırcı , Chunming Rong, "Security in Wireless Ad Hoc and Sensor Networks", John Wiley and Sons, 2009.

5. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004.

6. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition)", World Scientific Publishing, 2011.

7. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", John Wiley and Sons, 2010.

Web sites: www.memsic.com/**wireless-sensor-networks**

Department : Information Technology					**Programme :** M.Tech. (Information Technology)			
Semester :					**Category :** TY			
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE53	Software Quality Management	3	1	0	4	40	60	100
Prerequisite								
Objective	• To develop Quality project • To apply Quality assurance techniques in projects • To learn about Quality standards and certifications							
Outcome	• Apply Quality measure in Project. • Analyze the feasibility of applying Quality in project. • Apply Quality standards and certifications appropriately							
UNIT – I	**Introduction**							**Hours: 12**
The Software Quality Challenge - Software Quality Factors - Components of the Software Quality Assurance System. Pre-Project Software Quality Components - Contract Review - Development and Quality Plans								
UNIT – II	**Software Quality Assurance Components in the Project Life Cycle**							**Hours: 12**
Integrating Quality Activities in the Project Life Cycle – Reviews - Software Testing Strategies - Software Testing Implementation - Assuring the Quality of Software Maintenance - Assuring The Quality of External Participants' Parts - Case Tools and their Affect on Software Quality.								
UNIT – III	**Software Quality Infrastructure Components**							**Hours: 12**
Procedures and Work Instructions - Supporting Quality Devices - Staff Training for Quality management , Instructing and Certification - Preventive and Corrective Actions - Configuration Management Documentation and Quality Records Controls								
UNIT – IV	**Software Quality Management Components**							**Hours: 12**
Project Progress Control- Components, Internal & External Participants, Progress control regimes, Computerized tools, Software Quality Metrics – Objective, Classification, Process & Product Metrics, Implementation & Limitation of Software Metrics - Software Quality Costs – Objective, Classification Model of cost, Extended Model and Applications								
UNIT – V	**Standards, Certification and Assessment**							**Hours: 12**
SQA Standards – ISO9001 Certification - Software Process Assessment. Organizing for Quality Assurance - Management and its Role in Quality Assurance - The Software Quality Assurance Unit - SQA Trustees and Committees								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**						**Total Hours: 60**
Text Books:								
1. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison-Wesley, 2012. 2. Allen Gilles Software quality: Theory and management, International Thomson, Computer Press 1997.								
Reference Books:								
1. Roger S. Pressman, Software Engineering-A Practitioner's Approach, McGraw Hill Publication, 2010. 2. Stephen H.Kan, Metrics and models in software quality Engineering, Addison –Wesley 2003.								
Web sites:								
1. www.exforsys.com/tutorials/testing/software-quality-management								

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE54	Meta Heuristic Optimisation	3	1	0	4	40	60	100
Prerequisite								
Objective	• To make the students learn how and when meta heuristics should be implemented to solve optimization problems • To develop students to learn alternate paradigm to classical optimization methods such as linear, non-linear and integer							
Outcome	• Ability to apply the meta-heuristic methods to new combinatorial problems • Master in designing and implementing new algorithms (through hybrid methods) based on those learned in the course • Ability to conduct empirical studies and carry out research investigations							
UNIT – I								**Hours: 12**
Single Solution based Meta Heuristics: Optimization Models – Performance Analysis – Local Search – Simulated Annealing – Tabu Search –VNS- Guided Local Search – Hill Climbing – Gradient Based Search.								
UNIT – II								**Hours: 12**
Population based Meta Heuristics: Evolutionary Algorithms – Scatter Search – Swarm Intelligence – Other Population Based Methods – Differential Evolution – Co-Evolution.								
UNIT – III								**Hours: 12**
Meta Heuristics for Multi Objective Optimization: Multi Objective Optimization Concepts – Design Issues Fitness Assignment Strategies – Diversity – Elitism – Performance Evaluation								
UNIT – IV	**Software Quality Management Components**							**Hours: 12**
Hybrid Meta Heuristics: Combining Meta Heuristics with Mathematical Programming – Combining Meta Heuristics with Constraint Programming – Hybrid Meta Heuristics with Machine Learning and Data Mining – Hybrid Meta Heuristics for Multi Objective Optimization								
UNIT – V								**Hours: 12**
Parallel Meta Heuristics: Parallel Design of Meta Heuristics – Parallel Implementation of Meta Heuristics – Parallel Meta Heuristics for Multi Objective Optimization								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**						**Total Hours: 60**
Text Books:								
1. El-GhazaliTalbi, Meta Heuristics: from Design to Implementation, Wiley Publication, 2009. 2. C.A. Coello, G.B. Lamont and D.A. Van Veldhuizen , Evolutionary Algorithms for Solving Multi-Objective Problem,Springer 2007								
Reference Books:								
1. M. Dorigo and T. Stützle, At Colony Optimization, MIT Press, Cambridge, MA, F. Glover, G. Kochenberger, Handbook of Meta Heuristic, Springer 2003. 2. T. González , Handbook of Approximation Algorithms and Meta Heuristics, Chapman and Hall 2007. 2004								
Web sites:								
1. www.exforsys.com/tutorials/testing/software-quality-management								

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE55	Ontology and Semantic Web	3	1	0	4	40	60	100
Prerequisite								
Objective	• To identify and resolve real world problems. • To build systems in different domains (for instance, knowledge management, biomedicine, e-commerce, e-learning, etc.). • To assimilate technological changes.							
Outcome	Upon completion of the course, the students should be able to: • Design applications on the top of linked data on the WWW, • Create ontological models for such data. • Transform common data resources into semantic data.							
UNIT – I	**Introduction**							**Hours: 12**
Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background -Sample - Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation – Layers – Architecture.								
UNIT – II	**Languages For Semantic Web And Ontologies**							**Hours: 12**
Web Documents in XML – RDF - Schema – Web Resource Description using RDF- RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics - Traditional Ontology Languages – LOOM- OKBC – OCML - Flogic Ontology Markup Languages – SHOE – OIL - DAML - OIL- OWL								
UNIT – III	**Ontology Learning For Semantic Web**							**Hours: 12**
Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms – Evaluation.								
UNIT – IV	**Ontology Management And Tools**							**Hours: 12**
Overview – Need For Management – Development Process – Target Ontology – Ontology Mapping – Skills Management System – Ontological Class – Constraints – Issues. Evolution – Development Of Tools And Tool Suites – Ontology Merge Tools – Ontology Based Annotation Tools.								
UNIT – V	**Applications**							**Hours: 12**
Web Services – Semantic Web Services - Case Study For Specific Domain – Security Issues – Current Trends								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**						**Total Hours: 60**
Text Books:								
1. Asuncion Gomez-Perez, Oscar Corcho, Mariano Fernandez-Lopez, "Ontological Engineering: with examples from the areas of Knowledge Management,- e- Commerce and the Semantic Web", Springer, 2004 2. Grigoris Antoniou, Frank van Harmelen, A Semantic Web Primer (Cooperative Information Systems), The MIT Press, 2004								
Reference Books:								
1. Dieter Fensel (Editor), Wolfgang Wahlster, Henry Lieberman, James Hendler, Spinning the Semantic Web: Bringing the World Wide Web to Its Full Potential, The MIT Press, 2002 2. Michael C. Daconta, Leo J. Obrst, Kevin T. Smith, The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management, Wiley, 2003 3. Steffen Staab (Editor), Rudi Studer, Handbook on Ontologies (International Handbooks on Information Systems) , Springer 1st edition, 2004 4. Dean Allemang (Author), James Hendler (Author) Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL (Paperback), Morgan Kaufmann, 2008 5. Alexander Maedche, Ontology Learning for the Semantic Web, Springer; 1st edition, 2002 6. John Davies, Dieter Fensel, Frank Van Harmelen, Towards the Semantic Web: Ontology – Driven Knowledge Management, John Wiley & Sons Ltd., 2003.								
Web sites:								
1. obitko.com/tutorials/ontologies-semantic-web 2. www.w3.org › Standards › Semantic Web								

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE56	Knowledge Engineering	3	1	0	4	40	60	100
Prerequisite								
Objective	• To learn the concepts of knowledge base and inference engine.							
Outcome	Upon completion of the course the students should be able to: 1. Design applications that require knowledge in required format. 2. Perform reasoning with uncertain information							
UNIT – I	**Introduction**							**Hours: 12**
Key concepts – Why knowledge Representation and Reasoning – Language of first order Logic – Syntax, Semantics Pragmatics – Expressing Knowledge – Levels of Representation – Knowledge Acquisition and Sharing – Sharing Ontologies – Language Ontologies –Language Patterns – Tools for Knowledge Acquisition								
UNIT – II	**Resolution And Reasoning**							**Hours: 12**
Proportional Case – Handling Variables and Qualifies – Dealing with Intractability – Reasoning with Horn Clauses - Procedural Control of Reasoning – Rules in Production – Description Logic - Vivid Knowledge – Beyond Vivid.								
UNIT – III	**Representation**							**Hours: 12**
Object Oriented Representations – Frame Formalism – Structured Descriptions – Meaning and Entailment - Taxonomies and Classification – Inheritance – Networks –Strategies for Defeasible Inheritance – Formal Account of Inheritance Networks.								
UNIT – IV	**Defaults, Uncertainty and Expressiveness**							**Hours: 12**
Defaults – Introduction – Closed World Reasoning – Circumscription – Default Logic Limitations of Logic – Fuzzy Logic – Non-montonic Logic – Theories and World – Semiotics – Auto epistemic Logic - Vagueness – Uncertainty and Degrees of Belief – Non-categorical Reasoning – Objective and Subjective Probability								
UNIT – V	**Actions and Planning**							**Hours: 12**
Explanation and Diagnosis -Purpose – Syntax, Semantics of Context – First Order Reasoning – Modal Reasoning in Context – Encapsulating Objects in Context – Agents – Actions – Situational Calculus – Frame Problem – Complex Actions – Planning – Strips – Planning as Reasoning – Hierarchical and Conditional Planning.								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**					**Total Hours: 60**	
Text Books:								
1. Ronald Brachman and Hector Levesque, Knowledge Representation and Reasoning, The Morgan Kaufmann Series in Artificial Intelligence 2004 2. John F. Sowa, Knowledge Representation: Logical, Philosophical, and Computational Foundations, 2000								
Reference Books:								
1. Arthur B. Markman, Knowledge Representation, Lawrence Erlbaum Associates, 1998								
Web sites: 1. http://www.srmuniv.ac.in/sites/default/files/files/cse-ke_pg2013-14.pdf 2. https://targetstudy.com/courses/mtech-knowledge-engineering.html								

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
IT E57	Biometrics	3	1	0	4	40	60	100
Prerequisite								
Objective	To familiarize with: • The concepts and techniques of Image Processing • Traits and technology used in Identification • Knowledge about multi-bio-metrics and levels of fusion							
Outcome	• Awareness about Bio-metric Traits and its importance • To Design a Biometric System with enhanced performance than existing techniques. • Develop various applications using Multi-Biometrics							
UNIT – I	**Introduction of Biometrics**							**Hours: 12**
Image Processing Basics: Basic Image Operations, Segmentation, Edge Detection, Localization, Enhancement, Transformations - History Of Biometrics: Forensic And Identification - Biometric System: Characteristics, Components, Identification and Verification - Various Biometric Traits - Evaluation and Matching Score Parameters: FAR, FRR, ROC, DET, EER - System Design Issues.								
UNIT – II	**Physiological Biometrics Prominent Traits**:							**Hours: 12**
Face - Fingerprint - Iris - Palm Print - Hand/Finger Geometry - Ear - Hand Vein - Gait - Finger Knuckle Back - Identification System on Fingerprint and Iris - Comparison based on Strength and Weakness-**Other Traits**: Lips - Sclera - Tongue - Retina.								
UNIT – III	**Behavioural and Biological Biometrics Behavioral:**							**Hours: 12**
Signature - Keystroke - Handwriting – Voice - Driving- Identification System on Handwriting. **Biological:** DNA - Blood - Heartbeat - Odor – ECG.								
UNIT – IV	**Multi-Biometrics**							**Hours: 12**
Limitations of Biometric System - Issues In Multi-biometrics System Design - Level of Fusion: Sensor Level - Feature Level - Rank Level - Decision Level.								
UNIT – V	**Biometric Applications Government**:							**Hours: 12**
National ID Card (UID), Voter Registration, Welfare Disbursement, Border Crossing. **Forensic**: Corpse Identification, Criminal Investigation, Parenthood Determination-**Commercial**: ATM, Access Control, Mobile Phone, Banking, E-Commerce, Smart Card.								
Total Contact Hours: 45	**Total Tutorials: 15**			**Total Practical Classes:**				**Total Hours: 60**

Text Books:

1. Rafael C. Gonzalez and Richard Eugene Woods, Digital Image Processing using MATLAB, 2nd Edition, Tata McGraw-Hill Education, 2010.
2. Ruud M. Bolle, SharathPankanti, Nalini K. Ratha, Andrew W. Senior and Jonathan H. Connell, Guide to Biometrics, Springer, 2009.

Reference Books:

1. Anil K. Jain, Patrick Flynn and Arun A. Ross, Handbook of Biometrics, Springer, 2008.
2. DavideMaltoni, Dario Maio, Anil K. Jain, SalilPrabhakar, Handbook of Fingerprint Recognition, 2nd Edition, Springer, 2009.
3. M.J. Burge and K.W. Bowyer, Handbook of Iris Recognition, Springer, 2013.
4. Stan Z. Li and Anil K. Jain, Encyclopedia of Biometrics, Springer, 2009.

Web sites:

1. biometrics.cse.msu.edu/,
2. biolab.csr.unibo.it/

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE58	Image and Video Coding	3	1	0	4	40	60	100
Prerequisite								
Objective	• To make students aware of Various Coding Techniques • To make students understand the various standards in Coding							
Outcome	• The students are able to understand the various coding techniques and standards.							
UNIT – I	**Introduction**							**Hours: 12**
Information – Entropy - Properties of Information and Entropy - Relation Between Information and Probability - Mutual and Self Information - Coding Theory- Code Efficiency and Redundancy - Shannon's Theorem								
UNIT – II	**Lossless and Lossy coding**							**Hours: 12**
Construction of Basic Codes-Shannon and Fanon Coding, Run Length Encoding, Huffman Coding – Arithmetic Coding- LZW Coding. Quantization: Scalar Quantization and Vector Quantization – Predictive Coding Techniques								
UNIT – III	**Transform coding and Sub band coding**							**Hours: 12**
Transform Coding- Discrete Fourier Transform, Discrete Walsh Transform, Discrete Hadamard Transform, Wavelet Transform-EZW, SPIHT and EBCOT.								
UNIT – IV	**Motion estimation and Motion compensated Prediction**							**Hours: 12**
Motion Analysis and Motion Compensation, Bock Batching Motion Estimation Algorithms, PEL Recursive Techniques, Optical Flow.								
UNIT – V	**Image and Video Coding standards**							**Hours: 12**
JPEG Standard: Main Steps, Modes, A Glance at the JPEG Bit Stream, JPEG-2000: Main Steps, ROI Coding, Comparison of JPEG and JPEG 2000, MPEG-1: Motion Compensation in MPEG-1, MPEG-1 Bit Stream, MPEG-2: Supporting Interlaced Video, MPEG-2 Scalabilities MPEG-4: Object Based Visual Coding, Synthetic Object Coding, H.261:Video Bit Stream, H.263: Very Low Bit-Rate Coding, H.264: Core Features, H.265: HEVC.								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**						**Total Hours: 60**
Text Books:								
1. Ze-Nian Li and Mark S.- Drew, Fundamentals of Multimedia, Pearson Education, New Delhi, 2004. 2. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, 3rd Edition, Pearson Education, New Delhi, 2014. 3. Murat Tekalp, Digital Video Processing, Prentice Hall, New Jersey, 1995.								
Reference Books:								
1. Yun Q. Shi, Huifang Sun, Image and Video compression for Multimedia Engineering, CRC Press, New York, 2000. 2. K. R. Rao and J. J. Hwang, Techniques and Standards for Image, Video and Audio coding, Prentice Hall, New Jersey, 1996.								
Web sites:								
1. www.hhi.fraunhofer.de/fields-of.../image.../image-video-coding.html								

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE59	Compiler Construction and Optimization	3	1	0	4	40	60	100

Prerequisite	
Objective	• To understand, design and implement a lexical analyzer. • To understand, design and implement a parser. • To understand, design code generation schemes.
Outcome	Upon completion of the course, the students should be able to: • Apply basic principles and practices of Computer Science and Engineering to productively engage in the research. • Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, manufacturability, and sustainability.

UNIT – I	**Introduction to Compiler and Lexical Analysis**	**Hours: 12**
Language Processors - Structure Of A Compiler - Lexical Analysis - Role Of The Lexical Analyzer - Input Buffering - Specification And Recognition Of Tokens. Finite Automata - Regular Expression To Finite Automation - Optimization Of DFA-Based Pattern Matchers – LEX.		
UNIT – II	**Syntax Analysis**	**Hours: 12**
Role of a Parser - Context-Free Grammars - Top-Down Parsing – Non Recursive Predictive Parser - Bottom-Up Parsing- LR Parsers – SLR – CLR – LALR. Introduction To Language For Specifying Parser – YACC		
UNIT – III	**Intermediate Code Generation**	**Hours: 12**
Intermediate Code Generation: Intermediate Languages - Declarations - Assignment Statements - Boolean Expressions- Case Statements- Backpatching.		
UNIT – IV	**Code Generation**	**Hours: 12**
Issues In Design of Code Generator - Target Language – Addresses In Target Co- A Simple Code Generator- Register Allocation And Assignment		
UNIT – V	**Code Optimization**	**Hours: 12**
Basic Blocks And Flow Graphs - Optimization Of Basic Blocks – Peephole Optimization - The Principal Sources of Optimization - Introduction to Data Flow Analysis – Foundation To Data Flow Analysis – Constant Propagation - Partial Redundancy Elimination		

Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**	**Total Hours: 60**

Text Books:

1. Alfred V. Aho, Monica S. Lam , Ravi Sethi and Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools , Pearson, 2011.
2. Keith D Cooper and Linda Torczon, Engineering a Compiler, Elsevier Science, 2011

Reference Books:

1. A. V. Aho, Ravi Sethi and J. D. Ullman, Compilers: Principles, Techniques and Tools New Delhi:Addison-Wesley, 2005.
2. Kennath C. Louden, Compiler Construction Principles and Practice. New Delhi: Vikas publishing House, 2003.

Web sites:

1. www.compileroptimizations.com

Department : Information Technology					**Programme :** M.Tech. (Information Technology)			
Semester :					**Category :** TY			
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE60	Software Project Management	3	1	0	4	40	60	100
Prerequisite								
Objective	• To produce an activity plan for a project and to estimate the overall duration • To assess the risk of slippage • To select the most appropriate Human resource for the project							
Outcome	• Apply appropriable software model for project • Estimate project cost • Track project with team coordination							
UNIT – I	**Basic Concepts**							**Hours: 12**
Product Process and project—Definition—product life Cycle—project Life cycle models—Process Models. Activities covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning.								
UNIT – II	**Project Evaluation**							**Hours: 12**
Strategic Assessment – Technical Assessment – Cost Benefit Analysis –Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.								
UNIT – III	**Activity Planning**							**Hours: 12**
Objectives – Project Schedule – Sequencing And Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity On Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.								
UNIT – IV	**Monitoring and Control Teams**							**Hours: 12**
Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring Earned Value –Priortizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.								
UNIT – V	**Managing People and Organizing Teams**							**Hours: 12**
Introduction – Understanding Behavior – Organizational Behaviour: A Background –Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation– The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress – Health And Safety.								
Total Contact Hours: 45	**Total Tutorials: 15**				**Total Practical Classes:**			**Total Hours: 60**
Text Books:								
1.Bob Hughes, Mike Cotterell, Software Project Management, Third Edition, Tata McGraw Hill								
Reference Books:								
1. Ramesh Gopalaswamy, Managing Global Projects, Tata McGraw Hill, 2005. 2. Royce, Software Project Management, Pearson Education, 2011. 3. Jalote, Software Project Management in Practice, Pearson Education, 2002								
Web sites:								
1. http://www.salford.rkc.edu/ 2. https://scpd.stanford.edu/								

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE61	Speech Processing	3	1	0	4	40	60	100
Prerequisite								
Objective	• To understand the concept behind speech production. • To understand concepts on phonemes, syllables and morphemes. • To learn the concepts behind the design of speech synthesis system.							
Outcome	On successful completion of this course, the students will be able to: • Apply basic principles and practices of Computer Science and Engineering to productively engage in the research. • Design a speech synthesis system for any natural language • Design a speech recognition system with good accuracy							
UNIT – I	**Introduction**							**Hours: 12**
Spoken Language System Architecture And Structure – Sound And Human Speech System – Phonetics And Phonology – Syllables And Words – Syntax And Semantics –Probability Theory – Estimation Theory – Significance Testing								
UNIT – II	**Speech Signal Representation and Coding**							**Hours: 12**
Short Time Fourier Analysis – Acoustic Model Of Speech Production - Linear Predictive Coding – Cepstral Processing – Perceptual Motivated Representations – Formant Frequencies – Role Of Pitch – Scalar Waveform Coders – Scalar Frequency Domain Coders – Code Excited Linear Prediction – Low – Bit Rate Speech coders								
UNIT – III	**Speech Recognition**							**Hours: 12**
Hidden Markov Models (HMM) – Practical Issues in Using HMMs – HMM Limitations Acoustic Modeling – Phonetic Modeling – Language Modeling - Speaker Recognition Algorithms – Signal Enhancement for Mismatched Conditions								
UNIT – IV	**Speech Synthesis**							**Hours: 12**
Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification Of Speech – Source Filter Models For Prosody Modification – Evaluation Of Text To Speech System.								
UNIT – V	**Spoken Language Understanding**							**Hours: 12**
Dialog Structure – Semantic Representation – Sentence Interpretation – Discourse Analysis – Dialog Management – Response Generation And Rendition – Case Study.								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**					**Total Hours: 60**	
Text Books:								
1. Thomas F.Quatieri, Discrete-Time Speech Signal Processing, Pearson Education, 2002. 2. Xuedong Huang, Alex Acero, Hsiad, Wuen Hon, Spoken Language Processing, Prentice Hall ,2001.								
Reference Books:								
1. B.Gold and N.Morgan, Speech and Audio Signal Processing, Wiley and Sons, 2000. 2. M.R.Schroeder, Computer Speech – Recognition, Compression, Synthesis, Springer Series in Information Sciences, 1999. 3. A Brief Introduction to Speech Analysis and Recognition, An Internet Tutorial 4. Daniel Jurafsky & James H.Martin, Speech and Language Processing, Pearson Education ,2000.								
Web sites:								
1. http://www.mor.itesm.mx/~omayora/Tutorial/tutorial.html								

Department : Information Technology			**Programme :** M.Tech. (Information Technology)					
Semester :			**Category :** TY					
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE62	Multimedia Systems	3	1	0	4	40	60	100
Prerequisite								
Objective	• To study multimedia technologies and standards. • To learn about various applications of multimedia data.							
Outcome	On successful completion of this course, the students will be able to: • Knowledge of different multimedia, storage mode, display animated images. • Compress the audio and video images. • Apply suitable multimedia and animation technologies.							
UNIT – I								**Hours: 12**
Introduction, Media and Data Streams, Audio Technology, Multimedia Elements; Multimedia Applications; Multimedia Systems Architecture; Evolving Technologies for Multimedia Systems; Multimedia Data Interface Standards, The need for Data Compression; Multimedia Databases, Representation Media, Storage Media, Transmission Media, Information Exchange Media, Presentation Spaces & Values								
UNIT – II								**Hours: 12**
Asynchronous Transmission Mode, Synchronous Transmission Mode, Isochronous Transmission Mode; Characterizing Continuous Media Data Streams, Sound: Frequency, Amplitude, Sound Perception and Psychoacoustics; Audio Representation on Computers; Three Dimensional Sound Projection; Music and MIDI Standards; Speech Signals; Speech Output; Speech Input; Speech Transmission								
UNIT – III								**Hours: 12**
Graphics and Images, Video Technology, Computer-Based Animation Capturing Graphics and Images Computer Assisted Graphics and Image Processing; Reconstructing Images; Graphics and Image Output Options, Television Systems; Digitalization of Video Signals; Digital Television; Basic Concepts; Specification of Animations; Methods of Controlling Animation; Display of Animation; Transmission of Animation; Virtual Reality Modeling Language								
UNIT – IV								**Hours: 12**
Data Compression and Optical Storage Media s torage Space; Coding Requirements; Source, Entropy, and Hybrid Coding, Compression Techniques; JPEG: Image Preparation, Lossy Sequential DCT-based Mode, Expanded Lossy DCT-based Mode, Lossless Mode, Hierarchical Mode, H.261 (Px64) and H.263: Image Preparation. Coding Algorithms, Data Stream, H.263+ and H.263L; MPEG: Video Encoding, Audio Coding, Data Stream, MPEG-2, MPEG-4, MPEG-7; Fractal Compression, History of Optical Storage; Basic Technology; Video Discs and Other WORM.								
UNIT – V								**Hours: 12**
Content Analysis and Multimedia Application Design , Simple Vs. Complex Features; Analysis of Individual Images; Analysis of Image Sequences; Audio Analysis; Applications, Multimedia Application Classes; Types of Multimedia Systems Virtual Reality Design. Components of Multimedia Systems. Organizing Multimedia Database. Multimedia Security Applications								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**				**Total Hours: 60**		
Text Books:								
1. Parag Havaldar and Gerard Medioni, Multimedia Systems: Algorithms, Standards, and Industry Practices, July 2009. 2. Ralf Steinmetz and Klara Nahrstedt , Multimedia Systems , Feb. 2010.								
Reference Books:								
1. John F. Koegel Buford , Multimedia Systems , May 1994 2. Wenjun Zeng,Heather Yu and Ching Yung Lin , Multimedia Security technologies for Digital rights Management, Elsevier Inc 2006								
Web sites:								
3. http://www.springer.com/computer/information+systems+and+applications/journal/530 4. https://www.cs.cf.ac.uk/Dave/Multimedia/node12.html								

Department : Information Technology		**Programme :** M.Tech. (Information Technology)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE63	Pervasive Computing	3	1	0	4	40	60	100
Prerequisite								
Objective	• To introduce the characteristics, basic concepts and systems issues in pervasive computing • To illustrate architecture and protocols in pervasive computing and to identify the trends and latest development of the technologies in the area • To give practical experience in the area through the design and execution of a modest research project • To evaluate critical design tradeoffs associated with different mobile technologies, architectures, interfaces and business models and how they impact the usability, security, privacy and commercial viability.							
Outcome	Upon completion of the course, the students should be able to: • discover the characteristics of pervasive computing applications including the major system components and architectures of the systems • analyze the strengths and limitations of the tools and devices for development of pervasive computing systems							
UNIT – I	**Introduction**							**Hours: 12**
Pervasive Computing Application - Pervasive Computing Devices and Interfaces - Device Technology Trends, Connecting Issues And Protocols								
UNIT – II	**Web Support to Pervasve Computing** Pervasive							**Hours: 12**
Computing And Web Based Applications - XML and Its Role In Pervasive Computing - Wireless Application Protocol (WAP) Architecture And Security – Wireless Mark-Up Language (WML) – Introduction								
UNIT – III	**Voice Support to Pervasive Computing**							**Hours: 12**
Voice Enabling Pervasive Computing - Voice Standards - Speech Applications in Pervasive Computing and Security.								
UNIT – IV	**PDA in Pervasive Computing**							**Hours: 12**
PDA in Pervasive Computing – Introduction - PDA software Components, Standards, Emerging Trends - PDA Device characteristics - PDA Based Access Architecture								
UNIT – V	**Case Studies** .							**Hours: 12**
User Interface Issues In Pervasive Computing, Architecture - Smart Card- Based Authentication Mechanisms - Wearable Computing Architecture –Case Studies								
Total Contact Hours: **45**	**Total Tutorials: 15**	**Total Practical Classes:**			**Total Hours: 60**			
Text Books:								
1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec & Klaus Rindtorff. , Pervasive Computing Technology and Architecture of Mobile Internet Applications, Addision Wesley, Reading, 2002. 2. Uwe Hansman, Lothat Merk, Martin S Nicklous & Thomas Stober, Principles of Mobile Computing , Second Edition, Springer- Verlag, New Delhi, 2003.								
Reference Books:								
1. Rahul Banerjee, Internetworking Technologies: An Engineering Perspective, Prentice –Hall of India, New Delhi, 2003. 2. Rahul Banerje, Lecture Notes in Pervasive Computing, Outline Notes, BITS-Pilani, 2003.								
Web sites:								
1. www.searchnetworking.techtarget.com/definition/pervasive-computing								

Department : Information Technology			**Programme :** M.Tech. (Information Technology)						
Semester :			**Category :** TY						
Subject Code	**Subject**		**Hours / Week**			**Credit**	**Maximum Marks**		
			L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE64	Big Data Analytics		3	1	0	4	40	60	100
Prerequisite									
Objective	• To introduce the fundamental technologies used in manipulating, storing, and analyzing big data • To make the student understand details of Hadoop • To introduce tools that provide SQL-like access to unstructured data								
Outcome	• Categorize and Summarize Big Data and its importance. • Manage Big Data and analyze Big Data. • Apply tools and techniques to analyze Big Data.								
UNIT – I	**Introduction To Big Data and Its Technologies**								**Hours: 12**
Big Data and its Importance – Four V's of Big Data – Drivers for Big Data –Introduction to Big Data Analytics – Big Data Analytics Applications-Hadoop's Parallel World – Data discovery Open Source Technology for Big Data Analytics – Cloud and Big Data –Predictive Analytics – Crowd Sourcing Analytics - Information Management									
UNIT – II	**Processing Big Data**								**Hours: 12**
Integrating Disparate Data Stores - Mapping Data to Programming Framework- Connecting and Extracting Data From Storage - Transforming Data for Processing - Subdividing Data in Preparation for Hadoop Map Reduce									
UNIT – III	**Hadoop Map Reduce**								**Hours: 12**
Employing Hadoop Map Reduce - Creating Components Of Hadoop Map Reduce Jobs - Distributing Data Processing Across Server Farms –Executing Hadoop Map Reduce Jobs - Monitoring Progress of Job Flows - The Building Blocks Of Hadoop Map Reduce - Distinguishing Hadoop Daemons -Investigating Hadoop Distributed File System									
UNIT – IV	**Advanced Analytics Platform**								**Hours: 12**
Real-Time Architecture – Orchestration and Synthesis Using Analytics Engines– Discovery using Data at Rest – Implementation of Big Data Analytics – Big Data Convergence – Analytics Business Maturity Model.									
UNIT – V	**Big Data Tools And Techniques**								**Hours: 12**
Installing and Running Pig – Comparison with Databases – Pig Latin – User Defined Functions – Data Processing Operators – Installing and Running Hive– Hive QL – Tables – Querying Data – User-Defined Functions – Oracle Big Data.									
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**						**Total Hours: 60**	
Text Books:									
1. Michael Minelli, Michehe Chambers, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013. 2. Arvind Sathi, Big Data Analytics: Disruptive Technologies for Changing the Game, 1st Edition, IBM Corporation, 2012.									
Reference Books:									
1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, 1st Edition, Wiley and SAS Business Series, 2012. 2. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O'reilly, 2012.									
Web sites:									
1. http://www.thoughtworks.com/big-data-analytics 2. http://www.sas.com/en_us/insights/analytics/big-data-analytics.html 3. http://www.webopedia.com/TERM/B/big_data_analytics.html									

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE65	Business Intelligence	3	1	0	4	40	60	100
Prerequisite								
Objective	• To expose the field of Business Intelligence systems • To provide a practical understanding of the Business Intelligence life cycle and the techniques used in it. • To help the students to decide on appropriate technique.							
Outcome	Upon completion of the course, the students should be able to: • Explain the fundamentals of Business Intelligence. • Link data mining with Business Intelligence. • Explain the data analysis and knowledge delivery stages.							
UNIT – I	**Business Intelligence**							**Hours: 12**
Effective and Timely Decisions - Data, Information and Knowledge - Role of Mathematical Models - Business Intelligence Architectures: Cycle of a Business Intelligence Analysis - Enabling Factors In Business Intelligence Projects -Development of Business Intelligence System - Ethics and Business Intelligence.								
UNIT – II	**Data Analysis & Knowledge Delivery**							**Hours: 12**
Business Focused Data Analysis – Top Down Logical Data Modeling – Bottom Up Source Data Analysis – Data Cleansing – Deliverables Of Data Analysis - Business Intelligence User Types - Standard Reports - Interactive Analysis and Ad Hoc Querying - Parameterized Reports and Self-Service Reporting-Dimensional Analysis - Alerts/Notifications – Visualization- Integrated Analytics.								
UNIT – III	**Efficiency**							**Hours: 12**
Efficiency Measures – The CCR Model: Definition of Target Objectives – Peer Groups –Identification of Good Operating Practices: Cross Efficiency Analysis –Virtual Inputs and Outputs – Other Models.								
UNIT – IV	**Business Intelligence Applications**							**Hours: 12**
Marketing Models – Logistic and Production Models – Case Studies.								
UNIT – V	**Future Of Business Intelligence**							**Hours: 12**
Future of Business Intelligence-Emerging Technologies, Predicting the Future- Business Intelligence Search & Text Analytics-Advanced Visualization- Rich Report- Future Beyond Technology.								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**			**Total Hours: 60**			
Text Books:								
1. Larissa T. Moss, S. Atre, Business Intelligence Roadmap: The Complete Project Lifecycle for Decision Making, 1st Edition, Addison Wesley, 2003. 2. Carlo Vercellis, Business Intelligence: Data Mining and Optimization for Decision Making, 1st Edition, Wiley Publications, 2009.								
Reference Books:								
1. David Loshin Morgan and Kaufman, Business Intelligence: The Savvy Manager's Guide, 2nd Edition, 2012. 2. Cindi Howson, Successful Business Intelligence: Secrets to Making BI a Killer App, 1st Edition, McGraw-Hill, 2007								
Web sites:								
1. http://www.cio.com/article/2439154/business-intelligence								

Department : Information Technology					**Programme :** M.Tech. (Information Technology)			
Semester :					**Category :** TY			
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE66	Software Requirements Engineering	3	1	0	4	40	60	100
Prerequisite								
Objective	• To understand the need for requirements for large-scale systems. • To understand the stakeholders involved in requirements engineering. • To understand requirements engineering processes.							
Outcome	On successful completion of this course, the students will be able to: • Elicit requirements using a variety of techniques • Organize and prioritize requirements • Apply analysis techniques such as needs analysis, goal analysis, and use case analysis							
UNIT – I	**Basics of Requirements Engineering:**							**Hours: 12**
Definition -importance of requirements engineering-place of requirements engineering in development process-types of requirements: functional requirements, non-functional requirements, quality attributes- main requirements engineering activities, documents and processes								
UNIT – II	**Requirements Inception and Elicitation**							**Hours: 12**
Product vision and project scope-traditional elicitation approaches (interviews, stakeholders study, workshops, ...)-scenario/use case approaches-prototyping requirements negotiation and risk management								
UNIT – III	**Requirements Analysis and Specification - Modeling Techniques**							**Hours: 12**
Inception vs. specification-techniques for writing high-quality requirements-documentation standards (e.g., IEEE 830-1998)-goal-oriented modeling-Structured analysis and other techniques-UML v2 and URN notations-external qualities management, contract specification								
UNIT – IV	**Requirements Verification, Validation and Management**							**Hours: 12**
Detection of conflicts and inconsistencies, completeness-techniques for inspection, verification and validation-feature interaction analysis and resolution- traceability, priorities, changes, baselines-tool support (e.g., DOORS)								
UNIT – V	**Examples of Requirements Approaches in Typical Development Processes**							**Hours: 12**
Requirements for various types of systems: embedded systems, consumer systems, web-based systems, business systems, systems for scientists and other engineers-requirements engineering in RUP requirements engineering in agile methods								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**			**Total Hours: 60**			
Text Books:								
1. Leffingwell, D., Widrig, D., Managing Software Requirements A Use case approach, Second Edition, Pearson Education, 2000. 2. Ian K. Bray, An Introduction to Requirements Engineering, Addison Wesley, 2002.								
Reference Books:								
1. Swapna Kishore, Rajesh Naik, Software Requirements and Estimation, Tata McGraw Hill, 2001 2. K.Weigers, Software Requirements, Microsoft Press, 1999. 3. Ian Sommerville and P Sawyer, Requirements engineering a good practice Guide, Wiley India, 1997								
Web sites:								
1. http://www.visuresolutions.com/requirements-engineering-tool 2. https://www.interaction-design.org/encyclopedia/requirements_engineering.html								

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE67	Machine Learning Techniques	3	1	0	4	40	60	100
Prerequisite								
Objective	• To provide a broad survey of approaches and techniques in ML • To develop a deeper understanding of several major topics in ML • To develop the design and programming skills that will help you to build intelligent, adaptive artifacts							
Outcome	Upon completion of the course, the students should be able to: • setup and solve typical machine learning problems, by implementation or by using established computer simulation tools. • decide which machine learning methods/algorithms are suitable for which type of learning problems, i.e. know about their most important weaknesses and advantages. • decide how to represent data to facilitate learning..							
UNIT – I	**Introduction**							**Hours: 12**
Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.								
UNIT – II	**Neural Networks And Genetic Algorithms**							**Hours: 12**
Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evalution and Learning								
UNIT – III	**Bayesian And Computational Learning**							**Hours: 12**
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model								
UNIT – IV	**Instant Based Learning**							**Hours: 12**
K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.								
UNIT – V	**Advanced Learning**							**Hours: 12**
Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning								
Total Contact Hours: 45	**Total Tutorials: 15**			**Total Practical Classes:**			**Total Hours: 60**	
Text Books:								
1. Tom M. Mitchell, Machine Learning, McGraw-Hill Science /Engineering /Math; 1 edition, 1997 2. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004								
Reference Books:								
1. T. Hastie, R. Tibshirani, J. H. Friedman, The Elements of Statistical Learning, Springer; 1 edition, 2001								
Web sites: 1. http://en.wikipedia.org/wiki/Machine_learning 2. http://en.wikipedia.org/wiki/List_of_machine_learning_concepts								

Department : Information Technology				**Programme :** M.Tech. (Information Technology)				
Semester :				**Category :** TY				
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE68	Information Retrieval Techniques	3	1	0	4	40	60	100
Prerequisite:								
Objective	• To understand the basics of Information Retrieval with pertinence to modeling, query operations and indexing • To get an understanding of machine learning techniques for text classification and clustering							
Outcome	Upon completion of the course, the students should be able to: • Build an Information Retrieval system using the available tools • Identify and design the various components of an Information Retrieval system • Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval							
UNIT – I	**Introduction**							**Hours: 12**
Motivation – Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval –Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics–The impact of the web on IR – –IR Versus Web Search–Components of a Search engine								
UNIT – II	**Modeling**							**Hours: 12**
Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting –Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models –Algebraic Models – Structured Text Retrieval Models – Models for Browsing								
UNIT – III	I**ndexing**							**Hours: 12**
Static and Dynamic Inverted Indices – Index Construction and Index Compression Searching -Sequential Searching and Pattern Matching. Query Operations -Query Languages–Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis –Measuring Effectiveness and Efficiency.								
UNIT – IV	**Classification and Clustering**							**Hours: 12**
Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering –Matrix decompositions and latent semantic indexing – Fusion and Meta learning								
UNIT – V	**Searching and Ranking**							**Hours: 12**
Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking -Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries								
Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**			**Total Hours: 60**			
Text Books:								
1. Ricardo Baeza – Yates and BerthierRibeiro – Neto, Modern Information Retrieval: The concepts and Technology behind Search, ACM Press Books, Second Edition 2011 2. Christopher D. Manning, Prabhakar Raghavan and HinrichSchutze, Introduction to Information Retrieval, Cambridge University Press, First South Asian Edition 2012								
Reference Books:								
1. Stefan Buttcher, Charles L. A. Clarke, Gordon and V. Cormack, Information Retrieval Implementing and Evaluating Search Engines, The MIT Press, Cambridge, Massachusetts London, England, 2010								
Web sites: 1. http://comminfo.rutgers.edu/~aspoerri/InfoCrystal/Ch_2.html 2. http://www.langtoninfo.co.uk/web_content/9780521865715_frontmatter.pdf								

Department : Information Technology		**Programme :** M.Tech. (Information Technology)						
Semester :		**Category :** TY						
Subject Code	**Subject**	**Hours / Week**			**Credit**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CA**	**SE**	**TM**
ITE69	Ad hoc and Sensor Networks	3	1	0	4	40	60	100
Prerequisite								
Objective	• To understand the existing network architecture models and analyze the their performance • To understand the Ad hoc network protocols and design issues. • To learn various routing methods and Protocols							
Outcome	Upon completion of the course, the students should be able to: • Identify and describe Ad hoc networking protocols and the various network architectures. • Recognize the feasibility of applying Ad Hoc network.							

UNIT – I	**Hours: 12**
Introduction to Wireless Networks – Evolution of 3G Mobile Systems – Wireless LANs –Bluetooth – Scatternet – Piconet - Ad hoc Networks – Heterogeneity in Mobile Devices –Types of Ad hoc Mobile Communications – Types of Mobility – Challenges in Ad hoc Mobile Networks – Energy management - Scalability – Addressing and Service Discovery -Deployment Considerations.	
UNIT – II	**Hours: 12**
MAC Protocols for Ad hoc Networks: Design issues – Classifications – Contention based Protocols – MACAW – FAMA – BTMA – DBTMA - MACABI – Real-Time MAC Protocol – Multichannel protocols – Power Aware MAC – Routing Protocols: Design issues – Table driven protocols – DSDV – WRP – CGSR – On-Demand protocols – DSR – AODV – TORA – LAR – ABR – Zone Routing Protocol – Power Aware Routing protocols.	
UNIT – III	**Hours: 12**
Multicast Routing – Preferred Link based Multicast – Mesh-based protocols – Core-Assisted Mesh Protocol - Issues in Transport layer protocols – TCP over Ad hoc Networks – TCP Reno – Tahoe – Vegas – TCP SACK – Indirect TCP – Snooping TCP - Split-TCP – TCP BuS – Quality of Service Issues – MAC Layer Solutions – Network Layer Solutions – QoS Framework for Ad Hoc Networks – INSIGNIA – INORA – SWAN	
UNIT – IV	**Hours: 12**
Wireless Sensor Networks – Unique constraints and challenges - Applications –Collaborative processing – Architecture – Data Dissemination – MAC protocols – S-MAC –IEEE 802.15.4 and ZigBee – Geographic, Energy-Aware Routing – Attribute-based routing –Directed Diffusion – Rumor Routing - Geographic Hash Tables -GHT– PEGASIS – Location Discovery – Localization – Communication and Sensing Coverage.	
UNIT – V	**Hours: 12**
Topology Control – Time Synchronization - Sensor Taking and Control – Sensor Selection –IDSQ – Cluster Leader-based Protocol – Joint Routing and Information Aggregation –Sensor Network Databases – Challenges – In-Network Aggregation – TinyDB query processing –Platforms and Tools – Berkeley Motes –Programming Challenges – TinyOS – nesC – TinyGALS – NS2 extensions – TOSSIM	

Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes:**	**Total Hours: 60**

Text Books:

1. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks: Architectures and Protocols, Prentice Hall, 2011
2. Carlos de Morais Cordeiro, Dharma Prakash Agrawal ,Ad hoc Wireless Networks : Theory and Application, World Scientific2011

Reference Books:

1. C. K. Toh, Ad hoc Mobile Wireless Networks: Protocols and Systems, Pearson Education, 2007
2. Jochen Schiller, Mobile Communications, Pearson Education, 2009

Web Sites:

1. www.journals.sfu.ca/ahswn

Department : IT		Programme :M.Tech.						
Semester:Elective								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
ITE70	WEB DATA MINING	3	1	0	3	40	60	100
Prerequisite:	Data Mining (advisable, but not strictly required as Unit I covers it)							
Objective:	• Introduction about Data mining. • To focus on a detailed overview of the data mining process and techniques, specifically those that are relevant to Web mining • To Understand the basics of Information retrieval and Web search with special emphasis on web Crawling • To appreciate the use of machine learning approaches for Web Content Mining • To understand the role of hyperlinks in web structure mining • To appreciate the various aspects of web usage mining							
Outcome:	Upon Completion of the course, the students will be able to • Build a sample search engine using available open source tools • Identify the different components of a web page that can be used for mining • Apply machine learning concepts to web content mining • Implement Page Ranking algorithm and modify the algorithm for mining information • Process data using the Map Reduce paradigm • Design a system to harvest information available on the web to build recommender systems • Analyze social media data using appropriate data/web mining techniques • Modify an existing search engine to make it personalized							
UNIT – I	**Introduction to Data mining** Introduction –Getting to know your data-Data Preprocessing-Basics of Data Warehousing and Online Analytical Process-Data Cube Technology-Mining frequent pattern, Association Unsupervised Learning - K-means Clustering - Hierarchical Clustering - Classification- Cluster Analysis - Unsupervised Learning - K-means Clustering - Hierarchical Clustering -Outlier detection- Data Mining trends and research Fortier							Hours: 12
UNIT – II	**Introduction to Web Mining** Introduction – Web Mining –Sequential Pattern Mining -Information retrieval and Web search – Information retrieval Models- Text and Web page Pre-processing – Inverted Index – Latent Semantic Indexing – Web Search – Meta-Search – Web Spamming							Hours: 12
UNIT – III	**Web Content Mining and Web Link Mining** Web Content Mining – Supervised Learning – Decision tree - Naïve Bayesian Text Classification - Support Vector Machines - Ensemble of Classifiers.–Partially Supervised Learning - Opinion Mining and Sentiment Analysis Web Link Mining – Hyperlink based Ranking – Introduction - Page Rank - Authorities and Hubs -Link-Based Similarity Search - Enhanced Techniques for							Hours: 12

	Page Ranking - Web Crawling -A Basic Crawler Algorithm- Universal Crawlers- Focused Crawlers- Topical Crawlers - Crawler Ethics and Conflicts - New Developments	
UNIT – IV	**Structured Data Extraction** Structured Data Extraction: Wrapper Generation –Wrapper Induction- Instance-Based Wrapper Learning ·- Automatic Wrapper Generation: - String Matching and Tree Matching - Introduction to Schema Matching - Schema-Level Match - Analyzing Web Social Networks.	**Hours: 12**
UNIT – V	**Web Usage Mining** Web Usage Mining - Click stream Analysis -Web Server Log Files - Data Collection and Pre-Processing - Cleaning and Filtering- Data Modeling for Web Usage Mining - The BIRCH Clustering Algorithm - A Priori Algorithm – Binning. Discovery and Analysis of Web Usage Patterns – Modeling user interests –Applications- Recommender Systems – Web Recommender systems -PLSA and LDA Models	**Hours: 12**

Total Contact Hours: 45	**Total Tutorials: 15**	**Total Practical Classes: 0**	**Total Hours: 60**

Text Books:

- Jiawei Han , Micheline Kamber Jain Pei, " Data Mining: Concept and Techniques" Elsevier, Third Editions
- Bing Liu, "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data-Centric Systems and Applications)", Springer; 2nd Edition 2009
- Charu C. Aggarwal, "Data Mining" Springer, Edition May 2015
- Guandong Xu, Yanchun Zhang, Lin Li, "Web Mining and Social Networking: Techniques and Applications", Springer; 1st Edition.2010.
- Zdravko Markov, Daniel T. Larose, "Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage", John Wiley & Sons, Inc., 2007.

Reference Books:

- SoumenChakrabarti, "Mining the Web: Discovering Knowledge from Hypertext Data", Morgan Kaufmann; edition, 2002.
- Adam Schenker, "Graph-Theoretic Techniques for Web Content Mining", World Scientific Pub Co Inc , 2005.
- Min Song, Yi Fang and Brook Wu, "Handbook of Research on Text and Web Mining Technologies, IGI global, Information Science Reference – Imprint Of: IGI Publishing, 2008.

Web sites:

www.web-dataminning.net

Department : IT		Programme :M.Tech.						
Semester:ELECTIVE								
Course Code	Course Name	Hours / Week			Credit	Maximum Marks		
		L	T	P	C	CA	SE	TM
ITE71	Network Engineering and Management	3	1	0	3	40	60	100
Prerequisite:	Computer Networks							
Objective:	This course gives a overview of computer networks, TCP/IP protocols and also covers security and network management aspects. Course Objectives: • IPV4 and IPV6 protocols routing • Frame relay and ATM congestion control management • Network security and Integrated and Differentiated Service							
Outcome:	Upon completion of the course the students should be able to: • Identify and describe high speed networking protocols and the various network architectures. • Recognize the feasibility of applying congestion and traffic management in a network. • Apply TCP and ATM congestion control techniques. • Implementation of protocols for QOS							
UNIT – I	HIGH SPEED NETWORKS Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL. High Speed LAN's: Fast Ethernet, Gigabit Ethernet, Fibre Channel – Wireless LAN's.							Hours: 12
UNIT – II	CONGESTION AND TRAFFIC MANAGEMENT Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay- Congestion Control.							Hours: 12
UNIT – III	TCP AND ATM CONGESTION CONTROL TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO back-off – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.							Hours: 12
UNIT – IV	INTEGRATED AND DIFFERENTIATED SERVICES Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services.							Hours: 12
UNIT – V	PROTOCOLS FOR QoS SUPPORT RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.							Hours: 12
Total Contact Hours: 45	Total Tutorials: 15	Total Practical Classes: 0						Total Hours: 60
Text Books:								
1. William Stallings, "High Speed Networks and Internet", Pearson Education, Second Edition, 2012. 2. Prakash.C.Guptha, "Data Communication and Computer Networks", PHI , 6th printing 2012.								
Reference Books:								
1.Larry L. Peterson and Bruce S Davis , "Computer Network A System Approach", Elsevier,5th edition 2010. Irvan Pepelnjk, 2.Jim Guichard and Jeff Apcar, "MPLS and VPN Architecture",Cisco Press, Volume 1 and 2, 2003.								
Web sites:								
www.studygate.in/cp7101-design-and-management-of-computer-networks..								