	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**201**	Regulation	**2014**
Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**I**
CURRICULUM (Applicable to the students admitted in the academic year 2014-2015)					

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
THEORY								
P14CS101	Foundations of Computing Science	3	1	0	4	50	50	100
P14CS102	Algorithm Design and Analysis	3	0	0	3	50	50	100
P14CS103	Adhoc and Wireless Sensor Networks	3	0	0	3	50	50	100
	Elective I	3	0	0	3	50	50	100
	Elective II	3	0	0	3	50	50	100
PRACTICAL								
P14CS104	Algorithm Design and Analysis Lab	0	0	3	2	50	50	100
P14CS105	Wireless Networks Lab	0	0	3	2	50	50	100
P14CS106	Mini-project	0	0	3	2	50	50	100
				Total Credits	**22**	**400**	**400**	**800**

CA - Continuous Assessment, ESE - End Semester Examination

	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**201**	Regulation	**2014**
Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**II**
CURRICULUM (Applicable to the students admitted in the academic year 2014-2015)					

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
THEORY								
P14CS207	High Performance Computer Architecture	3	0	0	3	50	50	100
P14CS208	Component Based Technology	3	0	0	3	50	50	100
P14CS209	Open Source Systems	3	0	0	3	50	50	100
	Elective III	3	0	0	3	50	50	100
	Elective IV	3	0	0	3	50	50	100
	Elective V	3	0	0	3	50	50	100
PRACTICAL								
P14CS210	Component Technology Lab	0	0	3	2	50	50	100
P14CS211	Open Source Systems Lab	0	0	3	2	50	50	100
P14CS212	Mini-project	0	0	3	2	50	50	100
Total Credits					**24**	**450**	**450**	**900**

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	VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN (Autonomous Institution Affiliated to Anna University, Chennai) Elayampalayam, Tiruchengode – 637 205				
Programme	**M.E.**	Programme Code	**201**	Regulation	**2014**
Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**III**
CURRICULUM (Applicable to the students admitted in the academic year 2014-2015)					

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
THEORY								
	Elective VI	3	0	0	3	50	50	100
	Elective VII	3	0	0	3	50	50	100
	Elective VIII	3	0	0	3	50	50	100
PRACTICAL								
P14CS313	Project Phase - I	0	0	12	6	50	50	100
				Total Credits	**15**	**200**	**200**	**400**

CA - Continuous Assessment, ESE - End Semester Examination

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Programme	**M.E.**	Programme Code	**201**	Regulation	**2014**
Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**IV**
CURRICULUM (Applicable to the students admitted in the academic year 2014-2015)					

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
PRACTICAL								
P14CS414	Project Phase - II	0	0	24	12	50	50	100
				Total Credits	**12**	**50**	**50**	**100**

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Cumulative Course Credits: **73**

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**-**
CURRICULUM (Applicable to the students admitted in the academic year 2014-2015)					

LIST OF ELECTIVES

Course Code	Course Name	Periods / Week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE01	Logics for Computer Science	3	1	0	4	50	50	100
P14CSE02	Advanced Database Systems	3	0	0	3	50	50	100
P14CSE03	Embedded Systems	3	1	0	4	50	50	100
P14CSE04	Cryptography and Network Security	3	0	0	3	50	50	100
P14CSE05	Algorithms for Bioinformatics	3	0	0	3	50	50	100
P14CSE06	Artificial Intelligence	3	0	0	3	50	50	100
P14CSE07	Advanced Graph Theory	3	1	0	4	50	50	100
P14CSE08	Computational Complexity	3	0	0	3	50	50	100
P14CSE09	Discrete Structures	3	1	0	4	50	50	100
P14CSE10	Ubiquitous Computing	3	1	0	4	50	50	100
P14CSE11	Speech and Natural Language Processing	3	0	0	3	50	50	100
P14CSE12	Database Engineering	3	0	0	3	50	50	100
P14CSE13	Advanced Microprocessor Based Systems	3	0	0	3	50	50	100
P14CSE14	Advances in Operating Systems Design	3	0	0	3	50	50	100
P14CSE15	Parallel and Distributed Systems Design	3	0	0	3	50	50	100
P14CSE16	Advances in Compiler Construction	3	1	0	4	50	50	100
P14CSE17	Theory of Programming Languages	3	0	0	3	50	50	100
P14CSE18	Fault Tolerant Systems	3	0	0	3	50	50	100
P14CSE19	Multimedia Systems	3	0	0	3	50	50	100

P14CSE20	Computational Geometry	3	0	0	3	50	50	100
P14CSE21	Software Engineering	3	0	0	3	50	50	100
P14CSE22	Quantum Computing	3	1	0	4	50	50	100
P14CSE23	Complex Networks	3	0	0	3	50	50	100
P14CSE24	Information Retrieval	3	0	0	3	50	50	100
P14CSE25	Computational Number Theory	3	0	0	3	50	50	100
P14CSE26	Mobile Computing	3	0	0	3	50	50	100
P14CSE27	Grid Computing	3	0	0	3	50	50	100
P14CSE28	XML and Web Services	3	0	0	3	50	50	100
P14CSE29	Software Testing and Quality Assurance	3	0	0	3	50	50	100
P14CSE30	Software Project Management	3	0	0	3	50	50	100
P14CSE31	Information Security	3	0	0	3	50	50	100
P14CSE32	Visual Programming	3	0	0	3	50	50	100
P14CSE33	Discrete Mathematics	3	1	0	4	50	50	100
P14CSE34	Soft Computing	3	0	0	3	50	50	100

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Programme	**M.E.**	Programme code	**201**	Regulation	**2014**
Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**I**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS101	**Foundations of Computing Science**	3	1	0	4	50	50	100

Objective	• To understand the concept of Discrete Structures and Automata Theory • To understand the Foundations Of Computing Science		
Unit - I	**DISCRETE STRUCTURES**	Periods	**9+3**
Basic concepts of Sets, Relations and Ordering-Functions; Algebraic Structures, Grammars and Languages, Proof Techniques, Groups, Lattices and Boolean Algebras.			
Unit – II	**AUTOMATA THEORY**	Periods	**9+3**
Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions– FA and Regular Expressions – Properties of regular languages – Equivalence and minimization of Automata.			
Unit – III	**LANGUAGES AND AUTOMATA THEORY**	Periods	**9+3**
Context free languages, Context free grammars, Pushdown Automata, Non context free language, -Turing Machines, Variants of Turing Machines- Definition of Algorithm, Recursive and Recursively Enumerable Language			
Unit – IV	**COMPUTABILITY**	Periods	**9+3**
Church-Turing Thesis, Decision Problems, Decidability and Undecidability, Halting Problem of Turing Machines; Problem reduction (Turing and mapping reduction).			
Unit - V	**COMPUTATIONAL COMPLEXITY**	Periods	**9+3**
Time Complexity: Measuring Complexity, The class P, The class NP, NP-Completeness, Space Complexity: Savich's Theorem, The class PSPACE, PSPACE-completeness, The Class L and NL, NL-completeness, NL Equals coNL.			
		Total Periods	**60**

REFERENCES:	
1.	J.P. Trembley and R. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", First Edition, McGraw Hill Publication Private Ltd, 2001.
2.	Michael Sipser, "Introduction to The Theory of Computation", Third Edition, Cengage Learning, 2012.
FURTHER READINGS:	
1.	John E. Hopcroft and J.D.Ullman, "Introduction to Automata Theory, Languages and Computation", Second Edition, Addison Wesley, 2000.

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**I**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS102	**Algorithm Design and Analysis**	3	0	0	3	50	50	100

Objective	• Demonstrate a familiarity with major algorithms and data structures. • Apply important algorithmic design paradigms and methods of analysis.		
Unit - I	**ALGORITHM ANALYSIS**	Periods	**9**
Algorithmic paradigms: Dynamic Programming, Greedy, Branch-and-bound; Asymptotic complexity, Amortized analysis.			
Unit - II	**GRAPHS**	Periods	**9**
Graph Algorithms: Minimum Spanning Tree, Shortest paths, Flow networks; NP-completeness-Polynomial Time, Polynomial Time Verification, NP Completeness and Reducibility.			
Unit - III	**APPROXIMATION ALGORITHM**	Periods	**9**
Approximation algorithms-Lower Bounding OPT-Steiner Tree and TSP- Randomized algorithms.			
Unit - IV	**GEOMETRIC ALGORITHMS**	Periods	**9**
Geometric algorithms: range searching, convex hulls, segment intersections, closest pairs - Linear programming.			
Unit - V	**NUMERICAL & INTERNET ALGORITHMS**	Periods	**9**
Numerical algorithms: integer, matrix and polynomial multiplication, FFT, extended Euclid's algorithm, modular exponentiation, primality testing, cryptographic computations- Internet algorithms : text pattern matching, tries, information retrieval, data compression, Web caching.			
		Total Periods	**45**

REFERENCES:

1.	Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", Second Edition, MIT Press/McGraw-Hill, 2001.
2.	Jon Kleinberg and Éva Tardos, "Algorithm Design", Second Edition, Pearson Publication Asia, 2005.
3.	Michael T Goodrich and Roberto Tamassia," Algorithm Design: Foundations, Analysis, and Internet Examples", Second Edition, Wiley, 2006.
4.	Udi Manber, Algorithms -- A Creative Approach, Addison-Wesley, Reading, MA, 1989.
5.	Mark de Berg, Mark van Kreveld, Mark Overmars and Otfried Shwarzkopf (Cheong), "Computational Geometry: Algorithms and Applications", Third edition, Springer-Verlag, 2008.
6.	Rajeev Motwani and Prabhakar Raghavan, "Randomized Algorithms", Cambridge University Press, 1995.
7.	Dorit S Hochbaum (editor), "Approximation Algorithms for NP-Hard Problems", PWS Publishing Co, 1997.

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**I**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS103	**Adhoc and Wireless Sensor Networks**	3	0	0	3	50	50	100

Objective	• To introduce and study established and emerging areas of Wireless Networks. • To develop a comprehensive understanding of Wireless network protocols.		
Unit - I	**AD-HOC MAC**	Periods	**9**
Introduction – Issues in Ad-Hoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.			
Unit - II	**AD-HOC NETWORK ROUTING & TCP**	Periods	**9**
Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc –Feedback based, TCP with explicit link, TCP-BuS, Ad Hoc TCP, and Split TCP.			
Unit - III	**WSN –MAC**	Periods	**9**
Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols –self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.			
Unit - IV	**WSN ROUTING, LOCALIZATION & QOS**	Periods	**9**
Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN.			
Unit - V	**MESH NETWORK**	Periods	**9**
Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture –Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness– Heterogeneous Mesh Networks – Vehicular Mesh Networks.			
		Total Periods	**45**

REFERENCES:

1.	C.Siva Ram Murthy and B.Smanoj, " Ad Hoc Wireless Networks – Architectures and Protocols", Pearson Education, 2004
2.	Feng Zhao and Leonidas Guibas, "Wireless Sensor Networks", Morgan Kaufman Publishers, 2004
3.	C.K.Toh, "Ad Hoc Mobile Wireless Networks", Pearson Education, 2002.
4.	Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", O'Reilly Publishers, 2007.

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**I**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS104	**Algorithm Design and Analysis Lab**	0	0	3	2	50	50	100

LIST OF EXPERIMENTS

Object-oriented programming concepts:

1. Simple class design in C++, namespaces, objects creations.
2. Function overloading, Operator overloading, friend function in C++.
3. Class design in C++ using dynamic memory allocation, destructor, copy constructor.
4. Inheritance and run-time polymorphism.
5. Implementation of abstract data types.
6. Implementation of graph algorithms.
7. Implementation Linear programming with applications.

Basics of OS programming:

8. Implementation of Process creation and synchronization.
9. Implementation of Shared memory and semaphore.
10. Implementation of Shell programming.

TOTAL: 45 PERIODS

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS105	**Wireless Networks Lab**	0	0	3	2	50	50	100

LIST OF EXPERIMENTS

1. Simulate a LAN with 802.3 MAC consisting of TCP and UDP Traffic using NS2.
2. Performance evaluation of different routing protocols in wired network environment using NS2.
3. Simulate wireless Ad hoc networks with static nodes and study the performance using NS2.
4. Simulate and analyze the performance of Adhoc network with Dynamic Nodes using NS2.
5. Simulate WSN in NS2 and analyze the energy model of nodes.
6. Performance evaluation of different ad-hoc wireless routing protocols (DSDV, DSR, AODV) using NS2.
7. Simulate hierarchal structure of WSN in NS2.
8. Mini project.

TOTAL: 45 PERIODS

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS207	**High Performance Computer Architecture**	3	0	0	3	50	50	100

Objective	• To understand the Pipelining Concepts and Instruction Level Parallelism • To Learn Multiprocessors And Thread Level Parallelism And Distributed Architecture		
Unit - I	**INTRODUCTION**	Periods	**9**
Introduction: review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance. CISC and RISC processors. Pipelining: Basic concepts, instruction and arithmetic pipeline.			
Unit - II	**BASIC CONCEPTS OF PIPELINING**	Periods	**9**
Data hazards, control hazards, and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques. Compiler techniques for improving performance.			
Unit - III	**MEMORY HIERARCHY AND STORAGE DEVICES**	Periods	**9**
Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.			
Unit - IV	**MULTIPROCESSORS AND THREAD LEVEL PARALLELISM**	Periods	**9**
Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures. Array and vector processors, Multiprocessor architecture- taxonomy of parallel architectures. Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks.			
Unit - V	**DISTRIBUTED ARCHITECTURE**	Periods	**9**
Distributed shared-memory architecture. Cluster computers. Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures.			
		Total Periods	**45**

REFERENCES:	
1.	John L. Hennessy and David A. Patterson, “Computer Architecture: A Quantitative Approach”, Morgan Kaufmann.
2.	John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, Tata McGraw-Hill.
FURTHER READINGS:	
1.	M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.
2.	Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS208	**Component Based Technology**	3	0	0	3	50	50	100

Objective	• To explore different software components and their application. • Introduces in depth JAVA, CORBA and .Net Components • Deals with Fundamental properties of components, technology and architecture and middleware. • Component Frameworks and Development are covered in depth.		
Unit - I	**INTRODUCTION**	Periods	**9**
Software Components – objects – fundamental properties of Component technology – modules – interfaces – callbacks – directory services – component architecture – components and middleware.			
Unit - II	**JAVA COMPONENT TECHNOLOGIES**	Periods	**9**
Threads – Java Beans – Events and connections – properties – introspection – JAR files – reflection – object serialization – Enterprise Java Beans – Distributed Object models – RMI and RMI-IIOP.			
Unit - III	**CORBA TECHNOLOGIES**	Periods	**9**
Java and CORBA – Interface Definition language – Object Request Broker – system object model – portable object adapter – CORBA services – CORBA component model – containers – application server – model driven architecture.			
Unit - IV	**COM AND .NET TECHNOLOGIES**	Periods	**9**
COM – Distributed COM – object reuse – interfaces and versioning – dispatch interfaces – connectable objects – OLE containers and servers – Active X controls – .NET components - assemblies – app domains – contexts – reflection – remoting.			
Unit - V	**COMPONENT FRAMEWORKS AND DEVELOPMENT**	Periods	**9**
Connectors – contexts – EJB containers – CLR contexts and channels – Black Box component framework – directory objects – cross-development environment – component-oriented programming – Component design and implementation tools – testing tools - assembly tools.			
		Total Periods	**45**

REFERENCES:

1.	Clemens Szyperski "Component Software: Beyond Object-Oriented Programming", Pearson Education publishers, 2003.

FURTHER READINGS:

1.	Ed Roman, "Enterprise Java Beans", Third Edition , Wiley , 2004.
2.	Freeze, "Visual Basic Development Guide for COM & COM+", BPB Publication, 2001.
3.	Mowbray, "Inside CORBA", Pearson Education, 2003.
4.	G. Sudha Sadasivam, "Component Based Technology", Wiley India, 2008.
5.	Hortsamann, Cornell, "CORE JAVA Vol-II" Sun Press, 2002.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS209	**Open Source Systems**	3	0	0	3	50	50	100

Objective	• To introduce the concept of open source system with Linux operating system. • To provide adequate knowledge about MySQL, the open source database and open source programming languages PHP, Python, Perl. • To provide the adequate knowledge about open source tools and techniques.		
Unit - I	**OPEN SOURCE OPERATING SYSTEM**	Periods	**9**
Introduction to Open sources – Need of Open Sources – Advantages of Open Sources–Application of Open Sources. Open source operating systems: LINUX: Introduction –General Overview – Kernel Mode and user mode – Process – Advanced Concepts –Scheduling – Personalities – Cloning – Signals – Development with Linux.			
Unit - II	**OPEN SOURCE DATABASE**	Periods	**9**
MySQL: Introduction – Setting up account – Starting, terminating and writing your ownSQL programs – Record selection Technology – Working with strings – Date and Time– Sorting Query Results – Generating Summary – Working with metadata –Using sequences – MySQL and Web.			
Unit - III	**PHP**	Periods	**9**
Essential PHP-Operators and Flow control-Strings and Arrays-Creating functions-Reading data in web pages-PHP Browser-Handling Power-Object Oriented Programming-Advanced OOP-File Handling-Working with databases-Security			
Unit - IV	**PYTHON AND PERL**	Periods	**9**
Python: Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples – Dictionaries – Conditionals and Loops – Files – Input and Output – Errors and Exceptions – Functions – Modules – Classes and OOP. Perl: Variables and Data –Statements and Control structures – Subroutines, Packages, and Modules- Working with Files.			
Unit - V	**GUI PROGRAMMING**	Periods	**9**
Creating Dialogs: Rapid Dialog Design–Shape Changing Dialog–Dynamic Dialog–Build-in Dialog Class. Creating Main Windows: Creating Menus –Toolbars–Setting up Status Bar. Layout Management – Event Processing – Input and Output –Databases – Networking.			
		Total Periods	**45**

REFERENCES:

1.	Remy Card, Eric Dumas and Frank Mevel, “The Linux Kernel Book”, Wiley Publications, 2003
2.	Steve Suchring, “MySQL Bible”, John Wiley, 2002
3.	Steven Holzner, “PHP: The Complete Reference”, 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.
4.	Wesley J. Chun, “Core Phython Programming”, Prentice Hall, 2001
5.	Martin C. Brown, “Perl: The Complete Reference”, 2nd Edition, Tata McGraw-Hill Publishing Company Limited, Indian Reprint 2009.
6.	Jasmin Blanchette, Mark Summerfield, “C++ GUI Programming with Qt4” Second Edition, Prentice Hall, 2008

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS210	**Component Technology Lab**	0	0	3	2	50	50	100

LIST OF EXPERIMENTS

1. Create a distributed application to download various files from various servers using RMI
2. Create a Java Bean to draw various graphical shapes and display it using or without using BDK
3. Develop an Enterprise Java Bean for Banking operations
4. Develop an Enterprise Java Bean for Library operations
5. Create an Active-X control for File operations
6. Develop a component for converting the currency values using COM / .NET
7. Develop a component for encryption and decryption using COM / .NET
8. Develop a component for retrieving information from message box using DCOM / .NET
9. Develop a middleware component for retrieving Stock Market Exchange information using CORBA
10. Develop a middleware component for retrieving Weather Forecast information using CORBA

TOTAL: 45 PERIODS

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CS211	**Open Source Systems Lab**	0	0	3	2	50	50	100

LIST OF EXPERIMENTS

1. Configuring Linux Environment, MySQL and APACHE server.
2. XML and databases.
3. PHP with Database connectivity (Retrieving and uploading data, dynamic internet applications).
4. PYTHON programming.
5. Perl script and CGI with Database connectivity.
6. GUI Programming.
7. Mini Project.

TOTAL: 45 PERIODS

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE01	**Logics for Computer Science**	3	1	0	4	50	50	100

Objective	• To learn about Logic and its applications in computer science.		
Unit - I	**AXIOMATIC THEORY**	Periods	**9+3**
Propositional Calculus – Predicate Calculus.			
Unit - II	**FIRST ORDER LOGIC**	Periods	**9+3**
First Order Theories, Peano Arithmetic, Decision Procedures in First Order Logic models, Validity and satisfiability, Semantic tableaux.			
Unit - III	**RESOLUTION THEOREM PROVERS**	Periods	**9+3**
Elimination of quantifiers, unification, Resolution and various resolution strategies, Equality axioms and para-modulation-Theoretical issues.			
Unit - IV	**MODAL LOGIC AND TEMPORAL LOGIC**	Periods	**9+3**
Applications – Model Checking – Model Theory – Proof Theory.			
Unit - V	**FUZZY LOGIC**	Periods	**9+3**
Mu-Calculus – Lambda Calculus – Non-monotonic Reasoning – Intuitionistic First Order Logic – Fuzzy Logic.			
		Total Periods	**60**

REFERENCES:

1.	B.Arindama Singh, Logics for Computer Science, Prentice Hall of India.
2.	C. L. Chang and R. C. T. Lee, Symbolic Logic and Mechanical Theorem Proving, Academic Press.
3.	M. Ben-Ari, Mathematical Logic for Computer Science, Springer.
4.	E. M. Clarke Jr., Orna Grumberg and D. A. Peled, Model Checking, MIT Press.
5.	E. Mendelson, Introduction to Mathematical Logic, Chapman and Hall.
6.	Michael Huth and Mark Ryan, Logic in Computer Science: Modelling and Reasoning about Systems, Cambridge University Press.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE02	**Advanced Database Systems**	3	0	0	3	50	50	100

Objective	• To design high-quality relational databases and database applications. • To have developed skills in advanced conceptual modeling and database design		
Unit - I	**INTRODUCTION TO DATABASE SYSTEMS**	Periods	**9**
Database system concepts and architecture, ER Model, Normal forms (1NF,2NF,3NF,BCNF).			
Unit - II	**DISTRIBUTED DATABASES**	Periods	**9**
Parallel Databases – Inter and Intra Query Parallelism – Distributed Database Features – Distributed Database Architecture – Fragmentation – Distributed Query Processing – Distributed Transactions Processing – Concurrency Control – Recovery – Commit Protocols.			
Unit - III	**OBJECT ORIENTED DATABASES**	Periods	**9**
Introduction to Object Oriented Data Bases - Approaches - Modeling and Design - Persistence – Query Languages - Transaction - Concurrency – Multi Version Locks – Recovery – POSTGRES – JASMINE –GEMSTONE - ODMG Model.			
Unit - IV	**EMERGING SYSTEMS**	Periods	**9**
Enhanced Data Models - Client/Server Model - Data Warehousing and Data Mining - Web Databases – Mobile Databases- XML and Web Databases.			
Unit - V	**CURRENT ISSUES**	Periods	**9**
Rules - Knowledge Bases - Active and Deductive Databases - Multimedia Databases– Multimedia Data Structures – Multimedia Query languages - Spatial Databases.			
		Total Periods	**45**

REFERENCES:	
1.	Elmasri, Navathe. Fundamentals of Database Systems (Sixth Edition), Pearson Education, 2010.
2.	Thomas Connolly and Carlolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education 2003.
3.	C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
4.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts 4th Ed, McGraw Hill, 2002.
5.	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Ed, 2002.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE03	**Embedded Systems**	3	1	0	4	50	50	100

Objective	• To learn about embedded systems and its applications.		
Unit - I	**INTRODUCTION TO EMBEDDED COMPUTING**	Periods	**9+3**
Introduction- Characteristics of Embedding computing applications- Concept of real time systems- Challenges in embedded system design- Design process			
Unit - II	**EMBEDDED SYSTEM ARCHITECTURE**	Periods	**9+3**
CISC and RISC Instruction set architecture- Basic Embedded processor/Microcontroller Architecture- CISC Example- RISC Examples- DSP Processors- Harvard Architecture- Memory System Architecture- I/O Sub system- Coprocessors and Hardware Accelerators- Processor Performance Enhancement- CPU Power Consumption.			
Unit - III	**DESIGNING EMBEDDED COMPUTING PLATFORM**	Periods	**9+3**
Using CPU bus- Memory devices and their characteristics- I/O devices- Component interfacing- Designing with Processors- Implementation- Design Examples- Data Compressor- Alarm Clock.			
Unit - IV	**PROGRAMMING EMBEDDED SYSTEMS**	Periods	**9+3**
Program Design- Design patterns for Embedded Systems- Models of Program- Programming Languages- Desired Language Characteristics- Use of High Level Languages- Programming and Run-time Environment- Basic Compilation Techniques- Analysis and Optimization of Execution Time- Analysis and Optimization of Energy and Power- Analysis and Optimization of Program Size- Program Validation and Testing			
Unit - V	**NETWORK BASED EMBEDDED APPLICATIONS**	Periods	**9+3**
Network Fundamentals- Layers and Protocols- Distributed Embedded Architectures- Elements of Protocol Design- High Level Protocol Design Languages- Network Based Design- Internet-Enabled Systems- Wireless Applications.			
		Total Periods	**60**

REFERENCES:

1.	Peter Marwedel, Embedded System Design, Kluwer.
2.	Wayne Wolf, Computers as Components: Principles of Embedded Computing Systems Design, Morgan-Kaufmann, 2nd Edition, 2008.
3.	Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley.
4.	http://nptel.ac.in/courses/108102045

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P13CSE04	**Cryptography and Network Security**	3	0	0	3	50	50	100

Objective	• To understand the mathematical foundations of security principles • To appreciate the different aspects of encryption techniques • To understand the role played by authentication in security • To appreciate the current trends security practices		
Unit - I	**INTRODUCTION AND MATHEMATICAL FOUNDATION**	Periods	**9**
An illustrative communication game – safeguard versus attack – Probability and Information Theory - Algebraic foundations – Number theory.			
Unit - II	**SYMMETRIC TECHNIQUES**	Periods	**9**
Substitution Ciphers – Transposition Ciphers – Classical Ciphers – DES – AES –Confidentiality Modes of Operation – Key Channel Establishment for symmetric cryptosystems.			
Unit - III	**ASYMMETRIC TECHNIQUES AND DATA TECHNIQUES**	Periods	**9**
Diffie-Hellman Key Exchange protocol – Discrete logarithm problem – RSA cryptosystems & cryptanalysis – ElGamal cryptosystem – Need for stronger Security Notions for Public key Cryptosystems – Combination of Asymmetric and Symmetric Cryptography – Key Channel Establishment for Public key Cryptosystems - Data Integrity techniques – Symmetric techniques - Asymmetric techniques.			
Unit - IV	**AUTHENTICATION**	Periods	**9**
Authentication Protocols Principles – Authentication protocols for Internet Security – SSH Remote logic protocol – Kerberos Protocol – SSL & TLS – Authentication frame for public key Cryptography – Directory Based Authentication framework – Non - Directory Based Public-Key Authentication framework .			
Unit - V	**SECURITY PRACTICES**	Periods	**9**
Protecting Programs and Data – Information and the Law – Rights of Employees and Employers – Software Failures – Computer Crime – Privacy – Ethical Issues in Computer Security.			
		Total Periods	**45**

REFERENCES:	
1.	William Stallings, "Crpyptography and Network security: Principles and Practices", Pearson/PHI,5th Edition, 2010.
2.	Charlie Kaufman, Radia Perlman and Mike Speciner, " Network Security Private Communication in a Public World", PHI, Second Edition, 2012
FURTHER READINGS:	
1.	Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2nd Edition, Pearson, 2007.
2.	Behrouz A. Forouzan, "Cryptography and Network Security", 2nd Edition, Tata McGraw Hill Education, 2010.

3.	Douglas R. Stinson ,"Cryptography Theory and Practice ", 3rd Edition, Chapman & Hall/CRC,2006.
4.	W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, 2nd Edition, 2007.
5.	Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in computing", 3rd Edition, Prentice Hall of India, 2006.
6.	Wenbo Mao, "Modern Cryptography – Theory and Practice", Pearson Education, 2006.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE05	**Algorithms for Bioinformatics**	3	0	0	3	50	50	100

Objective	• The field of bioinformatics was conceived to systematically apply computer science algorithms to solve biological problems. • The success of the Human Genome Project has made the field widely popular. • This course will teach the basics of bioinformatics algorithms that have been applied over various types of biological data.		
Unit - I	**BASICS**	Periods	**9**
Introduction-Basics of biology-Biometrics and streaming of data			
Unit - II	**SEQUENCES**	Periods	**9**
Problem statement- Edit distance and substitution matrices- HMMs and pairwise HMMs- Global and local alignments- Spliced alignment- Space-efficient sequence alignment- Multiple alignment- Database searching tools- Sequence by hybridization- Profile HMMs.			
Unit - III	**STRUCTURES**	Periods	**9**
Protein structure alignment- Protein structure prediction.			
Unit - IV	**PHYLOGENETIC TREES**	Periods	**9**
Large parsimony and small parsimony problems- Probabilistic approaches- Grammar-based approaches.			
Unit - V	**MISCELLANEOUS TOPICS**	Periods	**9**
Pathways and networks- Microarrays- Biomedical images.			
		Total Periods	**45**

REFERENCES:

1.	"An Introduction to Bioinformatics Algorithms" by Jones, Pevzner. MIT Press.
2.	"Biological Sequence Analysis" by Durbin, Eddy, Krogh, Mitchison. Cambridge University Press.
3.	"Algorithms on Strings, Trees and Sequences" by Gusfield. Cambridge University Press.
4.	Introduction to Algorithms by Cormen, Leiserson, Rivest, Stein. Prentice Hall.
5.	www.renyi.hu/~miklosi/AlgorithmsOfBioinformatics.pdf
6.	www.cse.**iit**k.ac.in/teaching/courses/CS698W.html

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE06	**Artificial Intelligence**	3	0	0	3	50	50	100

Objective	• To understand the concept of State Space Problem and Logical Language • To understand the Concept of uncertainty and learning		
Unit - I	**PROBLEM SOLVING**	Periods	**9**
State space - problem reduction - game playing - constraint satisfaction.			
Unit - II	**REASONING AND UNCERTAINTY**	Periods	**9**
Probabilistic reasoning - belief networks.			
Unit - III	**AUTOMATED REASONING**	Periods	**9**
Proposition and first order logic - inference and deduction - resolution refutation - answer extraction - knowledge based systems - logic programming and constrained logic programming - non-monotonic reasoning.			
Unit - IV	**PLANNING**	Periods	**9**
State-space - plan space and partial order planning - planning algorithms.			
Unit - V	**LEARNING**	Periods	**9**
Inductive learning, decision trees - logical approaches - computational learning theory - neural networks - reinforcement learning - Intelligent agent - natural language understanding – Applications.			
		Total Periods	**45**

REFERENCES:	
1.	Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall. 3rd edition,2009
2.	Nils J. Nilsson, Artificial Intelligence: A New Sythesis, Morgan-Kaufmann. 3rd edition,1998
3.	http://nptel.ac.in/courses.php?disciplineId=106

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE07	**Advanced Graph Theory**	3	1	0	4	50	50	100

Objective	• To understand the concept of Paths and Cycles of algorithm. • To understand the Concept of External Problem.		
Unit - I	**BASIC CONCEPTS**	Periods	**9+3**
Graphs and digraphs, incidence and adjacency matrices, isomorphism, the automorphism group; Trees: Equivalent definitions of trees and forests, Cayley's formula, the Matrix-Tree theorem, minimum spanning trees; Connectivity: Cut vertices, cut edges, bonds, the cycle space and the bond space, blocks, Menger's theorem.			
Unit - II	**PATHS AND CYCLES**	Periods	**9+3**
Euler tours, Hamilton paths and cycles, theorems of Dirac, Ore, Bondy and Chvatal, girth, circumference, the Chinese Postman Problem, the Traveling Salesman problem, diameter and maximum degree, shortest paths.			
Unit - III	**MATCHINGS**	Periods	**9+3**
Berge's Theorem, perfect matchings, Hall's theorem, Tutte's theorem, Konig's theorem, Petersen's theorem, algorithms for matching and weighted matching (in both bipartitie and general graphs), factors of graphs (decompositions of the complete graph), Tutte's f-factor theorem.			
Unit - IV	**EXTREMAL PROBLEMS**	Periods	**9+3**
Independent sets and covering numbers, Turan's theorem, Ramsey theorems; Colorings: Brooks theorem, the greedy algorithm, the Welsh-Powell bound, critical graphs, chromatic polynomials, girth and chromatic number, Vizing's theorem; Graphs on surfaces: Planar graphs, duality, Euler's formula, Kuratowski's theorem, toroidal graphs, 2-cell embeddings, graphs on other surfaces.			
Unit - V	**DIRECTED GRAPHS**	Periods	**9+3**
Tournaments, directed paths and cycles, connectivity and strongly connected digraphs, branching; Networks and flows: Flow cuts, max flow min cut theorem, perfect square; Selected topics: Dominating sets, the reconstruction problem, intersection graphs, perfect graphs, and random graphs.			
		Total Periods	**60**

REFERENCES:	
1.	Douglas B. West, Introduction to Graph Theory, Prentice Hall of India, 2001
2.	Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science. Prentice-Hall.
3.	Frank Harary, Graph Theory, Narosa, 1995.
4.	R. Ahuja, T. Magnanti, and J. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice-Hall, 1993
5.	http://nptel.ac.in/courses.php?disciplineId=106

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE08	**Computational Complexity**	3	0	0	3	50	50	100

Objective	• To understand the concept of Computation and Complexity Classes • To understand the Concept of Counting Problem		
Unit - I	**COMPUTATION**	Periods	**9**
Models of computation, resources (time and space), algorithms, computability, complexity.			
Unit - II	**COMPLEXITY CLASSES**	Periods	**9**
Class P, Class NP and Class PSPACE, NP completeness-reductions, hardness, completeness, hierarchy, and relationship between complexity classes.			
Unit - III	**SPACE BOUNDED COMPLEXITY CLASSES**	Periods	**9**
Space bounded complexity classes, Reduction in NL, NL completeness, Savitch's Theorem, Undirected connectivity, Randomized log space, NL=coNL.			
Unit - IV	**CHARACTERISTICS**	Periods	**9**
Randomized computation and complexity, Logical characterizations, incompleteness, approximability , circuit complexity, lower bounds; parallel computation and complexity.			
Unit - V	**PROBLEM**	Periods	**9**
Counting problems; interactive proofs; probabilistically checkable proofs, communication complexity, Quantum computation.			
		Total Periods	**45**

REFERENCES:

1.	Michael Sipser, Introduction to the Theory of Computation, PWS Publishing. 1997.
2.	Christos H. Papadimitriou, Computational Complexity, Addison-Wesley Longman. Second edition 1994
3.	http://nptel.ac.in/courses.php?disciplineId=106

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE09	**Discrete Structures**	3	1	0	4	50	50	100

Objective	• Cultivate clear thinking and creative problem solving. • Thoroughly train in the construction and understanding of mathematical proofs.		
Unit - I	**PROPOSITIONAL LOGIC**	Periods	**9+3**
Propositional Logic, Proof Methods of Implications, Sets, Basic operations on sets, Functions, Relations.			
Unit - II	**BINARY RELATIONS**	Periods	**9+3**
Binary relations: Equivalence Relations, Partial orders and posets. Mathematical induction, pigeonhole principle, first order logic and other proof methods.			
Unit - III	**SETS**	Periods	**9+3**
Cardinality of sets, finite and infinite sets, countable and uncountable sets, Cantor's theorem.			
Unit - IV	**ALGEBRAIC STRUCTURE**	Periods	**9+3**
Algebraic structures: Semigroups, monoids, Groups, Substructures and morphisms, rings, fields and vector spaces; lattices.			
Unit - V	**BOOLEAN ALGEBRA**	Periods	**9+3**
Boolean algebras, morphisms of Boolean algebras; basic counting principles, permutations, combinations, recurrence relations and their solutions.			
		Total Periods	**60**

REFERENCES:

1.	Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw-Hill.
2.	C. L. Liu, Elements of Discrete Mathematics, Tata McGraw-Hill.
3.	Norman L. Biggs, Discrete Mathematics, Oxford University Press.
4.	Udi Manber, Algorithms -- A Creative Approach, Addison-Wesley, Reading, MA, 1989.
5.	Kenneth Bogart, Clifford Stein and Robert L. Drysdale, Discrete Mathematics for Computer Science, Key College Publishing
6.	Thomas Koshy, Discrete Mathematics with Applications, Elsevier.
7.	Ralph P. Grimaldi, Discrete and Combinatorial Mathematics, Pearson Education, Asia

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE10	**Ubiquitous Computing**	3	1	0	4	50	50	100

Objective	• To provide the ability to access services and resources all the time and irrespective to their location • To provide spontaneous emergent services created on the fly by mobiles that interact by ad hoc connections		
Unit - I	**WIRELESS TECHNOLOGIES**	Periods	**9+3**
Wireless technologies: Signal propagation, Multiplexing, Modulation, and Spread spectrum techniques. Media access control: FDMA, TDMA, CDMA.			
Unit - II	**CELLULAR SYSTEMS & SATELLITE SYSTEMS**	Periods	**9+3**
Cellular Systems: AMPS, GSM, DECT, UMTS, IMT-2000. CDMA-Based Cellular Systems. Satellite Systems: Basic Routing, Localization and Handoff Issues.			
Unit - III	**WIRELESS NETWORKS**	Periods	**9+3**
Wireless Networks: Packet Radio Network, Wireless LAN, IEEE 802.11b, Bluetooth, Wireless ATM, Wireless Application Protocol (WAP) and WML.			
Unit - IV	**MOBILE NETWORKS**	Periods	**9+3**
Mobile Networking: Mobile IP, Ad-Hoc Networks: AODV, DSR, DSDV Routing. Wireless TCP: Indirect TCP, Snooping TCP, Mobile TCP.			
Unit - V	**INFORMATION MANAGEMENT**	Periods	**9+3**
Information Management: Location-Independent and Location-Dependent Computing Models, Mobile Applications and Services, Security.			
		Total Periods	**60**

REFERENCES:	
1.	C.Siva Ram Murthy and B.Smanoj, “Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2004.
2.	Mullet, “Introduction to wireless communication ”, National Center for Telecommunication Tehnologies.
3.	Ron schneidermann, “The mobile technology Q & A Book ”, A Survival Guide for Business Managers.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE11	**Speech and Natural Language Processing**	3	0	0	3	50	50	100

Objective	• To learn advanced and cutting edge state of the art knowledge and implementation in natural language processing • To conduct independent project and to equip for scholarly research in natural language processing		
Unit - I	**WORDS**	Periods	**9**
Introduction- Brief Review of Regular Expressions and Automata- Finite State Transducers-Word level Morphology and Computational Phonology- Basic Text to Speech- Introduction to HMMs and Speech Recognition.			
Unit - II	**SYNTAX**	Periods	**9**
Indian language case studies- Part of Speech Tagging-Parsing with CFGs-Probabilistic Parsing-Language and Complexity.			
Unit - III	**SEMANTICS**	Periods	**9**
Representation of Meaning- Semantic Analysis- Lexical Semantics- Word Sense-Disambiguation.			
Unit - IV	**PRAGMATICS**	Periods	**9**
Discourse understanding; Natural Language Generation; Techniques of Machine Translation; Indian Language case studies.			
Unit - V	**INFORMATION EXTRACTION**	Periods	**9**
Named entity recognition -Relation extraction- IE using sequence labeling.			
		Total Periods	**45**

REFERENCES:	
1.	Daniel Jurafsky and James H. Martin, Speech and Language Processing, Prentice-Hall.
2.	Chris Manning and Hinrich Schuetze, Foundations of Statistical Natural Language Processing, MIT Press.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE12	**Database Engineering**	3	0	0	3	50	50	100

Objective	• To understand the concept of Discrete Structures and Automata Theory • To understand the Foundations Of Computing Science		
Unit - I	**RELATIONAL DATABASES**	Periods	**9**
Integrity Constraints revisited: Functional, Multi-valued and Join Dependency, Template Algebraic, Inclusion and Generalized Functional Dependency, Chase Algorithms and Synthesis of Relational Schemes. Query Processing and Optimization: Evaluation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information.			
Unit - II	**DEDUCTIVE DATABASES**	Periods	**9**
Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation. Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases. Case Studies: Gemstone, O2, Object Store, SQL3, Oracle xxi, DB2.			
Unit - III	**PARALLEL AND DISTRIBUTED DATABASES**	Periods	**9**
Distributed Data Storage: Fragmentation and Replication, Location and Fragment Transparency, Distributed Query Processing and Optimization, Distributed Transaction Modeling and Concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation. Data Mining: Knowledge Representation Using Rules, Association and Classification Rules, Sequential Patterns, Algorithms for Rule Accessing.			
Unit - IV	**ADVANCED TRANSACTION PROCESSING**	Periods	**9**
Nested and Multilevel Transactions, Compensating Transactions and Saga, Long Duration Transactions, Weak Levels of Consistency, Transaction Work Flows, Transaction Processing Monitors. Active Databases: Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery.			
Unit - V	**REAL TIME DATABASES AND WEB DATABASES**	Periods	**9**
Temporal Constraints: Soft and Hard Constraints, Transaction Scheduling and Concurrency Control. Image and Multimedia Databases: Modeling and Storage of Image and Multimedia Data, Data Structures - R-tree, k-d tree, Quadtrees, Content Based Retrieval: Color Histograms, Textures etc, Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio and Handwritten Data, Geographic Information Systems (GIS). WEB Databases: Accessing Databases through WEB, WEB Servers, XML Databases, commercial Systems: Oracle xxi, DB2.			
		Total Periods	**45**

REFERENCES:	
1.	Abraham Silberschatz, Henry Korth, and S. Sudarshan, Database System Concepts, McGraw-Hill.
2.	Raghu Ramakrishnan, Database Management Systems, WCB/McGraw-Hill.
3.	Serge Abiteboul, Richard Hull and Victor Vianu, Foundations of Databases. Addison-Wesley.
FURTHER READINGS:	
1.	Bipin Desai, An Introduction to Database Systems, Galgotia.
2.	J. D. Ullman, Principles of Database Systems, Galgotia.
3.	R. Elmasri and S. Navathe, Fundamentals of Database Systems8, Addison-Wesley

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE13	**Advanced Microprocessor Based Systems**	3	0	0	3	50	50	100

Objective	• To learn about sensing, actuation, path planning, control, memory and interfacing circuits, tools for microprocessor-based system design, development and testing of prototype systems. • To design, develop and commission a microprocessor-based product.		
Unit - I	**INTRODUCTION**	Periods	**9**
Basics of Von Neumann Architecture and the early Microprocessors, CISC and RISC concepts.			
Unit - II	**MULTIPROCESSOR ARCHITECTURE**	Periods	**9**
Taxonomy of parallel architectures; Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks, Distributed shared-memory architecture, Cluster computers.			
Unit - III	**PARALLELISM IN PROCESSOR ARCHITECTURE**	Periods	**9**
Pipelining, Super-scalar, Super-pipeline and VLIW Architectures, Low-power Architecture, Built-in Multiprocessing support, Co-processors.			
Unit -IV	**PROCESSOR ARCHITECTURE WITH HIERARCHICAL MEMORY ORGANIZATION**	Periods	**9**
Cache memory, Virtual memory, Built-in Multi-user and multitasking support in 16-bit and 32-bit microprocessors, Built-in memory mapping and management support.			
Unit - V	**EVOLUTION OF PLATFORM ARCHITECTURE**	Periods	**9**
Special-purpose processor architectures, Signal processing Microprocessors, Communication processors, Case studies with contemporary Microprocessors.			
		Total Periods	**45**

REFERENCES:

1.	R. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, Penram.
2.	A. Pal, Microprocessors: Principles and Applications, Tata McGraw-Hill.
3.	K. J. Ayala, The 8051 Microcontroller Architecture, Programming and Applications, Penram.
4.	Mazidi and Mazidi, Microcontroller and Embedded Systems, Pearson Education.
5.	R. Kapadia, 8051 Microcontroller and Embedded Systems, Jaico.
6.	http://cse.iitkgp.ac.in/syllabus.html

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE14	**Advances in Operating Systems Design**	3	0	0	3	50	50	100

Objective	• This course covers general issues of design and implementation of advanced modern operating systems. • The focus is on issues that are critical to the applications of distributed systems and computer networks, which include inter-process communication, distributed processing, and sharing and replication of data and files. • Approximately two-thirds of the course will be devoted to basic concepts and techniques, and the remaining third will be on assorted current topics in modern operating systems and distributed systems.		
Unit - I	**DISTRIBUTED OPERATING SYSTEMS**	Periods	**9**
Theory and implementation aspects of distributed operating systems. Process synchronization in multiprocessing/multiprogramming systems.			
Unit - II	**INTER-PROCESS COMMUNICATION**	Periods	**9**
Inter-process communication and co-ordination in large distributed systems. Distributed resource management.			
Unit - III	**FUNDAMENTALS OF REAL TIME SYSTEMS**	Periods	**9**
Fundamentals of real time operating systems. Case studies. Information management in distributed systems: security, integrity and concurrency problems. Fault tolerance issues.			
Unit - IV	**ISSUES**	Periods	**9**
OS issues related to the Internet, intranets, pervasive computing, embedded systems, mobile systems and wireless networks. Case studies of contemporary operating systems.			
Unit - V	**CLOCK SYNCHRONIZATION AND DEADLOCKS**	Periods	**9**
Clock Synchronization, Distributed mutual exclusion and distributed deadlocks, Case studies: DCOM and JINI.			
		Total Periods	**45**

REFERENCES:

1.	Mukesh Singhal and N. G. Shivaratri, “Advanced Concepts in Operating Systems”, McGraw-Hill, 2000
2.	Abraham Silberschatz, Peter B. Galvin, G. Gagne, “Operating System Concepts”, Sixth Edition, Addison Wesley Publishing Co., 2003.
3.	Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE15	**Parallel and Distributed Systems Design**	3	0	0	3	50	50	100

Objective	• This subject covers general introductory concepts in the design and implementation of parallel and distributed systems, covering all the major branches • Summarize the range of mechanisms (in a distributed system) that can be employed to realize concurrent systems and be able to describe the benefits of each.		
Unit - I	**FUNDAMENTALS**	Periods	**9**
Fundamentals: Models of parallel and distributed computation, complexity measures.			
Unit - II	**PRAM MODEL**	Periods	**9**
The PRAM Model: balancing, divide and conquer, parallel prefix computation, pointer jumping, symmetry breaking, list ranking, sorting and searching, graph algorithms, parallel complexity and complexity classes, lower bounds.			
Unit - III	**INTERCONNECTION NETWORKS**	Periods	**9**
Interconnection Networks: topologies (arrays and mesh networks, trees, systolic networks, hypercubes, butterfly) and fundamental algorithms, matrix algorithms, sorting, graph algorithms, routing, relationship with PRAM models; Asynchronous Parallel Computation.			
Unit - IV	**DISTRIBUTED ALGORITHMS**	Periods	**9**
Distributed Algorithms: models and complexity measures, safety, liveness, termination, logical time and event ordering, global state and snapshot algorithms, mutual exclusion, clock synchronization, election, termination detection, routing, Distributed graph algorithms, Applications of Distributed algorithms.			
Unit - V	**ARCHITECTURES AND PROGRAMMING**	Periods	**9**
Parallel architectures, Multithreaded programming , GPU architecture and programming.			
		Total Periods	**45**

REFERENCES:

1.	Kai Hwang, " Advanced Computer Architecture ", McGraw Hill International, 2001.
2.	Dezso Sima, Terence Fountain, Peter Kacsuk, ”Advanced Computer architecture – A design Space Approach” , Pearson Education , 2003.
3.	John P.Shen, “Modern processor design . Fundamentals of super scalar processors”, Tata McGraw Hill 2003.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE16	**Advances in Compiler Construction**	3	1	0	4	50	50	100

Objective	• Aims to teach students the principles involved in compiler design. • It will cover all the basic components of a compiler but not the advanced material on optimizations and machine code generation.		
Unit - I	**OVERVIEW OF COMPILER**	Periods	**9+3**
Definition of programming language – Lexical and syntactic structure of a language –Elements of a format language grammar – Derivation, reduction and syntax trees – A ambiguity – context free grammars – Capabilities of a context free grammar – Regular expressions-Compiler-Phases of Compiler.			
Unit - II	**LEXICAL, SYNTAX AND SEMANTIC ANALYSIS**	Periods	**9+3**
Role of lexical analyzer – Finite automats –Regular expressions to finite automata – Minimizing the number of states of DFA – Implementation of a lexical analyzer –Illustrations. Lexical analysis, parsing, semantic analysis.			
Unit - III	**PARSING TECHNIQUES**	Periods	**9+3**
Parse trees – Left most and right most Parsing techniques- Top down and bottom up parsing – Handles – Shift reduce Parse- Recursive descent Parser – Operator precedence and predictive Parse. Automatic Parsing techniques: LR grammars – LR Parsing – Canonical –collection of LR (0) items – construction of ACTION and GO TO table – Introduction to SLR – canonical and LALR Parsing.			
Unit - IV	**CODE GENERATION AND OPTIMIZATION**	Periods	**9+3**
Error recovery and intermediate code generation; Runtime storage management; Code generation Code improvement - peephole optimization, dependence analysis and redundancy elimination. Loop optimization, procedural and inter-procedural optimization, instruction scheduling, optimization for memory hierarchy.			
Unit - V	**ADVANCES IN COMPILER**	Periods	**9+3**
Compilation for high performance architecture; Portability and retarget ability; Selected topics from compilers for imperative, object-oriented and mark-up languages, parallel and distributed programming and concurrency.			
		Total Periods	**60**

REFERENCES:	
1.	V. Aho, Ravi Sethi, Jeffrey D. Ullman, Compilers: Principles, Techniques and Tools, Addison-Wesley.
2.	Michael L. Scott, Programming Language Pragmatics, Elsevier.
3.	Andrew W. Appel, Modern Compiler Implementation in C/Java, Cambridge University Press.
4.	Keith D. Cooper and Linda Torczon, Engineering a Compiler, Elsevier.

5.	Allen I. Holob, Compiler Design in C, Prentice-Hall.
6.	Steven S. Muchnik, Advanced Compiler Design and Implementation, Elsevier.
7.	Randy Allen and Ken Kennedy, Optimizing Compilers for Modern Architectures, Elsevier.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE17	**Theory of Programming Languages**	3	0	0	3	50	50	100

Objective	• To understand the concept of Architecture of Computers and Internal Parts of Computers • To understand the Pipelining Concepts and Instruction Level Parallelism		
Unit - I	**PRELIMINARIES**	Periods	**9**
Mathematical Proof, Sets, Mathematical Induction Syntax of Programming Languages.			
Unit - II	**AUTOMATA**	Periods	**9**
Formal languages and automata theory: Finite automata, Deterministic Finite Automata (DFA) , Non Deterministic Finite Automata(NFA), regular languages, pushdown automata, Languages for PDA, context free languages, linear bounded automata, context sensitive languages.			
Unit - III	**TURING MACHINES**	Periods	**9**
Turing machines and recursively enumerable sets. Theory of LR (k) parsing, attribute grammars. Semantics of programming languages.			
Unit - IV	**BASIC MATHEMATICAL INTRODUCTION**	Periods	**9**
Propositional and predicate calculus, lambda calculus, algebraic structures. Sequential languages (imperative and applicative): operational semantics, Vienna definition methods.			
Unit - V	**DENOTATION SEMANTICS**	Periods	**9**
Scott-Starchy theory, axiomatic semantics: Floyd-Hoare approach, temporal logic, algebraic semantics and data types.			
		Total Periods	**45**

REFERENCES:	
1.	Glynn Winskel, A Formal Semantics of Programming Languages: An Introduction, MIT Press.
2.	John C.Mitchell,Foundations for Programming Languages, MIT Press.
FURTHER READINGS:	
1.	Benjamin C.Pierce, Types and Programming Languages, MIT Press.
2.	Daniel P.Friedman,Mitchell Wand and Christopher T.Haynes, Essentials of Programming Languages,Prentice Hall of India.
3.	Ravi Sethi, Programming Languages: Concepts and Constructs, Addison-Wesley.
4.	H.P.Barendregt, The Lambda Calculus: Its syntax and Semantics, North-Holland.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE18	**Fault Tolerant Systems**	3	0	0	3	50	50	100

Objective	• The design of fault tolerant systems is gaining importance in large domains of embedded applications. • New software techniques, based on s- application of redundancy, have shown remarkable fault coverage with reduced costs and overheads.		
Unit - I	**FUNDAMENTALS**	Periods	**9**
Basic concepts in the theory of reliable computer systems design— Introduction to redundancy theory, limit theorems— decision theory in redundant systems.			
Unit - II	**HARDWARE FAULT TOLERANCE**	Periods	**9**
Redundancy techniques, detection of faults, replication and compression techniques, self-repairing techniques, concentrated and distributed voters, models of fault tolerant computing systems— Case studies.			
Unit - III	**SOFTWARE FAULT TOLERANCE**	Periods	**9**
Fault tolerance versus fault intolerance, errors and their management strategies.			
Unit - IV	**IMPLEMENTATION TECHNIQUES**	Periods	**9**
Software defense, protective redundancy, architectural support. Fault recovery techniques.			
Unit - V	**CODING THEORY**	Periods	**9**
Application to fault tolerant system design— Fault-tolerance and reliability of multicomputer networks (direct and indirect) including fault-tolerant routing and sparing techniques— Yield and reliability enhancement techniques for VLSI/WSI array processors.			
		Total Periods	**45**

REFERENCES:

1.	Israel Koren, C. Mani Krishna, “Fault Tolerant Systems”, Morgan Kaufmann Publishers, Elsevier, 2007.
2.	www.iit.edu/ecdre/research/new_awards.shtml
3.	en.wikipedia.org/wiki/Fault-tolerant_computer_system
4.	en.wikipedia.org/wiki/Fault_tolerance

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE19	**Multimedia Systems**	3	0	0	3	50	50	100

Objective	• To learn about multimedia streams and compression techniques. • To study about multimedia servers and databases and its applications.		
Unit - I	**MULTIMEDIA SYSTEM AND MEDIA STREAMS**	Periods	**9**
An overview of multimedia system – media streams.			
Unit - II	**REPRESENTATION AND COMPRESSION TECHNIQUES**	Periods	**9**
Source representation and compression techniques text, speech and audio, still image and video – Graphics and animation.			
Unit - III	**MULTI-MODAL AND MULTIMEDIA COMMUNICATION**	Periods	**9**
Multi-modal communication –Multimedia communication, video conferencing, video-on-demand broadcasting issues, traffic shaping and networking support.			
Unit - IV	**TRANSCODING**	Periods	**9**
Multimedia OS and middleware.			
Unit - V	**SYNCHRONIZATION AND QoS**	Periods	**9**
Multimedia servers, databases and content management – Multimedia information system and applications.			
		Total Periods	**45**

REFERENCES:

1.	Ralf Steinmetz and Klara Nahrstedt, Multimedia Systems, Springer.
2.	J. D. Gibson, Multimedia Communications: Directions and Innovations, Springer.
3.	K. Sayood, Introduction to Data Compression, Morgan-Kaufmann.
4.	A. Puri and T. Chen, Multimedia Systems, Standards, and Networks, Marcel Dekker.
5.	Iain E.G. Richardson, H.264 and MPEG-4 Video Compression, John Wiley.
6.	Borivoje Furht, Handbook of Multimedia Computing, CRC Press.
7.	http://www.iitb.ac.in/~cep/brochures/sduttaroy-bro.html

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE20	**Computational Geometry**	3	0	0	3	50	50	100

Objective	• Computational geometry is the development and analysis of algorithms for solving geometric problems on a computer. • The field of computational geometry provides a foundation for solving a wide range of practical problems in a variety fields such as graphics, computer-aided design, computer vision, robotics, databases, and pattern recognition		
Unit - I	**INTRODUCTION**	Periods	**9**
Historical perspective, geometric preliminaries— Convex hulls algorithms in 2d and 3d, lower bounds.			
Unit - II	**TRIANGULATIONS**	Periods	**9**
Polygon triangulations, representations, point-set triangulations— Voronoi diagrams: algorithms, closest pair problems— Delaunay triangulations: algorithms (divide-and-conquer, flip, incremental), duality of Voronoi diagrams, properties (min-max angle).			
Unit - III	**GEOMETRIC SEARCHING**	Periods	**9**
Point-location, 2d linear programming with prune and search— Visibility: algorithms for weak and strong visibility, visibility with reflections, art-gallery problems— Arrangements of lines: 2d arrangements, zone theorem, many-faces complexity, algorithms.			
Unit - IV	**SWEEP TECHNIQUES**	Periods	**9**
Plane sweep for segment intersections, Fortune's sweep for Voronoi diagrams, topological sweep for line arrangements—Combinatorial geometry: Ham-sandwich cuts, Helly's theorems, k-sets.			
Unit - V	**RECTILINEAR GEOMETRY**	Periods	**9**
Intersection and union of rectangles, rectangle searching. Robust geometric computing—Applications of computational geometry.			
		Total Periods	**45**

REFERENCES:

1.	Mark de Berg, Otfried Schwarzkopf, Marc van Kreveld and Mark Overmars, Computational Geometry: Algorithms and Applications, Springer.
2.	F. P. Preparata and Michael I. Shamos, Computational Geometry: An Introduction, Springer.
3.	Joseph O' Rourke, Computational Geometry in C, Cambridge University Press.
4.	Lecture Notes by David Mount.
5.	cse.iitkgp.ac.in/syllabus.html

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE21	**Software Engineering**	3	0	0	3	50	50	100

Objective	• Ability to define, assesses, and tailors software quality practices, and software processes and methodologies for appropriate application on software development projects in a variety of domain areas. • To Ability to be an effective member of a multi-disciplinary software-intensive product development with an awareness of individual professional.		
Unit - I	**SOFTWARE PROCESS MODELS**	Periods	**9**
Software Process Framework, Process Patterns, Personal and Team Process Models, Process Models: Waterfall Model, Incremental Models, Evolutionary Models, Iterative Development, The Unified Process, Agile process, Process Assessment, CMMI, Impact of Processes and Outcomes, Process Selection and applicability.			
Unit - II	**REQUIREMENTS ENGINEERING**	Periods	**9**
Requirements Engineering Tasks, Requirement Elicitation Techniques, Software Requirements: Functional, Non-Functional, Domain, Requirements Characteristics and Characterization, Requirement qualities, Requirement Specification, Requirement Traceability, System Analysis Model Generation, Requirement Prioritization .			
Unit - III	**UML 2.0 CONCEPTS**	Periods	**9**
Programming In Small Versus Programming In Large, UML 2.0 History/ New Features MDA/ MOF/ XMI/ CORBA, Introduction to UML Metamodel , Extensibility Mechanisms and its usage, Introduction to OCL ,Specification techniques of diagrams in UML .			
Unit - IV	**BEHAVIORAL MODEL AND DYNAMIC BEHAVIOR**	Periods	**9**
Use Cases, Use Case Diagram Components, Use Case Diagram , Actor Generalization, Include and Extend, Template for Use Case Narrative , Sequence diagrams, object lifelines and message types, Refining sequence diagrams, Implementing memory in objects using state machines, States, events and actions, Nested machines and concurrency, Modeling methods with activity diagrams, Activity Diagrams: Decisions and Merges, Synchronization, Drilling Down, Iteration, Partitions, Parameters and Pins, Expansion Regions, Swim lanes, concurrency and synchronization, Communication Diagram, Timing Diagrams .			
Unit - V	**TESTING AND PROJECT PLANNING AND ESTIMATION**	Periods	**9**
Testing Concepts: Purpose, aspects, Scenarios, Test cases, Test scripts/procedures, Strategies for Software Testing, Testing Activities, Mistakes, Faults & Failures, Testing, Debugging & Root Cause Analysis, Component & Units, Verification & Validation, Test Bed, Traceability and Testability, Attributes of Testable Requirements, Test Matrix, Benefits of Formal Test Documentation White-Box Testing, Black-Box Testing. Project Activities, Structures and Frameworks, Assessing Project Viability, Managing Stakeholders, Introduction to Function Points, Empirical Estimation, COCOMO II model, Software Measurement Framework, Ishikawa's Seven tools, Process Assessment and patterns, CMMI –IPPD, Product and Process attributes .			
		Total Periods	**45**

REFERENCES:	
1.	Ian Sommerville, Software Engineering, 7th Edition, Addison-Wesley, 2004,ISBN 81- 7758-530-4
2.	Fairley, “Software Engineering Concepts”, McGraw-Hill, 1985.
3.	Sommerville I., “Software Engineering”, 5th edition, Addison Wesley, 1996.
4.	David Gustafson, “Software Engineering”, Schaum’s outlines, Tata McGraw-Hill, 2003.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE22	**Quantum Computing**	3	1	0	4	50	50	100

Objective	• The design of main intellectual barriers that had to be overcome to make a vision of the quantum computer an important challenge to current science and technology. • To understand these features, and to make a use of them for the design of quantum algorithms, networks and processors.		
Unit - I	**MATHEMATICAL FOUNDATIONS**	Periods	**9+3**
Quantum mechanical principles — quantum entanglement — reversible computation, qubits, quantum gates and registers.			
Unit - II	**QUANTUM PARALLELISM**	Periods	**9+3**
Universal gates for quantum computing— quantum parallelism and simple quantum algorithms.			
Unit - III	**QUANTUM FOURIER TRANSFORMS**	Periods	**9+3**
Quantum Fourier transforms and its applications, quantum search algorithms.			
Unit - IV	**QUANTUM AUTOMATA**	Periods	**9+3**
Elements of quantum automata — quantum complexity theory.			
Unit - V	**QUANTUM CRYPTOGRAPHY**	Periods	**9+3**
Introduction to quantum error correcting codes— entanglement assisted communication—elements of quantum information theory and quantum cryptography.			
		Total Periods	**60**

REFERENCES:	
1.	M. A. Nielsen and I. L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press.
2.	Jozef Gruska, Quantum Computing, McGraw-Hill.
3.	Lecture notes by John Preskill and N. D. Mermin available in the Internet.
4.	http://cse.iitkgp.ac.in/syllabus.html
5.	http://www.fi.muni.cz/usr/gruska/quantum/chapters.html

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE23	**Complex Networks**	3	0	0	3	50	50	100

Objective	• Study of the models and behaviors of networked systems. • Empirical studies of social, biological, technological and information networks. • Exploring the concepts of small world effect, degree distribution, clustering, network correlations, random graphs, models of network growth, and preferential attachment and dynamical processes taking place on networks.		
Unit - I	**TYPES OF NETWORK**	Periods	**9**
Social networks, Information networks, Technological networks, Biological networks.			
Unit - II	**PROPERTIES OF NETWORK**	Periods	**9**
Small world effect, transitivity and clustering, degree distribution, scale free networks, maximum degree; network resilience; mixing patterns; degree correlations; community structures; network navigation.			
Unit - III	**RANDOM GRAPHS**	Periods	**9**
Poisson random graphs, generalized random graphs, the configuration model, power-law degree distribution, directed graph, bipartite graph, degree correlations.			
Unit - IV	**MODELS OF NETWORK GROWTH**	Periods	**9**
Price's model, Barabasi and Albert's model, other growth models, vertex copying models.			
Unit - V	**PROCESSES TAKING PLACE ON NETWORKS AND APPLICATIONS**	Periods	**9**
Percolation theory and network resilience, Epidemiological processes. Search on networks, exhaustive network search, guided network search, network navigation; network visualization.			
		Total Periods	**45**

REFERENCES:	
1.	S. N. Dorogovtsev and J. F. F. Mendes, Evolution of Networks, Oxford University Press.
2.	Narsingh Deo, Graph Theory, Prentice Hall of India.
FURTHER READINGS:	
1.	Current Literature.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE24	**Information Retrieval**	3	0	0	3	50	50	100

Objective	• To understand the concept of Architecture of Computers and Internal Parts of Computers • To understand the Pipelining Concepts and Instruction Level Parallelism		
Unit - I	**INTRODUCTION, TEXT INDEXING, STORAGE AND COMPRESSION**	Periods	**9**
The nature of unstructured and semi-structured text. Inverted index and Boolean queries. Text encoding: tokenization, stemming, stop words, phrases, index optimization. Index compression: lexicon compression and postings, lists compression. Gap encoding, gamma codes, Zipf's Law. Index construction. Postings size estimation, merge sort, dynamic indexing, positional indexes, n-gram indexes, real-world issues.			
Unit - II	**RETRIEVAL MODELS**	Periods	**9**
Boolean, vector space, TFIDF, Okapi, probabilistic, language modeling, latent semantic indexing. Vector space scoring. The cosine measure. Efficiency considerations. Document length normalization. Relevance feedback and query expansion. Rocchio.			
Unit - III	**PERFORMANCE EVALUATION**	Periods	**9**
Evaluating search engines. User happiness, precision, recall, F-measure. Creating test collections: kappa measure, interjudge agreement.			
Unit - IV	**TEXT CATEGORIZATION, FILTERING AND CLUSTERING**	Periods	**9**
Introduction to text classification. Naive Bayes models. Spam filtering. Vector space classification using hyperplanes; centroids; k Nearest Neighbors. Support vector machine classifiers. Kernel functions. Boosting. Clustering versus classification. Partitioning methods. K-means clustering. Mixture of Gaussians model. Hierarchical agglomerative clustering. Clustering terms using documents.			
Unit - V	**ADVANCED TOPICS**	Periods	**9**
Summarization, Topic detection and tracking, Personalization, Question answering, Cross language information retrieval. Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS, XML and Semantic web.			
		Total Periods	**45**

REFERENCES:	
1.	Manning, Raghavan and Schutze, Introduction to Information Retrieval, Cambridge University Press.
2.	Baeza-Yates and Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley.
3.	Soumen Charabarti, Mining the Web, Morgan-Kaufmann.
FURTHER READINGS:	
1.	Survey by Ed Greengrass available in the Internet.

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**-**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE25	**Computational Number Theory**	3	0	0	3	50	50	100

Objective	• To understand the concept of image processing and sensor • To understand the Concept of transformations		
Unit - I	**ALGORITHMS FOR INTEGER ARITHMETIC**	Periods	**9**
Divisibility, gcd, modular arithmetic, modular exponentiation, Montgomery arithmetic, congruence, Chinese remainder theorem, Hensel lifting, orders and primitive roots, quadratic residues, integer and modular square roots, prime number theorem, continued fractions and rational approximations.			
Unit - II	**REPRESENTATION OF FINITE FIELDS**	Periods	**9**
Prime and extension fields, representation of extension fields, polynomial basis, primitive elements, normal basis, optimal normal basis, irreducible polynomials.			
Unit - III	**ALGORITHMS FOR POLYNOMIALS**	Periods	**9**
Root-finding and factorization, Lenstra-Lenstra-Lovasz algorithm, polynomials over finite fields.			
Unit - IV	**ELLIPTIC CURVES AND ALGORITHMS**	Periods	**9**
The elliptic curve group, elliptic curves over finite fields, Schoof's point counting algorithm. Fermat test, Miller-Rabin test, Solovay-Strassen test, AKS test. Trial division, Pollard rho method, p-1 method, CFRAC method, quadratic sieve method, elliptic curve method.			
Unit - V	**COMPUTING DISCRETE LOGARITHMS OVER FINITE FIELDS**	Periods	**9**
Baby-step-giant-step method, Pollard rho method, Pohlig-Hellman method, index calculus methods, linear sieve method, and Coppersmith's algorithm. Algebraic coding theory, cryptography.			
		Total Periods	**45**

REFERENCES:

1.	Victor Shoup, A Computational Introduction to Number Theory and Algebra, Cambridge University Press. second edition, 2008.
2.	Maurice Mignotte, Mathematics for Computer Algebra, Springer-Verlag
3.	Joachim von zur Gathen and Juergen Gerhard, Modern Computer Algebra, Cambridge University Press.
4.	Rudolf Lidl and Harald Niederreiter, Introduction to Finite Fields and their Applications, Cambridge University Press.
5.	http://nptel.ac.in/courses.php?disciplineId=106

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**-**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE26	**Mobile Computing**	3	0	0	3	50	50	100

Objective	• To understand the emerging mobile computing ideas and best practices. • To learn the basics of wireless voice and data communication technologies. • To study the working principles of wireless LAN and its standards • To describe various mobile network architecture.		
Unit - I	**WIRELESS COMMUNICATION FUNDAMENTALS**	Periods	**9**
Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA.			
Unit - II	**WIRELESS NETWORKS**	Periods	**9**
Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Network – HiperLAN – BlueTooth – Wi-Fi – WiMAX.			
Unit - III	**MOBILE NETWORKS**	Periods	**9**
Cellular Wireless Networks – GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS.			
Unit - IV	**ROUTING**	Periods	**9**
Mobile IP – DHCP – AdHoc – Proactive and Reactive Routing Protocols – Multicast Routing - Tunneling and encapsulation – IP-in-IP Encapsulation – Minimal encapsulation – Generic Routing Encapsulation – Reverse Tunneling – Alternative matrix.			
Unit - V	**TRANSPORT AND APPLICATION LAYERS**	Periods	**9**
Mobile TCP – WAP – Architecture – WWW Programming Model – WDP – WTLS –WTP – WSP – WAE – WTA Architecture – WML – WML Scripts.			
		Total Periods	**45**

REFERENCES:	
1.	Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003
2.	Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2003
3.	William Stallings, “Wireless Communications and Networks”, Pearson Education, 2002.
FURTHER READINGS:	
4.	Kaveh Pahlavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, First Edition, Pearson Education, 2003
5.	Introduction to Wirless and Mobile Systems by Agrawal and Zeng, Brooks/Cole (Thomson Learning, First Edition, 2002.

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**-**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE27	**Grid Computing**	3	0	0	3	50	50	100

Objective	• To get an overview about system infrastructure of grid. • To learn about various grid monitoring related techniques. • To learn about security issues and working of scheduling paradigms in grids. • To learn about various available grid middle wares.		
Unit - I	**CONCEPTS AND ARCHITECTURE**	Periods	**9**
Introduction - Parallel and Distributed Computing - Cluster Computing - Grid Computing - Anatomy and Physiology of Grid - Review of Web Services – OGSA – WSRF.			
Unit - II	**GRID MONITORING**	Periods	**9**
Grid Monitoring Architecture (GMA) - An Overview of Grid Monitoring Systems- Grid ICE – JAMM – MDS - Network Weather Service - R-GMA - Other Monitoring Systems - Ganglia and Grid Mon.			
Unit - III	**GRID SECURITY AND RESOURCE MANAGEMENT**	Periods	**9**
Grid Security - A Brief Security Primer - PKI-X509 Certificates - Grid Security - Grid Scheduling and Resource Management - Scheduling Paradigms - Working principles of Scheduling - A Review of Condor, SGE, PBS and LSF - Grid Scheduling with QoS.			
Unit - IV	**DATA MANAGEMENT AND GRID PORTALS**	Periods	**9**
Data Management- Categories and Origins of Structured Data - Data Management Challenges-Architectural Approaches - Collective Data Management Services - Federation Services - Grid Portals - First-Generation Grid Portals - Second-Generation Grid Portals.			
Unit - V	**GRID MIDDLEWARE**	Periods	**9**
List of globally available Middlewares - Case Studies - Recent version of Globus Toolkit and gLite - Architecture, Components and Features.			
		Total Periods	**45**

REFERENCES:	
1.	Maozhen Li, Mark Baker, The Grid Core Technologies, John Wiley & Sons, 2005.
FURTHER READINGS:	
1.	Ian Foster & Carl Kesselman, The Grid 2 – Blueprint for a New Computing Infrascture , Morgan Kaufman – 2004
2.	Joshy Joseph & Craig Fellenstein, “Grid Computing”, Pearson Education 2004.
3.	Fran Berman,Geoffrey Fox, Anthony J.G.Hey, “Grid Computing: Making the Global Infrastructure a reality”, John Wiley and sons, 2003.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE28	**XML and Web Services**	3	0	0	3	50	50	100

Objective	• To Understand the XML technology and web services • To Understand the concept of XML coding and emerging system development		
Unit – I	**INTRODUCTION**	Periods	**9**
Role Of XML - XML and The Web - XML Language Basics - SOAP - Web Services - Revolutions Of XML - Service Oriented Architecture (SOA).			
Unit – II	**XML TECHNOLOGY**	Periods	**9**
XML - Name Spaces - Structuring With Schemas and DTD - Presentation Techniques - Transformation – XML Infrastructure.			
Unit – III	**SOAP**	Periods	**9**
Overview Of SOAP - HTTP - XML-RPC - SOAP: Protocol - Message Structure - Intermediaries - Actors - Design Patterns And Faults - SOAP With Attachments.			
Unit – IV	**WEB SERVICES**	Periods	**9**
Overview - Architecture - Key Technologies - UDDI - WSDL - ebXML - SOAP And Web Services In E-Com - Overview Of .NET And J2EE.			
Unit – V	**XML SECURITY**	Periods	**9**
Security Overview - Canonicalization - XML Security Framework - XML Encryption - XML Digital Signature - XKMS Structure - Guidelines For Signing XML Documents - XML In Practice.			
		Total Periods	**45**

REFERENCES:	
1.	Frank. P. Coyle, XML, Web Services And The Data Revolution, Pearson Education, 2002.
FURTHER READINGS:	
1.	Ramesh Nagappan , Robert Skoczylas and Rima Patel Sriganesh, " Developing Java Web Services", Wiley Publishing Inc., 2004.
2.	Sandeep Chatterjee, James Webber, "Developing Enterprise Web Services", Pearson Education, 2004.
3.	McGovern, et al., "Java Web Services Architecture", Morgan Kaufmann Publishers,2005.

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**-**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE29	**Software Testing and Quality Assurance**	3	0	0	3	50	50	100

Objective	• To Understand quality management processes • To Demonstrate the ability to apply multiple methods to develop reliability estimates for a software system.		
Unit – I	**FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE**	Periods	**9**
Ethical Basis for Software Quality – Total Quality Management Principles – Software Processes and Methodologies.			
Unit – II	**QUALITY STANDARDS**	Periods	**9**
Quality Standards – Practices and Conventions – Software Configuration Management – Reviews and Audits –Enterprise Resource Planning Software.			
Unit – III	**QUALITY METRIC SYSTEM**	Periods	**9**
Measurement Theory – Software Quality Metrics – Designing Software Measurement Programs – Complexity Metrics and Models – Organizational Learning – Improving Quality with Methodologies – Structured/Information Engineering.			
Unit – IV	**SOFTWARE TESTING – INTRODUCTION**	Periods	**9**
Testing as an Engineering Activity – Role of Process in Software Quality – Testing as a Process – Basic Definitions, Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support for Developing a Defect Repository.			
Unit – V	**TESTING ISSUES**	Periods	**9**
Introduction to Testing Design Strategies – The Smarter Tester –Test Case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Equivalence Class Partitioning – Boundary Value Analysis – Other Black-box Test Design Approaches – Black-box testing and COTS – Using White-Box Approach to Test design – Test Adequacy Criteria – Coverage and Control Flow Graphs – Covering Code Logic – Paths – White-box Based Test Design – Additional White Box Test Design Approaches – Evaluating Test Adequacy Criteria.			
		Total Periods	**45**

REFERENCES:

1.	Schulmeyer, G. Gordon, James McManus, "Handbook of Software Quality Assurance", Third Edition, Van Nostrand Reinhold, 1998.
2.	Edward Kit, "Software Testing in the Real World – Improving the Process", Pearson Education, 2004.
3.	William E.Perry , "Effective methods for Software Testing", Second Edition, Wiley, 2000.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE30	**Software Project Management**	3	0	0	3	50	50	100

Objective	• To understand the basic concepts of life cycle models. • To develop the skills required to design and develop a process/project database.		
Unit - I	**BASIC CONCEPTS**	Periods	**9**
Product, Process and Project – Definition – Product Life Cycle – Project Life Cycle Models.			
Unit - II	**FORMAT PROCESS MODELS AND THEIR USE**	Periods	**9**
Definition and Format model for a process – The ISO 9001 and CMM Models and their relevance to Project Management – Other Emerging Models like People CMM.			
Unit - III	**UMBRELLA ACTIVITIES IN PROJECTS**	Periods	**9**
Metrics – Configuration Management – Software Quality Assurance – Risk Analysis.			
Unit - IV	**IN STREAM ACTIVITIES IN PROJECTS**	Periods	**9**
Project Initiation – Project Planning – Execution and Tracking – Project Wind up – Concept of Process/Project Database.			
Unit – V	**ENGINEERING AND PEOPLE ISSUES IN PROJECT MANAGEMENT**	Periods	**9**
Phases (Requirements, Design, Development, Testing , Maintenance, Deployment) – Engineering Activities and Management Issues in Each Phase – Special Considerations in Project Management for India and Geographical Distribution Issues.			
		Total Periods	**45**

REFERENCES:	
1.	Kelkar Sa, “Software Project Management” , PHI Learning, New Delhi, 2007
2.	Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill, 2001.
FURTHER READINGS:	
1.	Pressman,Roger,”Software Engineering”, A Practitioner’s approach.McGraw Hill,1997.
2.	Bob Hughes and Mike Cotterell, “Software Project Management”,Third edition, Tata McGraw Hill 2004
3.	Wheelwright and Clark, “Revolutionising product development”,The Free Press,1993.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE31	**Information Security**	3	0	0	3	50	50	100

Objective	• To make the students to understand the principles of encryption algorithms, conventional and public key cryptography. • To understand the basics of Information Security • To know the legal, ethical and professional issues in Information Security • To know the technological aspects of Information Security		
Unit - I	**INTRODUCTION**	Periods	**9**
An Overview of Computer Security, Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies.			
Unit - II	**CRYPTOSYSTEMS**	Periods	**9**
Cryptography- Key management – Session and Interchange keys, Key exchange and generation, Cryptographic Key Infrastructure, Storing and Revoking Keys, Digital Signatures, Cipher Techniques			
Unit - III	**ACCESS CONTROL**	Periods	**9**
Systems: Design Principles, Representing Identity, Access Control Mechanisms, Information Flow and Confinement Problem.			
Unit - IV	**INTRUSION DETECTION**	Periods	**9**
Malicious Logic, Vulnerability Analysis, Auditing and Intrusion Detection			
Unit - V	**SECURITY ANALYSIS**	Periods	**9**
Network Security, System Security, User Security and Program Security			
		Total Periods	**45**

REFERENCES:	
1.	Matt Bishop ,“Computer Security art and science ”, Second Edition, Pearson Education 2002.
FURTHER READINGS:	
1.	Mark Merkow, James Breithaupt “ Information Security : Principles and Practices” First Edition, Pearson Education, 2005.
2.	Whitman, “Principles of Information Security”, Second Edition, Pearson Education, 2007.
3.	William Stallings, “Cryptography and Network Security: Principles and Practices”, Third Edition, Pearson Education,2003.
4.	“Security in Computing”, Charles P.Pfleeger and Shari Lawrence Pfleeger, Third Edition, 2002.

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Department	**COMPUTER SCIENCE AND ENGINEERING**			Semester	**-**

Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE32	**Visual Programming**	3	0	0	3	50	50	100

Objective	• To understand the concept of Windows and Visual programming using C++ • To develop the skills and understanding required to design and develop visual C++ applications.		
Unit - I	**INTRODUCTION**	Periods	**9**
Windows Programming Fundamentals – MFC – Windows – Graphics – Menus – Mouse and keyboard – Bitmaps – Palettes – Device-Independent Bitmaps.			
Unit - II	**CONTROL AND I/O**	Periods	**9**
Controls – Modal and Modeless Dialog – Property – Data I/O – Sound – Timer.			
Unit - III	**TOOLBARS**	Periods	**9**
Memory management – SDI – MDI – MFC for Advanced windows user Interface – status bar and Toolbars – Tree view – List view – Threads.			
Unit - IV	**DATABASE CONNECTIVITY**	Periods	**9**
ODBC – MFC Database classes – DAO - DLLs – Working with Images.			
Unit - V	**COM**	Periods	**9**
COM Fundamentals – ActiveX control – ATL – Internet Programming .			
		Total Periods	**45**

REFERENCES:	
1.	Richard C.Leinecker and Tom Archer, "Visual C++ 6 Programming Bible", Wiley Dream Tech Press, 2006.
FURTHER READINGS:	
2.	Lars Klander, "Core Visual C++ 6", Pearson Education, 2000.
3.	Deital, DEital, Liperi and Yaeger "Visual V++ .NET How to Program" , Pearson Education, 2004.

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE33	**Discrete Mathematics**	3	1	0	4	50	50	100

Objective	• Have knowledge of the concepts needed to test the logic of a program. • Be aware of a class of functions which transform a finite set into another finite set which relates to input output functions in computer science and the counting principles.		
Unit - V	**PROPOSITIONAL CALCULUS**	Periods	**9+3**
Propositions –Logical connectives-compound propositions-conditional and biconditional propositions-truth tables-Tautologies and contradictions-contrapositive-logical equivalences and implications-De Morgan's Laws-Normal forms-principal conjuctive and disjunctive normal forms-Rules of inference-Arguments-Validity of arguments.			
Unit - V	**PREDICATE CALCULUS**	Periods	**9+3**
Predicates-Statement function-Variables-Free and bound variables-Quantifiers-Universe of discourse-Logical equivalences and implications for quantified statements-Theory of inference-The rules of universal specification and generalization-Validity of arguments.			
Unit - V	**GRAPHS**	Periods	**9+3**
Graphs and graph models-Graph terminology and special types of graphs-Representing graphs and graph isomorphism -connectivity-Euler and Hamilton paths. .			
Unit - V	**ALGEBRAIC STRUCTURES**	Periods	**9+3**
Algebraic systems-Semi groups and monoids-Groups-Subgroups and homomorphisms-Cosets and Lagrange's theorem.			
Unit - V	**LATTICES AND BOOLEAN ALGEBRA**	Periods	**9+3**
Partial ordering-Posets-Lattices as Posets- Properties of lattices-Lattices as Algebraic systems –Sub lattices –direct product and Homomorphism- Boolean Algebra.			
		Total Periods	**60**

REFERENCES:	
1.	Kenneth H.Rosen, "Discrete Mathematics and its Applications", Special Indian edition, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, (2007).
2.	Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Re-print (2007).
FURTHER READINGS:	
1.	Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Fourth Edition, Pearson Education Asia, Delhi, (2002).
2.	Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, (2006).
3.	Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", Schaum's Outlines, Tata McGraw-Hill Pub. Co. Ltd., New Delhi, Second edition, (2007).

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Course code	Course name	Periods per week			Credit	Maximum Marks		
		L	T	P	C	CA	ESE	Total
P14CSE34	**Soft Computing**	3	0	0	3	50	50	100

Objective	• To study about the soft computing and neural networks. • To design generic algorithm with suitable examples and fuzzy logics. • To have developed skills in neuro fuzzy modeling and generic algorithms.		
Unit - I	**INTRODUCTION**	Periods	**9**
Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics			
Unit - II	**NEURAL NETWORKS**	Periods	**9**
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 - III	**FUZZY LOGIC**	Periods	**9**
Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rule based system – Fuzzy Decision Making – Applications of fuzzy logic			
Unit - IV	**NEURO-FUZZY MODELING**	Periods	**9**
Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro -Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification –Neuro-Fuzzy Control – Case studies			
Unit - V	**GENETIC ALGORITHMS**	Periods	**9**
Introduction to Genetic Algorithms (GA) – Terminologies and operators of GA – Classification of GA – GA for Optimization problem - Applications of GA			
		Total Periods	**45**

REFERENCES:	
1.	Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing",Prentice-Hall of India, 2003
2.	S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer, 2007.
3.	S.N.Sivanandam · S.N.Deepa, " Introduction to Genetic Algorithms", Springer, 2007.
FURTHER READINGS:	
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.	George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
4.	James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.

Annexure-I

List of Service Courses

Programme**: Department of Computer Science and Engineering**

Semester	Course Code	Course Name	Service Programme
Elective	P14CSE35	Neural Networks and Its Applications	M.E. Applied Electronics

Annexure-II

List of Common Courses

Programme: **Department of Computer Science and Engineering**

Semester	Course Code	Course Name	Common to			
			Programme	Semester	Course Code	Course Name
Elective	P14CSE27	Grid Computing	M.Tech.IT	Elective	P14CSE27	Grid Computing
Elective	P14CSE28	XML and Web Services	M.Tech.IT	Elective	P14CSE28	XML and Web Services
Elective	P14CSE29	Software Testing and Quality Assurance	M.Tech.IT	Elective	P14CSE29	Software Testing and Quality Assurance
Elective	P14CSE30	Software Project Management	M.Tech.IT	Elective	P14CSE30	Software Project Management
Elective	P14CSE31	Information Security	M.Tech.IT	Elective	P14CSE31	Information Security